The Florentine Wool Industry in the Late Sixteenth Century: a Case Study

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The production of wool cloths for an international market that got underway in the fourteenth century provided the Florentine economy with a strong industrial base complementing its international commercial and banking system; and no other sector of that economy has been as well studied. Research, however, has been concentrated almost exclusively on the period before 1500, and little attention has been given to the transformation the industry underwent in the sixteenth century. At that time, manufacturers shifted to the use of the higher quality wool recently developed in Spain and concentrated production on a new kind of luxury cloth – *rascie* (sometimes translated as "rash" in English) – that for the first time Florentines were able to sell in northern Europe as well as in their traditional Mediterranean markets. This study of a firm producing *rascie* in the 1580s is directed to providing a perspective on the extensively studied earlier period for the purpose of noting what changes, if any, the industry underwent after moving into this, its last phase. In addition, the more complete documentation for this firm, as compared to earlier ones that have been studied, fills in details about industrial operations, including production costs; and, for lack of studies of any industrial establishment, wool or otherwise, in the later sixteenth century, this firm provides a unique view into the larger business and industrial world in which it operated. Behind these subjects looms the larger problem of the performance of the Florentine economy in general during a period when it was losing its pre-eminence as an international industrial, commercial and banking capital. In going beyond the analysis of the internal operations of a

single firm this study complements Raymond de Roover's classic study of the Medici firm at mid-century.[1]

I.

The firm of Cristofano di Tommaso Brandolini & Co., *lanaiuoli in Garbo*, was organised as a partnership in August 1580 and went through three subsequent renewals down to 1597. The complete set of accounts survives for each of the four organisations (*ragioni*), identified sequentially by the letters A through D; and they document what in many respects was the traditional business organisation of the industry.[2] The partners were the brothers Lorenzo and Filippo di Messer Giovanbattista Strozzi and Cristofano di Tommaso Brandolini, and the capital of the firm was 7,000 florins: 6,600 florins in cash from the Strozzi and 400 florins representing (to judge from his current account, and in accordance with traditional business practice in Florence) the capitalised value of Brandolini's service (*persona*) as managing partner for purposes of giving him a share in the profits. Profits – after a prior claim of Brandolini in lieu of a salary, as we shall see, and a one per cent contribution to charity (*poveri di Dio*) – were prorated among the partners according to their investment. In just over eight years, from 1580 to 1589 (*ragioni* A and B), the company produced 889.5 cloths, a level of production that, at around 110 cloths a year, was probably near the annual average for all firms.[3] During the period of the first *ragione* 80 per cent of the wool it bought was Spanish, the rest coming from the Abruzzi and other places in the western Mediterranean; and around 75 per cent of its production were black *rascie*. During the period studied here, through to January 1589, the company returned an annual average of 5.17 per cent profit to

[1] For the bibliography on the industry see Francesco Franceschi, *Oltre il "Tumulto"* (Florence 1993); and for a general overview, H. Hoshino, *L'Arte della lana in Firenze nel basso medioevo*, (Florence 1980) and Paolo Malanima, *La decadenza di un'economia cittadina*.
[2] Archivio di Stato di Firenze, Carte strozziane, serie V, 1696-1740. The articles of association do not survive.
[3] Franceschi, *Oltre il "Tumulto"*, pp. 39-40 (for the later fourteenth and early fifteenth centuries); Raymond de Roover, "A Florentine firm of Cloth Manufactures," *Speculum*, XVI (1941), p. 102 (for the sixteenth century).

its investors (its performance is summarised in Table 1). Over the following nine years, through to the end of the fourth and last partnership, the company's return to its investors averaged just over 6 percent. This steady rate of profits for almost two decades gives some assurance that the company's operation was not eccentric, if it does not also suggest a certain stability in the industry over the entire twenty-year period.

The firm's accounts conform in general to the system described by Florence Edler relative to the Medici wool companies operating in the 1530s and 1550s (subsequently studied by de Roover), although the complete set of accounts does not survive for any of those firms.[4] This system consisted of two groups of accounts: (1) a ledger for central administration together with its accompanying income-expenditures journal, a combination journal and record book, and a cash book; and

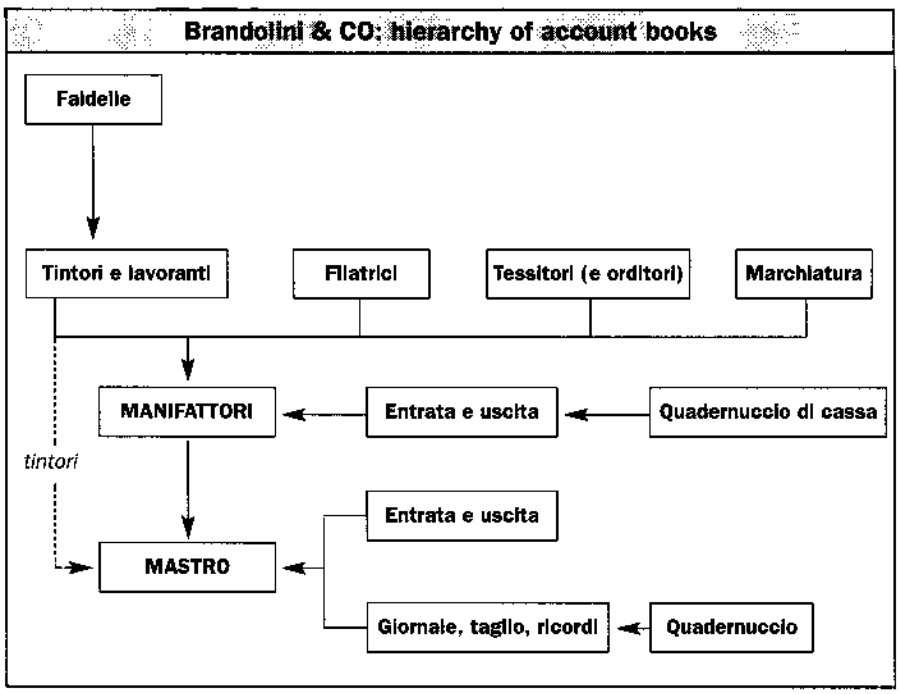
TABLE 1: Brandolini & Co: balance of operations, Aug. 1580 - Jan 1589

Credits			Debits		
Sales[a]		fl.62,396.48	Production costs		fl.58,899.35
889.5 bolts	61,302.77		lbs.95,696 raw wool[b]	23,694.35	
pieces (a taglio)	1,093.71		direct charges[c]	27,610.98	
Miscellaneous credits (mostly from discounts)		640.55	dyes and dyeing	6,049.53	
			indirect costs[d]	1,544.49	
Transfer to new ledger		11.71	Manager's share of profits	825.35	
			Return to investors	2,845.00	
			Unassigned credits	479.04	
TOTAL		fl.63,048.74	TOTAL		fl.63,048.74

Notes:
[a] Income recorded in account of *pannine* in ledger.
[b] Estimate of total wool purchased based on following calculation: total spent for wool divided by average price paid during first year of each *ragione* (fl.24.76 for lbs.100).
[c] Direct manufacturing costs are those charged to the *libri di manifattori*.
[d] Indirect costs are those charged to the ledgers less expenses for dyeing.

[4] Florence Edler, *Glossary of Medieval Terms and Business*, (Cambridge Mass 1934), App. II.

(2) a subsidiary ledger exclusively for manufacturing operations together with its income-expenditures journal and a cash book along with five other books tracking the wool and bolts of cloth through specific stages (washing, dyeing, spinning, weaving, sealing) - all together 12 account books for each partnership. There are three features to this system: (1) a record of the entire process by which single lots of wool became transformed into individual bolts of cloth and then sold, (2) the isolation into a separate sub-system of books of all internal operations related to direct manufacturing costs, and (3) a central administration concerned with indirect costs and external operations, namely purchase of raw materials, dyeing, and sales. The Brandolini accounts, in short, are notable for the articulation of separate operations, a clear hierarchical organisation and the overall integration into a single system through double entry, cross references and alphabetical indices, all of which facilitate cost analyses, including a complete breakdown of production costs for a single bolt of cloth (see Appendix). The account of sales in the ledger functions as a profit-loss account that provides full operating results,



something lacking in earlier accounting practice of industrial firms. None of the firms on which the earlier history of the industry has been written - including the Datini firm studied by Federigo Melis - is documented by such a comprehensive and well-articulated set of accounts.

In its internal organisation the Brandolini firm conforms to the general outline laid down by Edler and then by de Roover. Since the industrial process was organised around the traditional putting-out system, major tasks were contracted out for each phase: beating, cleansing, carding, combing and dyeing of the wool; distribution of wool to spinners and of thread to weavers; fulling and finishing of the cloth. The firm dealt with these workers through contracts or through intermediary sub-contractors. Working instead directly under the manager was a salaried staff numbering around four or five men at any one time: an accountant (*scrittore*) who kept the ledger, one to three youths (*giovani*) and usually two workers (*garzoni*). The accountant (who may have been part-time) was paid an annual salary of 12 florins, the youths from 12 to 20 florins, and the workers from 20 to 48 florins. Brandolini himself kept the cash box, for which he was paid 30 florins. In his capacity as manager, however, Brandolini did not receive a salary. Instead, he was given a share of the profits before their division among the partners, his share going from one-sixth to one-fifth (an increase of 20 per cent) from the first to the second partnership.[5] Over eight years his annual income averaged just over 81.57 florins from his claim on profits as manager and 21.57 florins from the return on his share as a partner; with the stipend for keeping the cash box, his earnings averaged 133 florins a year. These salaries can be put into perspective by noting that an unskilled worker could earn about 35 florins a year if he were able to work full time – around 250 days – for the maximum rate of one lire for a day's work (with seven lire equal to one florin).

In an industrial system of this kind with work contracted out, the individual firm had limited needs for capital. Most investment in plant and equipment - except for combs and cards - were sustained by the contractors

[5] This prior claim Brandolini had over the investors in the division of profits differs from the traditional arrangement for determining the manager's compensation. In the earlier period the service the manager performed (*persona*) was given a capitalized value so that he took his compensation as a share of the profits along with the other partners.

and subcontractors, from the modest equipment of the spinners to the weavers' looms and the fulling mill owned by the guild, while costs of obtaining raw materials abroad and of selling finished products abroad were born by international importer-exporters who dealt with firms like Brandolini's in the local market. The Brandolini firm, like most others, did not even own its premises: it paid 30 florins rent for a shop in via Porta Rossa and 15 florins for a smaller place with tentering frames. The capital needed for this kind of operation was, above all, cash to buy wool and dyestuffs as needed and to pay for work either as it was completed or as advances (notably to the weavers). The initial investment by the partners, therefore, served primarily as start-up capital to get the production process going to the point where the rhythm of sales assured a certain on-going liquidity. For the Brandolini firm this took about six months from the time it opened Ledger A, on 8 August 1580, with the first purchase of Spanish wool. The Strozzi paid their investment obligation in instalments that ran to 4 February 1581; and meanwhile income began to come in with the sale of the first bolt of cloth on 3 October 1580. Once the start-up capital was expended, the smooth operation of the firm depended on its ability to balance on-going expenditures with sales. Yet with raw wool constituting about 40 per cent of total operating costs, with two months production time needed to get the first bolt of cloth out of a lot of wool, and with profits running at no more than about 5 to 6 per cent, credit crunches were bound to occur.

The firm had several mechanisms available to gain access to short-term credit in order to maintain liquidity, all devices of long standing in Florentine business practice. By far the most important was overdraft on current account both in bank and with clients. In the five years of the first partnership, from 1580 to 1585, the current account of the Brandolini firm with its bank, Heirs of Federigo Ricci & Co., was overdrawn one-fifth of the time, for a total of 351 days. The longest period of overdraft was 61 days, during which the deficit rose to almost 62 florins; and at another moment the deficit reached its highest point of 382 florins, where it remained for three weeks. No cost of this service shows up on the account with the bank. Another instrument for short-term credit was the traditional practice in the industry of allowing many months to settle accounts for the purchase of both raw wool and finished cloth, with the

option of receiving handsome discounts at fixed rates as an inducement for more prompt payment – a practice that in effect amounted to granting credit at a cost to the buyer who put off payment. For instance, Brandolini started up production by purchasing wool from the Spanish firm of Baldassarre Suarez & Co. before there was any money in the bank to pay for it, since the Strozzi did not make the first instalment on their investment obligation until 27 August, about three weeks after operations had begun; and the cost of this credit was the discount the firm otherwise could have obtained. This practice, however, cut both ways. The Brandolini firm both received such credit at 9 percent interest from suppliers of raw wool and extended credit at 8 and 9 percent interest to buyers of finished cloth.[6] Savings and costs of such transactions are recorded on what is, in fact, called the profit-loss account in the ledger (global profits and losses, as already observed, are recorded on the account of sales), and in the final balance they more-or-less cancel one another out. Brandolini did not accept any time-deposits, an instrument traditionally used to obtain short-term credit, nor did he seek additional capital through the limited liability investment contract (*in accomandita*), another instrument that was becoming popular at the time. In any event, wherever the firm might turn to gain the flexibility needed to maintain liquidity, it found no give whatsoever on its front with the workers, where ready cash had always to be available for prompt payment, including advances to the weavers.[7]

II.

From a description of the internal operation of the Brandolini firm as both a business and a manufacturer, the industry appears to have changed little across the preceding two centuries. The firm's accounts,

[6] On this practice see F. Ruiz Martín, *Lettres marchandes échangées entre Florence et Medina del Campo*, (Paris 1955), p. CXXX.

[7] Cf. Carlo Cipolla, *Money in Sixteenth-Century Florence*, (Berkeley 1989), pp. 110-13, who sees a liquidity crisis at this time. The 1620 inquest into the problems of the industry found liquidity problems but specifically not at the level of wages: M. Carmona, "La Toscane face a la crise de l'industire lanière: techniques et mentalités economique aux XVIe et XIIe siècles", in M. Spallanzani, ed., *Produzione commercio e consumo dei panni di lana (nei secoli XII-XVII)*, (Florence 1976), pp. 162.

however, offer a view of the business scene beyond its shop doors that was somewhat different from that in which earlier firms operated.

One difference appears immediately on flipping through the pages of the firm's ledger: the centrality of the current account with a single bank, Heirs of Federigo de' Ricci & Co. The most active account opened in the name of an individual party, it served primarily for payment to wool suppliers, for receipt of payments from buyers of cloth, for access to cash, and, as noted above, for short-term credit through overdraft. The annual activity in the account over the period of the first partnership averaged 40 debit entries totalling 4,506 florins and 52 credit entries totalling 4,242 florins. The Ricci bank had a looming presence throughout the business world of late sixteenth-century Florence: whatever firm one examines in the 1580s, one is likely to encounter an active current account with just this one bank. Nothing like it existed in the fourteenth and fifteenth centuries, when manufacturers generally dealt directly with their business clients in cash, credit or kind and seldom through banks, and when no one bank - not even the Medici - dominated the scene. By the end of the sixteenth century, however, the Ricci appears to have been a central bank through which even other banks operated; but for the moment it remains completely unstudied (none of its accounts are known to have survived).[8]

Another new presence on the business scene were foreign import-export merchants. In the earlier phases of the wool industry, when raw wool was imported from the western Mediterranean and England and then from central Italy, Florentine merchant-banking firms virtually monopolised its sale in the local market; and, indeed, Florence not being a great trade emporium like Venice or Bruges, hardly any non-Florentine merchants operated in the city. With the rapid shift of the textile industry to Spanish wool in the sixteenth century, however, both Spanish and Genoese merchants managed to get a firm hold on the import trade. Bruno Dini has documented the earliest presence of Spanish merchants in Florence around 1490, and by the mid-sixteenth century they appear as major suppliers of wool in the accounts of the Medici firms studied by de

[8] I have commented on the Ricci bank in "Banking in Florence at the End of the Sixteenth Century", *Journal of European Economic History*, XVII (1998), pp. 500-504.

Roover[9]. Their eventual pre-eminence is confirmed by the accounts of the Brandolini firm, which unlike the Medici bought mostly Spanish wool. Over the entire period of the four partnerships, 7 Spanish merchant companies supplied 66 per cent of its wool (Baldassarre Suares & Co. the correspondent of the firm of Simón Ruiz studied by F. Ruiz Martín, alone supplied 47 per cent), 3 Genoese merchant companies 9 per cent and some 30 Florentine companies and individuals the remaining 25 per cent. The industry, in fact, became dependent on foreign importers, especially on merchants from Burgos; and the 1620 inquest into the severe - and ultimately fatal - crisis the industry was undergoing at that time considered the major problem to be the difficulty in obtaining raw materials as a result of the abandonment of the Florentine market by Spanish merchants because of high customs and transportation costs. The implication of this observation is that Florentine merchants were not in a position to take their place. The presence of foreigners in the books of a local producer such as the Brandolini firm, in short, is indicative of a major structural change the market was undergoing in the late sixteenth century.[10]

Foreigners had a presence, too, among exporters albeit a less commanding one. Of the firm's total production of finished bolts of cloth through all four partnerships 30 per cent was purchased by foreigners: 12 per cent by just 1 Spanish firm (Lesmes de Astudillo & Co.), another 12 per cent by 2 Genoese firms (Lionello Braccelle & Co. and Teramo Brignole & Co.) and the rest by about 20 other foreigners - firms and individuals - mostly Spaniards and Genoese but also several Frenchmen and Germans as well.[11] The profile of the Florentine buyers of the remaining 70 per cent of the firm's production reveals an utterly fragmented market, divided between about 175 companies and about 100 individuals (one-third of the latter being anonymous).[12] Of the 175

[9] Bruno Dini, "Mercanti spagnoli a Firenze" in his *Saggi su una economia-mondo: Firenze e l'Italia fra medioevo ed Europa*, (Florence 1995), pp. 294, 299, 303; De Roover, "A Florentine Firm", p.100; Ruiz Martin, *Lettres marchandes*, p. x.

[10] The market as reflected in the letters of one of these Spanish merchants is described by Ruiz Martín, *Lettres marchandes*, pp. CIV-CXX.

[11] The large firms were Lesme d'Astodiglio & Co. (continued by his son Baldassarre), Lionello Braccelle & Co. and Teramo Brignole & Co.

[12] De Roover's materials reveal the same results: "A Florentine firm", p. 101.

companies, no one bought as much as 4 per cent of the firm's production and only 17 bought more than 1 per cent. Most of these companies are not identified with respect to their activity; those that are fall into the categories of import-exporters (banks or warehouses) and operators within the textile sector - producers of wool and linen cloths, veil makers, dyers, soap makers. The business structure of the entire sector, in short, retained its traditional highly-fragmented character: not only was production dispersed among over a hundred manufacturers such as the Brandolini firm and marketing channelled through dozens of trading companies, but ties between individual producers and exporters remained loose and fluid. The Brandolini firm, for instance, had no strong ties to the bank of its Strozzi partners or to any Strozzi company for that matter. No large operators or conglomerates, familial or otherwise, had anything like a dominant position over smaller operators; and in this respect the Brandolini accounts reflect a feature of Florentine capitalism at the end of the sixteenth century that had lasted for over two centuries.

III.

The production process consisted of five stages: (1) processing the wool (from washing and sorting to combing and carding), (2) spinning the thread, (3) weaving, (4) finishing and (5) dyeing the cloth. Work was organised largely through three kinds of contractors, and payment was based on piece rates. For the processing of the wool and for spinning the firm contracted with agents who subcontracted: *capodieci* dealt with the workers who beat and cleansed the wool, *fattori* with the combers and carders, *lanini* with the spinners of yarns for the weft, *stamaiuoli* with the spinners of yarn for the warp. The weavers instead were employed individually, although they did not work on the premises. Finally, the workers who finished the cloth (burling, scouring, fulling, stretching, napping, shearing) and dyers contracted directly with the firm but generally through collectivities as partnerships or "companies" with varying degrees of formality. The largest single investment in fixed capital required in any one stage of the entire process was the fulling mill, but these were not owned by the fullers themselves, who instead rented the

premises. The fullers who worked for Brandolini rented their mill from the guild (the Arte della Lana).

All this conforms to the traditional structure of the industry, but a

TABLE 2: Percentage breakdown of production costs: various companies, 1384-1589

Category	Datini, 1390s wool				15th cent. (Hoshino)	Ridolfi 1464-68	Medici 1556-57	Brandolini 1581-89
	English	Minorcan	Majorcan	S Matteo		Matricina wool		Spanish wool
preparatory processing	23	27	32	27	21	?	13	14
spinning, warping	17	18	18	16	22	21	31	28
weaving	14	14	13	13	13	11	17	21
finishing, dyeing, etc	45	40	37	44	44	?	39	37
Subtotal: manufacturing	99	99	100	100	100		100	100
manufacturing	56		61		56	57	70	60
wool	44		39		44	43	30	40
TOTAL	100		100		100	100	100	100

Sources: Datini:Federigo Melis, *Aspetti della vita economica medievale*, (Siena, 1962), prospetto XXVII. H. Hoshino: "Il commercio fiorentino nell'Impero ottomano: costi e aspetti negli anni 1484-1488", in *Aspetti della vita economica medievale*, (Florence. 1985), p.86. Ridolfi: see n. 24 in text; figures calculated on basis of sale price, not production cost, so they are slightly higher. Medici: de Roover, "A Florentine Firm," p.118.

TABLE 3: Comparison of production costs: Datini and Brandolini companies

					Average cost, in lire
Category	Datini, 1395		Brandolini, 1580-89		,%
	bolt	braccio	bolt	braccio	increase
preparatory processing	15.54	0.30	37.76	0.61	103
spinning, warping	11.00	0.21	77.77	1.25	495
weaving	8.80	0.17	57.51	0.93	447
finishing, dyeing, misc.	31.11	0.60	104.01	1.68	180
Subtotal: manufacturing	66.45	1.28	277.05	4.47	249
wool	42.38	0.82	186.46	3.01	267
TOTAL	108.83	2.10	463.51	7.48	256
labor: daily wage of unskilled laborer	10s.		15-20s.		50-100

Note: for Datini, Spanish wool was used and one bolt = br.52; for Brandolini, cloth was black rascia using Spanish wool and one bolt = br.62.
Source: Federigo Melis, "La formazione dei costi sull'industria laniera alla fine del Trecento", in *Industria e commercio sulla Toscana medievale*, ed. B. Dini, (Florence 1989), pp. 248-51 (fl.1 = 79s. picc.)

TABLE 4: Comparison of rates paid to selected workers, 14th-16th centuries

(base rates for index figures are those of Brandolini company)

Average cost, in lire

Worker		14th cent. companies						15th cent. companies		16th cent. companies			
		Del Bene	Strozzi	Datini	Datini, 1396-1400			Salviati	Ridolfi	Medici	Brandolini	1557-1571	
		1367-68	1386-90	1392-93	English	Minorcan	Spanish	1424-27	1464-68	1531-57	1580-85	-	-
		soldi per pound											
Stamaiuolo:	rate	8.35	7 - 11	5 - 11.5	5.59	4.60	3.33	7.2 - 10.2	3.00-7.00	7 - 30	20 - 28	25	-
	index	30	25-39	18-41	20	16	12	26-36	11-25	25-107	71-100		
Lanino:	rate	3.62	2 - 5	2 - 4.7	2.58		1.56	2.8	1.33 - 2.33	2.67 - 14	4 - 12	14	12
	index	30	17-42	17-39	22		13	23	11-19	22-117	33-100		
		lire per pound											
Weaver:	rate	11.60	7 - 26	11.6-28.7	11.20	8.56	5.82	9-26	7-9	10-66	30-78		
			ave: 14	ave: 17.1				ave: 13.4		ave: 36	ave: 61		
	index	9	11-43	19-47	18	14	10	15-43	11-15	16-108	49-128		
			ave: 23	ave: 28				ave: 22		ave: 59	ave: 100		

Sources: Del Bene: Bruno Dini, "I lavoratori dell'Arte della Lana a Firenze nel XIV e XV secolo," in *Artigiani e salariati: il mondo del lavoro dei secoli XII-XV* (Pistoia, 1984), n. 49. Strozzi, Datini 1392-93, Salviati: Franceschi, *Oltre il Tumulto*, pp. 244-46. Datini, 1396-1400: Melis, *Aspetti*, pp. 550 and 554. Ridolfi: Archivio dell'Ospedale degli Innocenti, CXLIV, 763 (quaderno di cassa). Medici: Edler, *Glossary*, pp. 413-26; de Roover, "A Florentine firm", p. 114.

comparison of costs with data from the fifteenth century reveals changes in the nature of work that had occurred in the meantime. The essential elements of the comparison are presented in Tables 2, 3 and 4: Table 2 compares the percentage breakdown of total costs; Table 3 compares the actual monetary costs of these same categories for the Brandolini firm with those for the best documented of the Datini firms; and Table 4 compares rates paid various workers. The fundamental observations to be made about these comparisons with respect to the Brandolini firm are:

(1) the stability in the relative cost of the raw material - around 40 per cent - and manufacturing - around 60 per cent (Table 2); but

(2) the rise of costs of both the raw material and manufacturing in real monetary values by well over 100 per cent (Table 3);

(3) the greater percentage of manufacturing costs that went for spinning and weaving, with a corresponding decrease in the relative costs of preliminary work and finishing (Table 3);

(4) the rise of rates paid to certain workers (Table 4)

In other words, the Brandolini firm faced higher wool prices and higher manufacturing costs. Historically, manufacturing costs were closely linked to the quality of wool. When, in the fifteenth century, the industry shifted to *matricina* wool, which cost one-third to one-half less than English wool, manufacturing costs also fell by about the same rate; and now that the industry had shifted again to more expensive Spanish wool, those costs rose accordingly. Inasmuch as the capital needs of a wool firm were primarily for start-up funds to maintain cash flow until income from sales reached a certain pace, a firm at the end of the sixteenth century represented a much larger investment. Thus the capital formation of the Brandolini firm, at 49,000 lire (7,000 florins) was, in real monetary values, slightly higher than the largest firm registered in the 1427 Catasto (16,000 lire, or 4,000 florins) and much higher than the average fifteenth-century firm, which had a capital of closer to 20,000 lire (3-4,000 florins).[13] One of the two contemporary firms of the Corsi family had a capital of 91,000 lire (13,000 ducats), an astronomical figure for the industry before

[13] Franceschi, *Oltre il "Tumulto"*, p.39.
[14] Goldthwaite, "Banking in Florence," p. 479.

the sixteenth century even considering inflation of about 75 per cent in lira prices by the 1580s.[14] (These values are stated in lire to facilitate a comparison, since in the fifteenth century the lira, unlike the florin, remained stable in its power to purchase labour; in the course of the sixteenth century the real value of the lira declined by 25 to 50 per cent.[15])

The rise in costs occurred conspicuously in two phases of production, spinning and weaving: together they account for 49 per cent of the costs sustained to transform wool into cloth as compared to 35-40 per cent for the earlier period, a rise of 25 per cent or more (Table 2). In monetary values these costs had risen from between four to five times, which is to say that, after factoring in inflation, they had more than doubled (Table 3). This conclusion is confirmed by a comparison of the rates paid both to the *stamaiuolo* and the *lanino* (who put the wool out to spinners) and to the weavers (Table 4). The standard accounting procedures followed by wool firms throughout this entire period make it possible to isolate the expenses of these two phases in the manufacturing of cloth with more precision than for any of the other phases, although, given the putting-out system, it is not possible to enter into the specific nature of the work involved.[16]

The reason for this rise of costs was a change in the types of cloth being produced, most of which were black *rascie*. The ratio of wool that went into the warp and the weft for the making of *rascie* as compared to the cloth the Florentine industry produced in the fifteenth century with *matricina* wool rose from 1:2 to 2:3, an increase of one-third. This shift carried attendant costs since preparation of the warp was the more expensive process, especially in the spinning stage. In general, spinning on the distaff to make the warp was less efficient than the spinning wheel used for the weft.[17] The loss of weight in the spinning process was greater for the warp - by over 25 per cent - than for the weft, and this loss was more costly for

[15] This aspect of the Florentine monetary system is clarified in R.A. Goldthwaite and G. Mandich, *Studi sulla moneta fiorentina (secoli XIII-XIV)*, (Florence 1994), pp. 73-76.
[16] For some observations on the variation in the costs of spinning, weaving and finishing depending on the quality of cloth, see Federigo Melis, *Documenti per la storia economica dei secoli XIII-XVI*. (Florence 1972), pp. 108-11.
[17] The spinning wheel offered "major potential for saving", reducing cost from one-half to one-third; P. Chorley, "The evolution of the woollen industry, 1300-1700", in N.B. Harte ed., *The New Draperies in the Low Countries and England, 1300-1800)*, (Oxford 1997), p. 10.

a firm like the Brandolini that used Spanish wool rather than the cheaper *matricina* wool. Moreover, spinning of the warp involved additional transportation costs. The firm's two *stamaiuoli* are identified as from Pontassieve and Carmignano, both about twenty kilometres away but in opposite directions from the city, and they presumably had to cover transport costs to get the wool to and from the warp spinners in the countryside, whereas all the weft spinners of the one *lanino* employed by the firm lived in the city. Distance travelled probably explains the slightly varying rates paid the *stamaiuoli* in contrast to the single rate paid the *lanino*. In any event, the rates paid the former were more-or-less twice that paid the *lanino*, with 61 per cent of total spinning costs going to the former as compared to 39 per cent to the latter.[18] All this is reflected in contemporary legislation directed to regulate the industry: spinners of warp were to be paid a rate-per-pound that was twice what was paid to spinners of weft, and the *stamaiuoli* earned more than twice what the *lanino* earned for each pound of thread delivered to the shop.[19] Finally, the warp yarn had to be warped; and although this was a minuscule 1 per cent in the total costs of the manufacturing process, the Brandolini paid rates that, in real values, were over two-and-a-half times higher than what they had been a century earlier.

Weaving costs, too, went up over fifteenth-century levels by as much as spinning costs. The weavers, however, show up on the company books only in individual accounts debited for advanced payments and credited for delivery of finished wool; and there is no way to penetrate through these entries to know the extent to which the higher rates per cloth they received represent more complex work or more time and labour or simply higher wages.

The fall in costs in the preliminary stage is something of a mystery. Relative costs fell by much more than one-half (Table 2) and the rise of 53 per cent in real costs was less than the inflation factor of 75-100 per cent (Table 3). Since the inflation factor is derived from the minimum wage paid to unskilled labourers, a rise in costs that is less than the rate

[18] Total spinning costs for *ragioni* A-B (1580-89, 489.5 bolts) were £66,552, of which £40,518 went to the *stamaiuoli* and £26.033 to the *lanino*.

[19] *Legislazione toscana*, ed. Lorenzo Costantini, (Florence 1800-1804), I, 366-70; III, 214-18.

of inflation suggests less labour or more efficient labour. Yet, the increased ratio of warp to weft would seem to have involved greater costs also in this preliminary stage of processing the wool for the spinners, since the combing of the wool destined for the warp was in general a more expensive operation than the carding used for the weft, even though the tools needed were cheaper.[20]

As to the finishing stage - the handling of the cloth once it left the hands of the weavers – relative and real costs seem not to have changed much from the earlier period. Finishing costs other than dyeing were relatively low, despite the capital investment in fulling mills and stretching establishments, and were apparently little affected by changes in the quality of cloth. Dyeing, however, accounted for 44 per cent of the Brandolini firm's total finishing costs (18 per cent of total manufacturing costs). Almost all cloths were dyed black in a process consisting of two stages: first by a firm of woad dyers (*tintori di guado*), then over-dyeing by a separate firm of *tintori d'Arte Maggiore* using kermes and madder. In the fifteenth century the industry concentrated on the production of blue cloth, which was dyed with woad; and the shift to black cloth in the sixteenth century requiring an additional dyeing process increased dyeing costs by about 50 per cent.

The accompanying appendix discusses the specific nature of the principal product, *rascie*, and details of the production process, including a breakdown of costs for one bolt of this cloth. Here the concern is with the implications of the shift to *rascie* for the work force. The increased cost of spinning warp thread reflects greater demand for low skilled labour outside the city, since rock spinners were all women in the immediate countryside who worked to supplement family income (wheel spinners of weft yarn were also women but they resided in the city).[21] The increased cost of weaving, instead, reflects conditions within a category of highly skilled urban workers. That weavers had more work and probably higher pay can be inferred from three characteristics that emerge from an analysis of their individual accounts in the Brandolini

[20] Melis, *Aspetti della vita economica*, p. 567.

[21] This may explain why in the Medici books studied by Edler the *lanino*'s accounts identify the wheel spinners by name while the *stamaiuolo*'s do not; Edler, *Glossary*, p. 415. The Brandolini accounts mention no spinners by name.

books: most were immigrants, virtually all were men and few worked with any degree of regularity.

A surprising number of weavers were immigrants. Of the 71 recorded during the first partnership, 66 are identified by their place of origin, only 5 of whom were from Florence. No fewer than 57 came from outside the city and its immediate vicinity: 40 from more remote areas of Tuscany (6 from the Mugello, 7 from the Casentino and 17 from an area extending from Lucca through the Garfagnana and the Valdimagra to Pontremoli), 1 from the Marche, 3 from the Romagna and 9 from the major cities of Parma, Reggio Emilia, Ferrara and Perugia (and the two warpers who worked for the firm came from Piacenza). The presence of non-Florentines is also notable among the 25 weavers de Roover listed for the Medici firm earlier in the century, with 17 coming from outside Florence, of which 7 from Emilia and Lombardy and 3 from beyond Italy; and the same phenomenon emerges from the apprenticeship records from the end of the century studied by Maurice Carmona.[22] Franco Franceschi noted the trend toward fewer women weavers and more immigrants, especially from Germany, already at the end of the fourteenth and early fifteenth centuries, with a shift in immigration later in the fifteenth century toward more Italians from outside Tuscany; but he thinks that about half the weavers were still Florentine.[23] Of the 73 weavers recorded as working for the Ridolfi company later in the fifteenth century, only 8 are specifically designated as coming from outside Florence.[24]

Only three weavers with accounts on the Brandolini books were women, but some of the male weavers - especially the three who produced more than one bolt a month - may have had women working for them. Franceschi noted a trend in the early fifteenth century toward the substitution of women weavers by immigrants; but women show up on the rosters of the Ridolfi company later in the century (21 out of 73 weavers were women) and of the Medici company operating in the mid-sixteenth century (7 out of 54). According to the figures in the 1604

[22] De Roover, "A Florentine firm", p.114; M. Carmona, "Sull'economia Toscana del Cinquecento e del Seicento", *Archivio storico italiano*, CXX (1962), 32-46.
[23] Franceschi, *Oltre il "Tumulto"*, pp.119-35.
[24] The accounts of the firm of Lorenzo di Antonio Ridolfi & Co., 1463-68 (*ragione* A), are in the Archivio dello Spedale degli Innocenti, Florence, CXLIV, 746, 751-52, 756, 762-64.

legislation women weavers outnumbered men by 5 to 3, and the ratio is assumed to be higher since women who were members of a man's household were counted separately. Most of the weavers who worked for Brandolini resided around the Camadolese monastery in the Oltrarno and in the parish of San Barnaba near San Lorenzo, both areas that traditionally had large concentrations of weavers.

The most striking conclusion to draw from an analysis of the weavers' accounts is the fluidity in their ranks. With about three to four weeks, or a month, needed to weave a single cloth, a full-time work force of only between 12 and 13 weavers would have sufficed to produce the 450 bolts of cloth that marked the level of production reached by the Brandolini firm from October 1580 through October 1583 (before production fell off as the first partnership wound down its activity prior to the reorganization of the second *ragione*). Instead, no fewer than 71 weavers show up on the firm's rosters, 16 of whom produced only 1 bolt, 33 no more than 3 bolts and 45 no more than 6 bolts. Only 2 worked anything like fulltime (32 and 35 months); and of the 13 next most frequently paid weavers, who produced between 12 and 23 bolts over the entire period, only 7 turned in work regularly – about one bolt per month – during the interval they were on the roster.

The rates paid for bolts of different kinds of cloth were standardised, regardless of the sex of the weaver and of the frequency of employment. At around 65 lire per bolt it was enough to weave 4 bolts to have a gross income equivalent to what an unskilled labourer working full time at 1 lira per day was paid in a year (around 250 lire), and a weaver who produced 8 bolts earned as much as the highest paid skilled worker in the construction industry (around 500 lire, or 71 florins). At these rates, and assuming a minimum of expenses, a weaver who worked full time, producing around 12 bolts in a year, was one of the highest paid workers in the city, earning much more than anyone on the staff of the Brandolini firm and almost as much as Brandolini himself. The dates of consignments of finished work on the weavers' individual accounts in Brandolini's ledger would suggest that very few weavers employed by this firm were working more than one loom, contrary to what is often

said about the Florentine industry.[25] A notable exception was the weaver identified only as Lodovico da Firenze, who in six months, from October 1580 to March 1581, turned in no fewer than 15 bolts, almost all *rascie*, and after an interval of two years reappears to consign two bolts on each of two different days. If Lodovico produced bolts the year round at the rate he supplied the Brandolini firm, he would have earned a gross income of around 1800 lire, or 287 florins.

The firm paid all weavers weekly advances in cash, and accounts were settled on consignment of the woven cloth. None of these accounts reveals indebtedness on the part of a weaver that extended beyond the completion of his work, and the firm did not have any financial interest in their looms. Contemporary guild regulations reveal a continuing concern about cash loans to weavers and liens on their looms;[26] but the accounts of this one firm suggest that Florentine weavers, now at the end of the sixteenth century as at the end of the fourteenth century, enjoyed a financial autonomy from their employers that was rare in the industry elsewhere in Europe.[27] As we shall see, mobility within the ranks of weavers may have been more a function of the firm's liquidity from one moment to the next than a function of the labour market.

Fluidity in the ranks of the weavers contrasts with the stability among the other employees of the firm. The employee rosters over the five years of the first partnership record only one factor for combing, one factor for carding, one *lanino*, one napper and one company of shearers, while among the other workers just one *capodieci*, one *stamaiuolo*, one company of washers and one company of fullers had most of the firm's business. Of these employees of the first partnership, the *capodieci*, the two factors for carding and combing, the lanino, the *stamaiuolo*, and the company of shearers continued to get the bulk of the firm's business also through the second partnership, bringing their total employment record to almost ten years. It is not known whether, in turn, these men worked only for the Brandolini firm or whether their prospects for upward mobility were represented by the career of Brandolini himself: the son

[25] Franceschi, *Oltre il "Tumulto"*, p. 75.
[26] Paolo Malanima, *Sviluppo economico e società preindustriale*, (Roma 1997), pp. 126-27.
[27] Franceschi, *Oltre il "Tumulto"*, pp. 74-77; de Roover : "A Florentine firm", p.5n.

of an employee (a *lanino*) of one of the Medici companies studied by Edler and de Roover, he became the manager and partner of the firm without having any need of capital[28]. Virtually all these employees were paid in cash (not in bank) on a fairly regular basis.

Finally, a note of changing times in later Renaissance Florence: most of these men with whom the firm dealt directly had surnames. That the accountant, youths and workers who constituted the staff in the shop had surnames is not surprising, since traditionally these jobs served as an apprenticeship for sons of upper-class families; but the use of surnames by the *lanino*, some of the *stamaiuoli*, two of the shearers and the men the firm dealt with for washing, fulling, stretching and napping marks a change in social practice since the fifteenth century.

IV.

This account of the Brandolini firm both as a business organisation and as a manufacturing operation has emphasized the fragmentation and fluidity of the larger structures in which the firm operated, and in this it falls in line with the traditions of the Florentine wool industry. The market, crowded as it was with relatively small producers on the one hand and importers of raw materials and exporters of finished cloths on the other, lacked centrality, both physical and temporal. Florence, unlike wool centres in north-western Europe, had no communal wool hall where buyers and sellers met; and the city not being a major trade emporium, the local market was not subject to the periodicity, seasonal or otherwise, of trade fairs or a state shipping system. In this fragmented market of importers, exporters and producers, brokers played the key role of the intermediary who brought the parties together; and they enjoyed official guild status. This market structure functioned to assure the wool manufacturer of the security of his investment. He could sell bolts of cloth as they were finished to any merchant-exporter who would buy

[28] Other Brandolini appear among the firm's customers who bought finished cloth: Francesco Brandolini & Co., Ilarione di Giorgio Brandolini & Co., and Vincenzo di Giorgio Brandolini & Co (on the latter see Goldthwaite, "Banking in Florence", p. 482).

them; and any slack in demand could be met simply by ceasing production. Hence he bought only enough raw wool as he could put into production, so he had relatively little capital tied up in materials, while the putting-out system freed him from any investment whatsoever in plant and equipment. Since the longest commitment in the production process was the several weeks wool was in the hands of weavers, the firm had no long-term demands on its payroll; and in any case, the easy availability of short-term credit – from its bank, from clients, from investors – assured a reasonably smooth cash flow. Finally, the putting-out system allowed the firm to dip into the labour pool as needed – hence the fluidity in the ranks of the weavers. In short, the firm had no ties of dependency to specific clients or to a fixed work force.

This fragmentation and fluidity gave the firm the flexibility to remain solvent even in the worst of times. A firm's fortunes varied according to the vagaries of demand abroad, and in moments of crisis in the industry partners might find it difficult to recover their capital; but with reasonable management they could avoid being hounded into ruin by creditors. The industry was a conservative investment, offering only a moderate return but posing little risks. As Leon Battista Alberti observed (in the third book of *Della famiglia*), the cloth industry in general gave much less trouble and bother than trade. Over a century later the Florentine correspondent of the Spanish merchant Simón Ruiz – a client of the Brandolini firm - considered the wool market as still stable and unperturbed, a good place to do business: "it was the safest of all such markets, for the buyers of wool are solid, and in a thousand years not one failure has been seen."[29] In fact, it is difficult to find a bankruptcy in the annals of the industry, even during the rapid collapse of production in the early seventeenth century.

In the course of its long history the industry obviously had its ups and downs, the most notable moment of what some have called a veritable depression coming in the early fifteenth century; but in general the performance of the industry was strong over three centuries, even as a vigorous silk industry grew up alongside it in the course of the fifteenth

[29] Ruiz Martín, *Lettres marchandes*, pp. CXX, 289.

century. The industry successfully underwent shifts in the sources for wool, in the quality of its products and in its market outlets. Moreover, investment confidence in the industry remained strong to the end of the century. Over the same decades the Brandolini firm was operating, the Corsi family, which had considerable knowledge of foreign markets through its commercial interests in southern Italy, also invested in wool shops in Florence, the number growing from two to four during the period 1590 to 1605; and likewise the Riccardi, perhaps the richest family in the city after the Medici, increased the number of wool firms in its portfolio from two to four in the last decade of the century. It was only after the turn of the century, in fact, that both families shifted their investment to favour silk over wool.[30] Moreover, the register of limited-liability (*accomandita*) contracts records more investment in wool than in silk during this period. Something of the strength of the industry is reflected in the accounts of the Brandolini firm. The owners were prepared to meet higher investment costs, they renewed their partnership four times over almost twenty years; and profits were steady, if modest, over the entire period. Demand for labour in the industry was high, to judge from the considerable fluidity in the ranks of the weavers, the large number of immigrants among them, many from outside Tuscany, and their high wages. Demand for the firm's products was also high, to judge from the distribution of sales among so many clients, on none of whom was it dependent. In short, the view from this one cloth producer would seem to confirm a tentative judgement Hoshino once made that the second half of the sixteenth century was one of the industry's "happiest moments."[31]

In retrospect, however, we can see that there were heavy clouds hanging over the future. Differences between the Brandolini firm and the typical firm of the fourteenth and fifteenth centuries reflect changed market conditions. Although production levels were no higher, the firm required considerably more start-up capital to pay for the more expensive Spanish wool and to meet the higher labour costs for the spinning and

[30] Hoshino, "Messina e l'arte della lana fiorentina nei secoli XVI-XVII," in *Studi dedicati a Carmelo Trasselli*, ed. G. Notta (Soneria Mannelli, 1983), (for the Corsi), p. 435; Paolo Malanima, *I Riccardi di Firenze*, (Florence 1977), pp. 75 and 98.
[31] Hoshino, *L'industria laniera fiorentina*, pp.4-5.

weaving of a better quality product. These higher costs, however, did not stimulate investigations into improved technology or higher productivity or induce a shift to less expensive products. In fact, the return of 5-6 per cent the Brandolini firm enjoyed, though steady, must have been close to minimum expectations at a time when deposits in the public bank, the Monte di Pietà, were earning 5 per cent and money put on the international exchange markets earned at around the same level;[32] and it was certainly much lower than what could be earned in the silk industry. Moreover, fundamental changes in the international market to which the industry was oriented eventually, in the course of the century, locked the Florentines out. At home, they slowly lost control of the supply of raw materials, while abroad, with the shift of sales to northern Europe, they found themselves selling just one expensive product in an increasingly complex international market, where there were more competitors and a greater variety of products of different quality. In the accompanying article, Patrick Chorley reviews two major forces that eventually cut the Florentine industry out of the northern markets that it had entered for the first time barely two generations earlier: the rise of competition from other Italian cities and the contraction of the Florentine commercial system abroad. In the first quarter of the seventeenth century Florentine production for international markets fell off rapidly, almost within a generation; and unable to challenge the Dutch and English merchants who were invading the Mediterranean markets with their cheaper and lighter cloths, the industry never recovered.[33]

In a certain sense this concluding chapter to the long history of the Florentine wool industry is written around a critical shift in the market structure in which the industry operated. In the fourteenth and fifteenth centuries the industry had grown and prospered by producing for outlets in the eastern Mediterranean and for luxury markets closer at home, especially in Rome and Naples – all areas of limited economic

[32] Goldthwaite, "Banking in Florence," p. 525.

[33] According to Malanima the ruralisation of the industry to cut costs was not a possibility owing to the organization of Tuscan agriculture; *Sviluppo economico*, pp. 101-102; but cf. J.C. Brown, "The economic 'decline' of Tuscany: the Role of the Rural Economy," in *Florence and Milan: Comparisons and Relations*, (Florence 1989), II, pp. 101-15.

development; but in the sixteenth century with the production of *rascie* for northern Europe consumption, Florentines for the first time found themselves targeting markets in a dynamically expanding economy where demand was volatile and competition keen. They showed considerable enterprise in developing a new kind of high-quality product that initially enjoyed much success, but in the long run the industry failed to adjust to the rapidly changing economic conditions of north-western Europe and in particular to recognize the marked trend of textiles toward ever-lighter cloths. The 1620 ducal inquest into the crisis the industry had reached by then recognised both of the basic problems: the withdrawal of Spanish merchants from Florence and the production of cloths not easily marketable.[34] In short, a less flexible industry and more fluid markets.

[34] Carmona, "La Toscane face à la crise", pp. 151-68. Other major problems, according to the report, included a decline in the quality of woad and a lack of silver specie.

APPENDIX
RASCIE: THE MANUFACTURING PROCESS

The Brandolini firm used the traditional method for keeping track of each bolt of cloth it produced through the entire manufacturing process; and, given the even greater discipline of accounting practice at the end of the sixteenth century, it is relatively easy to follow that course in some detail. The wool, once washed and beaten, was divided - at least for record-keeping purposes - into lots of around 6,000 pounds; and at this point the decision was made about the nature of the cloth to be produced and the number of bolts that would be made from each lot. A number or sign identified each lot and bolts were numbered consecutively within each lot; and this identification tag with its two components marks the wool from the moment it was sent to the factors for combing and carding through the entire manufacturing process to its final sale as a finished piece of cloth[35]. The following description of this process is based on the record for the 67 bolts, 64 of them black *rascie*, in lot #1.

Timing. The Brandolini firm purchased its first bales of Spanish wool from a Spanish importer, B. Suarez & Co., on 8 August 1580. The next day the wool was sent in 100-pound sacks to the washing firm, and the washed wool was returned in *fardelle* of 10 pounds to be beaten, carded and combed. By 18 August the wool for the first bolt of *rascia* to be made from lot #1 was ready for the spinners; on 5 September the warp yarns (*tela*) for lot #1 bolt #1 went to the weaver and this was followed by deliveries of the weft yarns (*lana*) on 12, 17, 24 and 28 September; finally, on 1 October, the woven cloth was returned. The finishing process for lot #1 bolt #1 lasted the month of October, and on the last day of that month the cloth was sold as a *rascia nera fine*, 62.5 *braccia* in length, to the Genoese firm of B. Bagnoli, F. Spannocchi & Co. for 74.78 florins (bolt #2 had been sold a few days earlier). The first bolt of lot #1 had been produced in two months and 23 days from the time of the purchase of the first bales of wool:

preliminary processing	9 days
spinning:	18 days
weaving:	26 days
finishing:	30 days

[35] A. Stella, "*Ars lane* ou *ars rationandi*", pp. 113-119, in *Le marchand au moyen age*, (Paris 1992), describes the similar way a fourteenth-century shop "programmed" production, using different signs to distinguish lots with respect to the quality of cloth to be made from them.

The last of the 64 *rascie* of lot #1 were sold in April 1581, eight months after the purchase of the first bales of wool.

Loss of weight. In the course of being transformed into cloth wool undergoes a considerable loss of weight. The documentation of this loss, however, is complete only at those points where it was in the firm's interest to keep track of it: this was during the preliminary stages through spinning, when rates for work were based on weight and when weight was a device for checking against thievery by the spinners, warpers and weavers who worked beyond the direct supervision of the firm. Once made into cloth, there was no need to take note of weight.

In the initial washing process the first 9,670 pounds of raw wool purchased by the firm was reduced by 9 to 27 per cent, the average being 18.34 per cent (de Roover noted a loss of 18.5 percent for the firm he studied). The subsequent steps in the preliminary stage apparently did not lead to notable weight loss; but the next stage, spinning, did. Of the 5,655.55 pounds of wool constituting lot #1, 4.82 per cent was lost during the next stage of spinning: warp yarn lost at rates that varied for each consignment, from 4.95 to 6.27 per cent, whereas the loss of weft yarn was simply built into the accountant's calculation as 4 per cent (the ratio of warp to weft yarn was 1.45:1 before and 1.48:1 after spinning). The average weight of the 64 *rascie* of lot #1 returned by the weavers was 85 pounds (Hoshino calculated a weight between 77 and 85 pounds). Another significant loss of weight came with the washing and scouring of the cloth (*purgatura*), but this loss was generally not recorded since the work was paid by the bolt not weight. The Brandolini accountant, however, made marginal notations of this loss for four *rascie* in lot #1: the loss ranged from 18 to 26 per cent, averaging 21.68 per cent. We can assume, therefore, that during the finishing process the average *rascia* in lot #1 that left the weaver weighing 85 pounds weighed no more than 66-67 pounds after it was finished. It also shrunk in length by about the same percentage: from 76.14 to 61.77 *braccia* (less 18.87 per cent).

To recapitulate, using the average figures mentioned above, wool lost 39.13 per cent of its original weight in these stages:

washing:	18.34 per cent
spinning:	4.82 per cent
scouring:	21.68 per cent

We have some precise figures for Lot #1 bolt #1. In the spinning of the yarn it was made from, the loss was 6.26 per cent for the warp and the standard 4 per cent for the weft; and the bolt the weaver delivered weighed 87 pounds and

TABLE A1: Production costs of one bolt of rascia nera based on rate charges[a]

Operation	Weight in lbs.[b]	Rate in £ s.d.		Cost lire	%
Preparatory processing				28.69	9.87
washing[c]	108	£1 per lbs.100 (before washing)	1.08		0.37
alum[d]	108	30s. per lbs.100	1.62		0.56
capodieci	88	1s. 4d. per lb.	5.87		2.02
warp: beating	88	1s. 4d. per fardella (lbs.10)	0.59		0.20
combing	33	5s. 8d. per lb.	9.35		3.22
arranging on distaff	33	£1 13s. 4d. per lbs.100	0.55		0.19
weft: carding[e]	55	14s. per paiuola (about lbs.4?)	9.63		3.31
Spinning				80.15	27.56
warp: stamaiuolo	31	28s. per lb.(varied from 25-28s.)	43.40		14.92
warping		£4 per bolt	4.00		1.38
marking		19s. per bolt	0.95		0.33
weft: lanino	53	12s. per lb.	31.80		10.94
Weaving[f]	85	£0.77 per lb., or £0.86 per braccio for br.76		65.45	22.51
Finishing				15.43	5.31
burling: dizzeccolatura		£1 15s. per bolt	1.75		0.60
riveditori		£2? per bolt	2.50		0.86
scouring	67	£4 per bolt (varied from £2-4)	4.00		1.38
fulling		£1 per bolt	1.00		0.34
Arte della Lana: fee		9s. 8d. per bolt	0.48		0.17
shearing: cimatura di molle		£2 per bolt	2.00		0.69
cimatori		£2? per bolt	2.25		0.77
tentering		£1 per bolt	1.00		0.34
mending		9s. per bolt	0.45		0.15
Dying				52.50	18.05
tintori di guado		£37 per bolt (varied £35-37)	37.00		12.72
tintori d'Arte Maggiore		£15? per bolt	15.50		5.33
Brokerage		£3 per bolt (varied from £2-3?)		3.00	1.03
Indirect costs: average of 889.5 bolts over two *ragioni*				12.15	4.18
Balance: miscellaneous direct manufacturing costs				33.42	11.49
					100.00
SUBTOTAL: manufacturing costs				£290.79	54.92
Raw wool: lbs.108 @ f.27.51 per lbs.100 (ave. price in lot #1)				207.98	39.28
Profit: estimated @5.8% on gross income over 2 *ragioni*				30.71	5.80
TOTAL: average selling price of a *rascia* in lot #1 (60.5 of 64 bolts identified)				£529.48	100.00

Notes: The discrepancy between the costs under some categories on this table and those on Table 3 is owing to the averaging process used in Table 3, which made no distinction between kinds of cloths produced.

[a] Data derived from records of 64 *rascie* in lot #1 (average length: br. 76 before scouring, br.62 after).

[b] Weights calculated on basis of weight losses reported in text.

[c] Rate went up to £1 15s. from November through February.

[d] Lbs.7.5 alum, @4s. per lb., needed for lbs.100 wool.

[e] Weight per *paiuola* is my estimate based on warp-weft ratio.

[f] Rates are not specified in payments to weavers; these are my calculations.

was 75 *braccia* in length. After washing and scouring it weighed 70 pounds (a loss of 19.54 per cent), and its length when sold was 62.5 *braccia* (a loss of 16.67 per cent). In today's units (1 Florentine pound = kg. 0.339; 1 *braccio* = m. 0.583) this bolt of *rascia* measured 36.438 m. and weighed 23.73 kg., or 0.651 kg. per meter, which was slightly heavier than the average.

Costs. Table A1 summarises the rate charges paid for the stages in the production of *rascie* that are documented, and applies these to the cost of one hypothetical bolt. Rates were applied to weight for the preliminary processing and spinning, to length for weaving and to the piece (the bolt) in the finishing stage. The length and weight of the hypothetical bolt - 62.5 *braccia*, 70 pounds - is that of lot #1 bolt #1, which is one of the only four bolts in this lot for which is also documented its weight after scouring. Working backwards from the weight of this cloth before scouring, and using the average weight losses cited above, we arrive at 112 pounds as the quantity of raw wool needed to produce this bolt[36]. Other data for the hypothetical bolt are the averages reported in the previous section: rates of prior weight losses (working backwards this results in a quantity of raw wool whose weight has been rounded to 110 pounds), losses in spinning weft and warp yarns, and the ratio of weft to warp. The rate charges account for 88 per cent of the average of total manufacturing costs.

[36] This approximate weight is confirmed by another calculation: taking the total spent for wool during the two *ragioni* - 23,694.35 florins - and dividing this by the average spent for lbs.100 of wool during the first year of each of the two *ragioni* (24.76 florins), we come up with a hypothetical total weight of the wool purchased - lbs.95,696; and dividing this by the total bolts produced - 889.5 - results in an average weight of lb. 107.58 for the raw wool needed for each bolt.