

MORAL HAZARD AND ASSET SPECIFICITY IN THE RENAISSANCE THE ECONOMICS OF SHARECROPPING IN 1427 FLORENCE

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I

For over seven centuries sharecropping (*mezzadria*) was the main tenure arrangement in large parts of central and northern Italy. Though similar contracts had already been used in Roman times and the early middle ages, it was only from the thirteenth century onward that *mezzadria* came to predominate in Tuscany, a position it retained into the twentieth century (Rerolle 1888; Solmi 1923; Luzzatto 1948; Imberciadori 1951; Jones 1964 and 1968; Desplanques 1969; Byres 1983). Some historians have discounted the contract's longevity as no more than a locked-in "feudal" equilibrium (Sereni 1947; Giorgetti 1974) though modern analyses have severely criticized this point of view (Cohen and Galassi 1990; Galassi 1992; Luporini and Parisi 1996). In spite of a

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lively debate on the contract's effects on the development of agriculture, relatively little attention has been focused on why share contracts were adopted in this area in the first place. Only recently a number of alternative hypotheses have been put forth (Epstein 1994; Galassi 1994).

Yet without a clear understanding of why share contracts were adopted, the puzzle of their long-term survival cannot be solved. The thesis of this paper is that changes in property rights during the late middle ages altered the distribution of costs and benefits for laborers and landlords. Together with intensified farming and the spread of costly cultivations such as vines, this increased the scope for, and the cost of, opportunistic behavior. Share contracts reduced (but did not restrict to zero) the range over which workers could act opportunistically, and over time proved flexible enough to adapt to changing conditions.

The next two sections will set the stage by presenting an analysis of the transformation of the rural society of Tuscany in the late middle ages and reviewing alternative explanations of why sharecropping was adopted. A testable hypothesis will then be presented. Section IV will discuss data sources and sampling methods, and report the econometric results.

II

Demographic growth in late medieval Italy increased the intensity of cultivation and brought about a redefinition of property rights in land. Increasing complexity of agricultural operations expanded the margins over which agents could practice opportunistic behavior. Institutional arrangements were modified to address these new problems, and share contracts became common. When incomes rose with demographic decline in the 1300s, share contracts smoothly adapted to the growing demand for income-elastic, capital-intensive products.

The eleventh to thirteenth centuries were a period of population growth. Estimates suggest that the Italian population more than doubled between 1000 and 1300, going from about five to over 11 million people (Jones 1964; Bellettini 1973; Cherubini 1984, pp. 14–15). Demographic expansion appears to have occurred both in the countryside and in towns, which in Italy had retained a greater administrative and economic role than elsewhere in Europe: by the fourteenth century some Italian cities (Florence, Milan, Venice, Genoa) had close to 100,000

people, and many more had reached 50,000 (Luzzatto 1961; Hyde 1973; Jones 1978).

Late medieval demographic growth increased population pressure on land, extending cultivation onto previously untilled territories. As food prices, and rents, rose (Pinto 1981a; Herlihy 1967, p. 143; Romano 1973, pp. 1828–1832), cultivation spread to “waste” areas. Marshes were reclaimed and woodlands cleared (Cherubini 1984, 18–24; Redi 1981), but especially in central Italy, where waste was limited and demographic growth had been particularly high, farming became more intensive. Farm size appears to have decreased (Comba 1983), and higher yields (Cherubini 1984, pp. 12 and 252; Ugolini 1978a, pp. 382–383; Herlihy 1968) were obtained through the introduction of new rotations restricting fallow and replacing it with deeper ploughing, more spade work, and increased manuring to prevent soil exhaustion.

Higher yields, and therefore higher land prices, increased the expected net benefits of investing resources in specifying, acquiring, and policing property rights in land, as Domar (1970) and North and Thomas (1973) have argued. In fact, the twelfth and thirteenth centuries witnessed growing friction between lords and villeins over traditional rights, disputes between manors and towns sheltering fugitive serfs, and acts of “recognition” of customary obligations and status. These disputes have been traditionally seen as a quest by town-dwelling merchants for liberalization from the customary rights of manorial lords (Leicht 1946). In fact, the assertion of control by towns on the neighboring countryside was often led by urbanized noble families, or by former peasants who had transformed customary rights of occupation or use into *de facto* private property (Jones 1968, 1978; Ugolini 1978b; Cammarosano 1979; Caferro 1994; Plesner 1934; Piccinni 1975–1976). Urban statutes in the thirteenth century (*cartae libertatis*) regulated and protected landownership, established rules for consolidation of scattered properties (*ingrossatio*), commuted seigniorial dues, converted freehold and copyhold to private property, and defined rights to inherit and alienate. Enfranchisement decrees, such as those of Bologna in 1257 or Florence in 1289, were aimed less at bestowing freedom upon the peasants than at reasserting their obligations, securing supplies to the city, and preventing land sales to foreigners (Jones 1968, pp. 215–217; Ugolini 1978b, p. 766). The keen interest taken by town governments in the sur-

rounding country stemmed not only from the political power of urban landlords, but also from the city officials' concern with maintaining a steady supply of food, particularly grains at regulated prices, to swollen urban populations (Pinto 1978; Ugolini 1978b, p. 747). The fiscal surveys (*estimi*) of farmland, such as Siena's in 1318, bear witness to the importance attached by city administrations to identifying and regulating property rights in land in a time of high demographic density.

Population pressure demanded more intense farming methods, and this in turn made it more difficult to enforce labor services. Fenoaltea (1984) has argued that forced labor is efficient with relatively simple routine tasks, but when complex operations involving multiple potential sequences have to be carried out, incentives yield better results than punishment. Growing numbers of sequentially linked, complex tasks broadened the range for opportunistic behavior on the part of laborers. This posed a particularly severe problem for landlords in that strong exogenous influences typical of agriculture make detecting opportunism *ex post* difficult (Holmström 1979). The centuries after the new millennium were thus marked by a shift away from labor dues toward rents, first in money and later, as inflation rose in the 1200s, in kind (Ugolini 1978b). Even though not all customary obligations were removed (at times some were simply transferred to the new owners), on balance by the beginning of the demographic crisis of the fourteenth century the manorial system in central and northern Italy had been largely wrecked.

By the end of the 1300s, too, a substantial proportion of landed property in Tuscany had come to belong to city dwellers, be they urbanized nobles and villeins or town merchants, and over the following centuries urban landlords appear to have further extended their ownership of farmland (Cherubini 1984, pp. 69–70; Jones 1968, pp. 217–218, 1978, pp. 221, 236; Conti 1965, pp. 297–319; Herlihy 1968, pp. 256ff). In some areas, such as Florence, the growth of urban property in the countryside was in part aided by harsh fiscal policies that may have forced some small-holders into debt, but this was by no means generally true and urban landed property grew also in states where fiscal pressure was lighter (Caferro 1994; Fiumi 1956). Side by side with the expansion of urban property went a reorganization of holdings fragmented by the demographic growth of previous centuries: permutations and buyouts of small-holders,

actively supported by urban legislation, permitted engrossing of lands and the creation of self-contained farms called *poderi* (Cherubini 1984, pp. 75–82; Ugolini 1978b). The new owners invested heavily in their farms, building houses, barns, wine and oil presses, stables, drainage ditches, and retaining walls—particularly important in a hilly region such as Tuscany—and planting vines, fruit groves, olive trees (Ugolini 1978b, pp. 756–757; Cherubini 1974; Pinto 1979, p. 270; Imberciadori 1958, pp. 254–255; Herlihy 1968, pp. 275–276; Emigh 1997).

The conquest of the countryside by the towns did not always proceed smoothly: conflicts with manorial lords, especially the rich abbeys, and peasant resistance, marred the establishment of town-dwellers' exclusive property rights, and certainly the actual results in any given area were greatly influenced by the local balance of political power. By the time of the demographic crisis of the early 1300s, in any event, large parts of the countryside had not yet undergone the process just described. Nonetheless the change had been sufficiently widespread that by the late 1300s consolidated holdings complete with buildings, livestock (Emigh 1996), and producing a variety of crops, were dotting the countryside (Jones 1968, pp. 222 and 234–241).

The demographic decline of the fourteenth century, particularly after the Black Death of 1348–1350, did not reverse the intensification of Tuscany's farming, as population decline, estimated at around 30 percent (Cherubini 1984), did not return demographic density to the pre-1000 levels. However, the smaller, but richer, population affected the structure of demand, favoring income-elastic products, most notably wheat (as opposed to "inferior" grains like rye or barley) and, above all, wine.

Wheat had always been one of the main crops in Tuscany and rising urban demand from the early 1300s onward meant that, per unit of land, it now yielded revenues between 50 and 100 percent higher than less sought-after grains. Not surprisingly, wheat rose as a proportion of grain output, in some areas apparently reaching 70 percent of all cereals (Cherubini 1984, pp. 11–16; Pinto 1979, 1981a). Though desirable, wheat is also the most soil exhausting of all grains, so that its rising relative importance required increased care to compensate greater demands made on the soil (DeAngelis 1981).

The real beneficiary of higher incomes was, however, the wine trade. Estimates based on tax revenues suggest that yearly wine sales

in Florence more than doubled in the first half of the fourteenth century, while population declined by a third (Pinto 1979, pp. 256–257). The rapid increase of wine demand is well documented by the secular trend in the terms of trade between wine and wheat on the Florence market. Taking relative prices of wine to wheat in the 1280/1290s as 100, by the mid-1300s the terms of trade had risen to 140, reaching 200 in the early 1400s (de la Roncière 1963, Tables 4 and 12; Pinto 1981b, pp. 188–190). Price series for other towns show similar movements (Herlihy 1967, p. 149). The shift in the terms of trade favored the growth of viticulture, and ample evidence exists of new vines and vineyards being planted in this period (Cherubini 1984, pp. 85–87; Pinto 1979, pp. 259–261; Herlihy 1968, pp. 247, 251). Greater care was being taken in choosing suitable lands for this increasingly profitable product, and selected, high-quality varieties were adopted (de la Roncière 1973, p. 126; Pinto 1979, p. 260). Renewed interest in viticulture was also reflected in the work of contemporary agronomists who devoted long and detailed chapters to vine-growing and winemaking (De'Crescenzi [1478] 1536; Tanaglia 1953). Rising incomes encouraged the diffusion of other high-value plants, such as olive and fruit trees, though apparently not in the same degree as vines (Pinto 1979, pp. 261–268).

For our purposes what matters is that the intensification of cultivation and the shift in the crop mix increased, first, the dimensions over which laborers could behave opportunistically, and second, the potential consequent damages to landlords. For wheat, more intense cultivation implied further restrictions of fallow, which had to be compensated with deeper, more frequent ploughing, more careful spadework, greater use of legumes in rotations, and more manuring. Each of these operations had to be performed at particular times, in a sequence that was reasonably predetermined, all the while being susceptible to more or less significant modifications depending on contingencies. Laborers' response to contingencies were difficult to observe and therefore ultimately depended on the laborers themselves.

Labor response was even more important for tree crops such as vines, than for an annual crop like wheat. Vines represented a substantial capital investment for the initial planting, and planting was only part of the capital costs of viticulture: presses, vats, and storage areas were also necessary. Vines were delicate, prone to diseases (de la Roncière 1973, p. 133), and particularly susceptible to improper handling.

Modern estimates suggest that vines require, per unit of land, between 2.5 and four times more labor input per year than grains (Chisholm 1968, p. 59, Table 7). Further, no one predetermined sequence of actions could be defined in advance. In fact, what is striking about the discussion of vine-growing in contemporary agronomists is the contingent nature of the advice proffered: straw placed around the base of the trunk helped protect roots against frost, but if left during a rainy period would grow mould and damage the vine. Temperature and precipitation determined whether to prune in the fall after the picking was complete, or in late winter before new buds appeared. Exactly where and what to prune depended on the quantity and quality of the last vintage. The amount of cuttings to be left near the plant to rot and rebuild soil nutrients varied with humidity, exposure, and branch size (De'Crescenzi [1478] 1536, book 4). An optimal response sequence covering all contingencies was simply too difficult to determine, and even if it could be set down there remained the problem of ensuring workers would actually follow it. The cultivation of vines inevitably involved significant discretion on the part of labor over numerous complex and interdependent operations.¹

If performance could be costlessly observed, discretionary behavior could be measured at all relevant margins. But if measurement had to be limited to one or a few margins, agents may have neglected important—but unmeasured—tasks and concentrated on good performance in dimensions easily observed by the principal. Growing complexity of tasks and rising costs of improper responses thus posed a significant problem for Tuscany's landlords. The institutional means of restricting the range of potentially damaging opportunistic behavior was sharecropping, as contemporaries were well aware. In 1351 the monastery of Forcole, northwest of Florence, introduced share contracts "...in order that [laborers] be more mindful and efficient in tilling and harvesting" (Herlihy 1965, p. 236).

III

The awareness of contemporaries has not been transmitted into historical knowledge. Scholars remain divided on the reasons for the spread of sharecropping between the 1200s and the 1400s, and three main approaches have been proposed (Galassi 1992; Botticini 1998). Some have argued that demographic decline led to the adoption of *mezzadria*:

as labor became increasingly scarce, landlords needed to “attract and retain” workers, which they did by sharing risks (Herlihy and Klapisch-Zuber 1978, pp. 270–271; Herlihy 1967, pp. 145–146). Others have emphasized impoverishment of peasants. Acquisition of land by townfolk and rapacious fiscal policies meant that landlords, who would have preferred fixed rent, were faced with poor tenants unable to bear any risk (Epstein 1994). The third approach ties share contracts to expensive monitoring and moral hazard. Costly monitoring made detecting opportunism expensive, and share tenancy gave labor incentives to self-monitor (Emigh 1997; Galassi 1992).

In this section I argue that each of these analyses has to meet two criteria to explain the spreading of *mezzadria* in late medieval Tuscany: first, it has to account for the timing of its adoption, from about 1200 onward. Second, it must account for *share* tenure, that is, it must explain what purpose was served by determining factor incomes as a proportion of output rather than as fixed payments.

First, the issue of timing. The adoption of *mezzadria*, beginning in earnest in the 1200s, straddles the population crisis of the fourteenth century, which does not easily accord with the argument that it was adopted to “attract and retain” workers in a period of demographic decline. Among other considerations, given that population movements were similar all over Europe, it remains unclear why share contracts only became common in some areas (Hoffman 1984, p. 311; Jones 1968, pp. 226ff). The other two explanations fit more easily with the historical record: the redefinition of property rights, whether it brought about the impoverishment of peasants as one approach would have it, or increased the margins and costliness of opportunistic behavior as the other suggests, occurred at the same time as the spreading of share contracts.

As for *share* rent, two of the three explanations see output sharing as a risk diffusion mechanism. Is there evidence, then, of high exogenous risks in Tuscan agriculture in this time period? Contemporay yield data are scarce, but when information is available for the same farm over a number of years, annual variations in output are striking: fluctuations in the order of 60 percent in wine and wheat production are common (Conti 1966, pp. 55–58). These data are at least consistent with the risk dispersion approach. However, both theoretical and empirical research has shown that output sharing does not depend on risk aversion (Rao 1971; Stiglitz 1974; Reid 1976; Newbery 1977; Singh 1989). In the first

place, identical risk dispersion outcomes can be obtained by sharecropping as can by mixing different contracts. Mixing contracts was commonly practiced in late medieval Tuscany: a number of contracts from the late 1200s stipulate that fixed rent would be converted to a share in case of poor harvests (Cherubini 1979, p. 142; Cammarosano 1979, pp. 173–175). In the 1420s mixed contracts were commonly used around Florence (ASF/CCi 64 131r; 73 4r and 66r; 78 86r, 88v, and 126v; 89 61r; 81 104r). The point is simply that while risk spreading was undoubtedly an attractive feature of share contracts, it cannot be the main reason for choosing this form of tenancy because alternative arrangements with equivalent characteristics existed and were commonly used. Furthermore, there are numerous cases of peasants with substantial landed property of their own entering into share agreements with urban landlords (Cammarosano 1979, pp. 201–202, 210): such share contracts could hardly have been adopted to disperse risk, as landed farmers could borrow on the futures market (Herlihy 1965, pp. 239–240; Epstein 1994, p. 72; Cherubini 1984, p. 68).

To put the question in these terms is to see the root of the advantages enjoyed by sharecropping. Mixed contracts are difficult to negotiate and may involve “perverse” adjustments on the part of one of the contracting parties as they become more familiar with the precise payoff structure of the agreement—for example, unless monitored, labor has an incentive to shirk and then claim a bad harvest. The conflicts involved in arrangements of this sort reveal that the strength of share contract lay in the simplicity and flexibility of the agreement.

In any event, the risk hypothesis is not properly seen as an alternative to the moral hazard/transaction cost story. Factors affecting risk are not easily differentiated, given the data set used in Section IV, from transaction cost variables, and in some ways it can be argued that risk, that is unpredictable exogenous influences on output, is what creates the moral hazard problem in the first place (see below). If output were a deterministic function of inputs only, then observing the outcome—harvest—would give the landlord an unambiguously accurate measure of tenants’ competence and diligence. It is the noise introduced by risk that resonates on contractual choice.

The last explanation views share rent as the solution to opportunistic behavior. As compared to a wage contract where labor must be supervised, share tenancy reduces the margin for opportunistic behavior by tying income to effort. Thus when monitoring is inexpensive and

opportunism easily detected, wage contracts prevail. But if monitoring becomes more expensive, or the scope for opportunism rises, agents have to be given incentives to perform adequately, and in agriculture the most easily administered reward is a linear sharing rule tied to the harvest (Holmström and Milgrom 1987). Both fixed rent and share agreements tie agent's income to harvest size, however, and share agreements may create some disincentives by "taxing" the marginal product of inputs (Johnson 1950; Jaynes 1984). What then was the advantage of share tenancy?

In late medieval Tuscany using harvest size to determine rewards set up adverse incentives in wheat production as farmers would reallocate labor away from soil-protecting activities, and maximize current output unless monitored or assigned rights to future income streams (fixed rent). Wheat, however, was a reasonably homogeneous commodity with relatively low sunk costs: opportunistic behavior was unlikely to affect its quality significantly, and soil exhaustion could be remedied. Other crops posed different problems, and it is this "multitask" aspect of the problem that, I argue, made share contracts attractive (Holmström and Milgrom 1991).

Opportunism could have dire consequences for wine, whose quality is the prime determinant of price (Conti 1966, p. 44). Location affected wine quality, but so did proper handling. Contemporary farming treatises caution against tenants favoring quantity over quality: as a sixteenth century viticulture manual put it, with a surprisingly modern turn of phrase, "labourers are only interested in their own utility [*utilità*];... it is up to landlords...to keep profits in mind" (Soderini 1600, p. 62). Workers, landlords were warned, apply too much manure to avoid spadework—a productive but tiring task—thus watering down the final product (Gallo [1579] 1572, p. 195; De'Crescenzi [1478] 1536, book 8). Short pruning, increasing current output at the expense of long-term yields, also appears as an example of commonly practiced opportunism (Gallo [1579] 1572, pp. 66–71 and 193). Improper pruning had high costs in foregone output, not only in the current year but in future as well, and the damage inflicted on a vine may well prove irreversible, leading to the loss of an expensive asset.

Seemingly, the solution to this kind of opportunistic behavior is to offer tenants exclusive property rights to future income streams, that is, long-term fixed rent contracts. Tenants will then not shirk on labor

inputs because they receive the entire marginal product, and will maximize the life of the asset. However, the term of the contract must then be the same as the expected life of the asset: a contract lasting less than the productive life of the vines would result in the tenant's maximizing income over the contract term, that is extracting more output per year than optimal from the landlord's point of view.

Two problems result from this. First, the life of the asset must be clearly defined *ex ante*. This was probably close to impossible at the time, as vines were, before the phylloxera invasions of the 1800s, seldom grown in vineyards, but rather in rows along the sides of fields, often supported by other trees (intercropping). Whereas a vineyard of a certain age is simply uprooted and replaced, intercropped vines were individually replaced as they sickened or aged. Whatever the contract term, thus, the fixed-rent tenant had an incentive to over-exploit young vines and avoid replacing them as they died, unless the contract was sufficiently long term to justify his doing so. But landlords were not likely to offer such long-term agreements as they would thereby lose all ability to evict incompetent tenants. Besides, as Carmona and Simpson (1998) have argued, long-term fixed rent agreements of this sort are likely to create ongoing friction as relative prices change.

Second, even if landlords could costlessly discriminate among tenants, they would only offer fixed-rent contracts if rent equalled the opportunity costs of land and of the capital invested in vines, plus the depreciation of the asset. But if the term of the contract is the same as the expected productive life of the vines (assuming it could be defined), upon its expiry the value of the asset would be zero. The landlord, that is, must accumulate during the life of the contract the capital necessary to re-plant. In other words, the landlord has to act as residual claimant even with fixed rent, and there is therefore no incentive for tenants to accept such contracts. Regardless of the term of the contract, thus, the tenant has an incentive to maximize output in the short term and deplete the asset.² Fixed-rent contracts do not allow the landlord to economize on monitoring resources after all, given the nature of the assets on these farms. But if the landlord had to monitor assets anyway, there was an incentive for him either to offer no fixed rent contracts at all, or to charge extremely high rents in order to self-ensure against damages to his assets. In fact, in 1427 a Florentine landlord complained about his fixed-rent tenants saying, "I was badly paid and suffered damages for I charged too high a rent," and a fixed-rent tenant complained that his

landlords "have always wanted to keep their rents so high and expensive, that it has not been possible for me to pay" (Pinto 1979, p. 247). These were not aberrations due to individual greed, but the result of the incentives built into the asset-specificity of the crops. In the rare cases of fixed-rent contracts being used for vineyards throughout Tuscany, the rents were, in fact, long term and expensively high (Epstein 1986, pp. 70–71).

Does that mean that fixed-rent contracts and vines are incompatible? Obviously not, though Botticini (1998) has found that the presence of vines on a farm worked against fixed-rent contracts being in use. In addition, my argument is that an expensive and sensitive asset such as vines increases the probability of opting for an incentive-compatible contract such as sharecropping under the particular circumstances found in Florence in the fourteenth/fifteenth centuries. These can be described as landlords having their main place of residence and economic activity away from their farms in an area where factor prices were such that additional output had to be obtained from rising labor intensity rather than an extension of farming. The point is that, when landlords find it costly to supervise an expensive asset whose output is sensitive to the application of a particular input, a sharing rule is a likely solution. Both parties are thereby turned into residual claimants. Other areas matching these characteristics have also historically used share contracts (Yoon 1975; Carmona and Simpson 1998). Even in Tuscany, of course, cases of vineyards leased for fixed rent can be found, albeit often under somewhat peculiar circumstances. Epstein has identified a few cases of fixed-rent contracts for plots with vines, but only in very peculiar settings, such as elderly widows charging a fixed rent for their vineyards, or an instance of a cobbler who donated a vineyard to the hospital of Siena but kept its use for his lifetime, paying the hospital a fixed annual sum (1987, pp. 160–161). The cases are few and obviously rather extraordinary.

My point, backed by the quantitative analysis reported below and consistent with Botticini (1998), is that these were exceptions. Even with fixed-rent contracts, landlords had to monitor the use of their assets. With share contracts, landlords in effect managed the farm and took the important decisions, and their involvement restricted the margins over which tenants could behave opportunistically. Late medieval contracts without exception reserve the right to manage to the landlord, and from the thirteenth century on impose a growing number of clauses

setting out in detail what practices to follow: when and how to prune and plough, how much manure to spread, how to work with the spade, how to plant new vines or olive trees (Luzzatto 1948, p. 77; Imberciadori 1951, pp. 47–64; Pinto and Pirillo 1987, pp. 46–47; Muzzi and Nenci 1988, pp. 104–114). Enforcing these stipulations was a source of conflict between landlords and peasants (Cherubini 1984, pp. 131–138; Giorgetti 1974, p. 42), which in later centuries lead to a further curtailment of tenants' discretionary responses (Galassi 1992, p. 91; Luporini and Parigi 1996 for theoretical discussion). What matters, however, was not whether sharecropping was conflict-free, which is an unreasonable test to put to any contract, but why it was adopted in the first place. *Mezzadria* was the tradeoff between leaving no room for discretion but paying an enormous cost in monitoring wage laborers, and reducing supervision costs but suffering asset depletion. With valuable assets such as vines, no savings were possible through fixed rent. Sharecropping was the compromise that gave workers some incentive to self-monitor while landlords concentrated their resources on overseeing the use of invested capital.³

This must not be taken to mean that sharecropping involved no monitoring costs. Rather, the contract established incentive-compatibility between tenants and landlords as far as production was concerned, thereby reducing the daily cost of supervising labor. There remained monitoring the distribution of output, the subject of a vast contemporary literature against the “thieving” sharecroppers (Cherubini 1984, pp. 137–138). Note, however, that dealing with this kind of opportunism by laborers was no less costly with any other form of contract: at the time of the harvest, it is not difficult for workers in the fields, especially in a hilly area, to hide a certain amount of produce. That this was a particularly pressing point for landlords with several farms is another matter, not related to the specific contractual arrangement in use. In any event, during the 1500s and 1600s landlords attempted to deal with cheating by collecting individual farms into centralized estates (the *fattoria*), run by salaried supervisors whose task it was precisely to monitor not so much the technical quality of the tenants' labor, but their respect for the terms of the contract. The rise of this system, far from undermining my argument about the functions of share contracts, actually confirms it because this centralized arrangement shows precisely that sharecropping created an incentive for tenants to monitor themselves while landlords (or their stewards) monitored capital (Ciuffoletti

1985). But this was all the in the future at the time when the database I use in the next section was being gathered.

The hypothesis developed in this section, then, is that share tenancy was a way of controlling some dimensions of opportunistic behavior with high monitoring costs. The next section presents the data and methodology to test it empirically.

IV

Two main problems are involved in testing the opportunism approach to *mezzadria*. First, the explanatory variables (cost of labor opportunism and supervision) are unobservable, and proxies have to be chosen. Second, a reasonably large sample is necessary. The only adequate quantitative source of farming data for this period is the 1427 *Catasto* (property registry and population census) of Florence (Herlihy and Klapisch-Zuber 1978; Conti 1965, 1966). The *Catasto*, however, is a cross-section, which may raise some concerns about its suitability for what is essentially a dynamic phenomenon. However, in the first place the source has already been used for studies of dynamic processes such as wealth accumulation and demographic change (Herlihy 1981; Herlihy and Klapisch-Zuber 1978). Furthermore, provided appropriate proxies are selected for the unobserved variables, spatial variations in tenancy choice should reflect the local importance of the scope of opportunism and of supervision costs.

The *Catasto* consists of several hundred volumes recording the wealth held by the citizens of Florence, its territory, and subject cities, compiled by the city government in 1427 as part of a fiscal reform. Each family head had to declare all property, in rural and urban real estate as well as financial investments, to city officials. Asset value was estimated by capitalizing annual revenues at 7 percent, and once allowable exemptions were calculated, a tax was assessed on net wealth. In spite of the danger of underreporting, the consensus is that the *Catasto* data are reliable at least for real estate, which is what concerns us here (Conti 1966, pp. 29–33 and 52–58; Ugolini 1978b, p. 754; Herlihy and Klapisch-Zuber 1978, chap. 1).

The *Catasto* contains records of 15,327 farms, organized by place of residence of the owner. A sample of 1,208 farms was selected by letting a random number generator determine page numbers for each of the volumes (*campioni*) of the *Catasto* until data had been collected for 10

landlords in each of the 16 *gonfalon*i (the administrative subdivisions of Florence).⁴ A further 68 landlords were then selected from among the rural residents (*contadini*), two each from randomly selected volumes of the *contado* and three each from the towns of Prato and Pistoia.⁵ Data were collected by landlord rather than by farm because what has to be modeled is the decision by landlords to adopt one of three possible tenure systems. Using landlords as observation points allows the modeling to take into account both the specific characteristics of each farm and the costs each choice imposed on the individual landlord.

A recent paper by Botticini (1998) approaches the same problem with a smaller sample of landlords (39, against my 228) and farms (523, against my 1,208). The smaller sample size in her paper is the result of the extremely time-consuming research effort she has undertaken to match individual landlords and tenants, something I have avoided in my sample, focusing instead exclusively on landlords' declarations. In other words, her analysis is more circumstantial in that she is able to include more specific variables than I can, but mine covers a considerably larger sample. It is comforting that, in spite of differing methodologies, our results are consistent with each other.

In the opportunistic behavior framework, landlords make their choice considering the cost of monitoring labor relative to the potential loss induced by unchecked opportunistic behavior. Two variables are thus necessary to test the opportunism model, a proxy for landlords' monitoring costs and one for the dimensions over which tenants could exercise opportunism. The latter is reasonably straightforward. I have argued that the presence of vines increased both the scope for opportunistic behavior and its potential costliness. In the words of the fourteenth-century agronomist De'Crescenzi, "...he who does not take care of his vineyards will in his turn be abandoned by them. No fear checks the greed of labourers but the presence of the landlord" ([1478] 1536, p. 357). Since individual farm crop mix is recorded in the *Catasto*, the scope for opportunistic behavior may be proxied by a dummy taking the value of one in the presence of vines or other fruit trees (wide scope for, and cost of, opportunism) and zero otherwise.⁶ The prior is that the presence of vines should favor arrangements limiting agents' discretionality, that is, wage labor over sharecropping and the latter over fixed rent. The use of a dummy variable, instead of the percentage of wine and oil in total farm income, is due to the fact that using this percentage actually worsened the fit of the regression.

Choosing a variable to proxy monitoring costs is more complex. Hoffman (1984) uses distance from the owner's residence to the farm, and contemporary evidence suggests that distance from the holding was indeed a consideration for landlords: the humanist L.B. Alberti, himself a rich Florentine landowner, wrote in the early 1400s: "I would have my property in a location...such that I could go there often, and would take my exercise walking around it, and *the labourers, seeing me often, would cheat rarely...and be more diligent at their work*" ([1468] 1906, p. 210, emphasis added). Elsewhere Alberti advised landlords to build houses for their tenants near their own for the same reason, "so that hour by hour [the landlord] can see what each is doing, and that they [the tenants] be aware of what has to be done" ([1485] 1853). Direct information on the distance between a landlord's residence and any given farm is not available in the *Catasto*, but other data can be used instead.

As indicated, in the *Catasto* the assessed value of rural property was the capitalization of the value of mean output over the previous three years. Wheat prices used to evaluate output varied inversely with the distance of the farm from city gates: wheat from farther farms was valued at lower prices. While these prices form a discrete, rather than a continuous, gradient, they do reflect the cost of transporting wheat to the city. For landlords dwelling in Florence, these prices may be taken as a reasonable proxy of the cost of travel to each farm. For farms owned by landlords not dwelling in Florence, on the contrary, the assessed wheat price in relation to the Florence market is not an appropriate proxy of the cost of supervising operations. For these landlords, the monitoring costs proxy has been set at the highest assessed price, equivalent to assuming that these landlords resided within eight km of their farms. The assessed wheat price variable has been transformed into kilometres by picking the midpoint in each price band.⁷ The priors for the estimated distance are that the closer the farm, the cheaper it was to monitor labor: short distance favors wage contracts over sharecropping and sharecropping over fixed rent.

Beside the cost of traveling to their farms, landowners residing in urban centers, and thus presumably involved in urban activities such as trade, may have had an additional reason for wishing to delegate some decision-making authority to their tenants. A city dweller may have found it difficult to acquire the necessary skills to monitor farming

Table 1. Distribution of Sample Farms by Ownership, Crop, and Location

Farm Ownership and Characteristics	Distribution of contract type by ownership, crop, and location			Distribution of ownership by farm type
	Fixed Rent	Share Tenure	Wage Labor	
Rural landlord, no vines/trees	46.2	12.4	41.1	15.4
Rural landlord, vines/trees	6.9	30.7	62.4	8.4
Urban landlord, no vines/trees	71.8	28.2	0.0	28.1
Urban landlord, vines/trees	2.9	96.7	0.3	48.1
Rural landlord, distant farm ^a	—	—	—	0.0
Rural landlord, nearby farm ^b	32.4	18.8	48.8	23.8
Urban landlord, distant farm ^a	25.1	74.9	0.0	59.4
Urban landlord, nearby farm ^b	39.9	59.1	1.0	16.8
Distribution by contract type	29.3	58.9	11.8	100.0

Note: (a) distant farm = over five Florentine miles (8.3 Km) from landlord's residence;

(b) nearby farm = up to and including five Florentine miles from landlord's residence.

Source: ASF/CCi, 64, 65, 66, 67, 68, 69, 72, 73, 74, 75, 76, 77, 78/I, 78/II, 79, 80, 81, and ASF/CCo, 168, 169, 170, 171, 173, 174, 175, 176, 177, 178, 179, 180, 181, 247, 251, 253, 257, 263, 264, 266, 271, 272, 274, 275, 315, 316, 317, 319, 321, 323, 324, 325, 326, 327.

operations, which required a degree of sector-specific human capital. Quantitative evidence does in fact suggest that urban residents tended to favor contracts that left the daily operation of the farm into the hands of their tenants (Galassi 1992, p. 87). To capture this effect, a dummy has been used in the logit model taking the value of one when the landlord resided in Florence and zero otherwise. The priors are that urban residence favored fixed rent over sharecropping and sharecropping over wage contracts.

Botticini's (1998) paper also uses landlord's profession as a proxy for monitoring costs. This is a useful addition, of course, but it is one of the reasons why her sample is so much smaller than mine, as it is not always possible to determine landlord's professional status. I chose to forego this variable for the sake of building a larger sample.

Two other proxies can be used for monitoring costs, the number of farms each landlord owned and his assessed net wealth. Whereas the estimated distance is farm-specific, these are (like residence) landlord-specific variables aimed at capturing individual landlord characteristics that may have made the detection of opportunistic behavior by laborers more or less expensive. The priors are that landlords with more farms would have to delegate more, and would thus prefer fixed rent

over sharecropping and the latter over wage labor. Likewise, richer landlords had higher opportunity costs for their time, and would similarly prefer less direct involvement in running their properties. Other variables seem intuitively important in determining monitoring costs, such as the age the landlord and/or other adult members of the household. The problem here is that while ages are available for town-dwelling landlords, rural declarations are less regularly reported, which again would reduce the sample size. For this reason this variable was excluded.

Table 1 presents the distribution of the sample farms by contract type, crop, and location.

Two comments are in order before moving on to the econometric modeling of contract choice. First, the cutoff of eight km between nearby and distant farms is of necessity arbitrary, but was chosen as a reasonable walking distance: under eight km, a landlord could conceivably visit his farm and return home in a few hours, making labor monitoring easier. It is noteworthy that, consistently with the opportunism approach, wage contracts exist only in the "nearby farm" category. Second, no rural landlord owned a "distant" farm.

The analysis of the determinants of contract choice is based on specifying a discrete response model where the dependent variable is $y_{if} = \{R, S, W\}$, indicating fixed rent, sharecropping, and wage labor contracts respectively, where $i = \{1, \dots, n\}$ indexes landlords, $f = \{1, \dots, F_i\}$ indexes the farms owned by landlord i , and F_i is the number of farms owned by i . The model specifications must take two facts into account. One is that there are no observations of wage contracts on farms far from the landlord's residence (242 farms), emphasizing the importance of monitoring costs in contract choice. In order to solve identification problems, the probability of observing wage labor on such farms is assumed to be zero. For these farms a binary logit model has been estimated for the choice between fixed rent and share contracts. For the remaining 966 farms, all three types of contracts are allowed. Second, all farms above eight km from the landlord's residence are owned by urban landlords, so that the urban/rural landlord dummy is relevant only for nearby farms.

Table 2. Estimated Multinomial Logit Models of Contract Choice

	Nearby Farms (<i>n</i> = 966)		Distant Farms (<i>n</i> = 242)	
	Fixed Rent relative to Wage Labor	Sharecropping relative to Wage Labor	Fixed Rent relative to Sharecropping	Fixed Rent relative to Sharecropping
Intercept	-0.762 (-2.235)	-1.759 (-4.343)	0.997 (2.673)	0.815 (1.9)
Distance	—	—	—	-0.049 (-2.13)
Vines and Trees Dummy	-3.299 (-6.678)	0.677 (1.907)	-3.976 (-9.38)	-4.438 (-11.32)
Landlord's Net Assessed Wealth	0.47 (2.176)	0.732 (3.389)	-0.262 (-1.213)	-0.134 (-4.786)
Number of Farms Owned by Landlord	0.092 (2.14)	0.001 (0.022)	0.091 (2.068)	0.078 (7.091)
Urban Landlord Dummy	4.457 (5.351)	3.528 (4.6)	0.929 (1.161)	—
Log-likelihood	979.26			
<i>N</i>	1,208			

t-statistics in brackets

The two multinomial logit models are specified as follows. Let $P(y_{if}=k)$ be the probability of contract type k being observed in the j th farm of the i th landlord. Then:

Distant farms:

$$P(y_{if} = R | x_{yf}) = \frac{\exp(bx_{if})}{1 + \exp(bx_{if})}$$

$$P(y_{if} = S | x_{yf}) = \frac{1}{1 + \exp(bx_{if})}$$

$$P(y_{if} = W | x_{yf}) = 0$$

where x_{if} is the vector of explanatory variables and b a vector of coefficients.

Nearby farms:

$$P(y_{if} = h | x_{vf}) = \frac{\exp(c_h z_{if})}{\sum_{i=1}^3 \exp(c_h z_{if})}$$

where $h = \{R, S, W\}$, z_{if} is a vector of explanatory variables and c_h , c_j are coefficient vectors (with c_W normalized to zero). A more complete analytical framework is presented in Pudney, Galassi, and Mealli (1998).

Table 2 reports the logit results (*t*-statistics in brackets).

The estimated logit models support the opportunism framework, with a few important and interesting exceptions. Taking each explanatory variable in turn will reveal some of the complexities in the economics of sharecropping in 1427 Florence.

Starting at the bottom of Table 2, the urban landlord dummy and number of farms owned by each landlord are the variables that most closely conform to the priors derived from the opportunism approach. In both cases the explanatory variable is taken as a proxy of high monitoring costs, favoring delegation of discretionary responses and the use of performance related remuneration. Interestingly, the urban landlord dummy performs best when the choice is between fixed or share rent and wage contracts, while it fails the significance test at 10 percent when fixed rent and sharecropping are compared. Urban landlords were evidently unwilling to use a wage contract, arguably because this required ongoing supervision of the labor force and a degree of specific technical knowledge city dwellers were unlikely to possess. This contradicts Botticini's finding (1998) that landlords in the nonfarming professions were more likely to delegate. Urban residents were apparently not more likely to use fixed rent than share contracts, which argues that, while they preferred to delegate, the particular form of delegation was influenced by individual considerations.

One of these appears to have been the number of farms owned by each landlord. The only case in which this variable fails a significance test is when sharecropping is compared to wage labor. Landlords with large numbers of farms definitely preferred fixed-rent contracts to both share rent and wage contracts,⁸ a preference easy to understand consid-

ering that fixed-rent contracts economized on their monitoring resources.

The landlord's wealth variable, used here as a measure of opportunity costs of the landlord's time, is at first sight less clear. The prior was that higher opportunity cost should favor delegation, that is, fixed rent over sharecropping and sharecropping over wage contracts. In fact, the likelihood of both fixed rent and sharecropping relative to wage contracts rises with wealth. However, for both nearby and remote farms, sharecropping appears to be preferred to fixed rent as wealth increases (though for nearby farms the coefficient is not significant). Richer landlords, that is, preferred to avoid wage labor, but were either indifferent between share and fixed rent or actually, contrary to expectations, preferred the former, even though this necessarily entailed a greater commitment of their own resources to supervising farming operations. This preference for share contracts is consistent with Botticini's result that asset poor tenants preferred share contracts: richer landlords were also likely the ones who had invested more in their farms.⁹

The vines and trees dummy appears, on purely quantitative grounds, as the most important variable in the model: its coefficients are among the largest, and in three out of four cases it passes the significance test at 1 percent. Whenever the choice is put in terms of fixed rent and share contracts, the logit consistently indicates a strong preference for the latter, consistently with the priors. Wage labor also appears to have been preferred to fixed rent for farms with vines or fruit trees, again emphasizing that the agency problems created by the presence of an expensive asset required landlords to constrain labor's discretionary responses. In only one case is this not supported by the logit estimates: in the choice between share and wage contracts, the presence of vines makes sharecropping, not wage labor more likely (the coefficient just misses significance at 5%). This is an interesting exception because it highlights an important element in the contract choices made by Florentine landlords. Comparing the sharecropping/wage and fixed rent/wage choices, what emerges is a strong preference for wage labor over fixed rent and a weak preference for sharecropping over the latter if vines are present. Without share contracts, in other words, landlords would have opted for cultivating vines with wage labor, and accepted to pay the high monitoring costs necessary to ensure proper cultivation. This solution was technically possible but, with landlords being largely urban, far from ideal. Monitoring cost time and resources, and perhaps most

important, required a set of skills which not all urban landlords could easily acquire. Sharecropping reduced, relative to wage contracts, the need for daily monitoring of labor, while the high sunk costs associated with tree crops made fixed rent unattractive to landlords.

The distance variable, finally, is significant though extremely weak and, more important, negative, contrary to expectations. In part this may reflect the crude data used here, as the *Catasto* data do not allow precise distance measurements to be taken. However, that distance did matter in tenure choice is made clear by the absence of wage contracts over eight km away from the landlord's residence (Table 1). Above that limit, an increase in distance weakly favors sharecropping over fixed rent. More than the effect of distance, this may reflect that moving farther away from Florence in almost any direction one goes deeper into the hilly areas that surround the city, which are prime wine producing areas. Increasing distance may simply have made it more likely to find farms with vines. Interacting the "vine" variable with the "distance" variable, that is, multiplying them by each other, does not materially alter the other parameter estimates, and the interacted variable is positive but insignificant. In all likelihood, this is a reflection of the discrete, rather than continuous, nature of the distance gradient.

A number of criticisms may be raised against these conclusions. First, no measure of risk is present in the estimated logit models. Spatial risk differentials may affect the outcome of tenancy decisions, and no way of calculating them exists from the data. Without data to calculate standard deviations of different crops on the sample farms, this objection, valid in principle, cannot be conclusively answered. However, it is important to point out that risk can often be reduced by altering the crop mix, so that tenancy arrangements are not the only way of dealing with it. By the 1420s the spread of vines and higher-priced crops such as wheat had been proceeding for close to one hundred years, and it seems reasonable to believe that farmers had by then learned how to balance their crop mix to reduce risk in so far as possible. In any event, Botticini's (1998) results confirm that tenant wealth mattered to contract choice.

The absence of other variables is perhaps less serious. Land productivity data cannot be derived from the *Catasto* as farm size is not recorded. Whether larger farms attracted a particular type of tenant cannot be checked, and neither can other factors such as location (hills as opposed to plains) be properly controlled for. To a degree location is

implicit in the logit model in that vines and fruit trees grew best on slopes where drainage was good, but the relationship is too crude to derive a firm conclusion from it. Finally, tenants' wealth ought to be included, as they are in Botticini's sample (1998).

Such caveats notwithstanding, the conclusions are rather robust, and indicate that tenancy choice in early Renaissance Florence was largely the result of the cost of monitoring labor in an uncertain environment where ex post monitoring was inaccurate and the potential for costly and possibly irreversible damages to expensive capital was great. What stands out clearly from the analysis is that no one factor can explain the adoption of sharecropping in this time period. The contract, rather, was selected because it provided a reasonable solution to the problem of safeguarding asset values and income streams without incurring prohibitive monitoring costs.

V

Opportunism and property rights constitute the answer to the puzzle of sharecropping in the early Renaissance. The intensification of farming that resulted from rising demographic density in the late Middle Ages altered the relative factor prices and encouraged the creation of exclusive property rights in land. Exclusive rights in effect altered the labor's self-monitoring incentives that had existed under the old system of common property. As techniques became more labor intensive, itself a result of growing demographic pressure, the scope for opportunism by laborers increased, as did the potential cost of careless or dishonest activity. Strong self-monitoring incentives had to be used to offset such behavior, and sharecropping contracts, already in limited use, spread. After the demographic crisis of the fourteenth century, changing relative product prices brought about an alteration of the crop mix, which increased the cost of opportunism while making landlords even less able to detect it. Share contracts responded reasonably easily to this new situation by allowing landlords to concentrate costly resources on supervising invested capital while in effect leaving tenants to run the farm on a daily basis.

The equilibrium that developed in Tuscany between the closing of the Middle Ages and the Renaissance was to prove surprisingly resilient: until mass urbanization after the Second World War emptied out the countryside of central Italy, *mezzadria* remained by far the predominant

tenure arrangement. The analysis of this paper thus inevitably raises the twin issues of the optimality and stability of this equilibrium. The two are closely connected.

Why did *mezzadria* last so long? New clauses were added to the contract over time, and important reorganizations did occur, such as the grouping of different sharecropped farms under a central coordinating administration (Epstein 1986; Ciuffoletti 1985). Yet the essential element of the contract, the division by halves of output, remained unvaried into the 1950s. This division has been shown to be stable in game theoretic work (Young 1993), but stability of the sharing rule does not explain the stability of the institutional arrangement itself.

Stability may be the result of diverse elements. Long-term stability certainly suggests a measure of success in responding to changing conditions, and the argument that share contracts allow reasonably easy adjustments has been repeatedly made (Weitzman 1984; Murrell 1983). But long-term stability also suggests that share contracts fulfilled some fundamental function in the agrarian economy of the area, and it is tempting to see this as a proof of their optimality. The temptation must be resisted, however, because stability can, finally, also simply reflect a locked-in equilibrium, where the costs of exit are prohibitively high and path dependency comes to dominate institutional choices. Strictly, path dependency does not by itself prove suboptimality, however. In any event, saying that sharecropping was an optimal choice does not mean that this particular form of sharecropping was optimal. The problem may simply be with a concept of optimality based on a walrasian equilibrium where transaction costs do not exist. While methodologically useful, this is hardly a standard by which to judge historical reality. Thus optimality in this sense may simply be irrelevant in evaluating *mezzadria*, and the issue reverts to one of stability over the very long run. The argument of this paper is that this stability can be understood largely, if perhaps not exclusively, as a functional success in the sense that sharecropping solved some important problems in an uncertain world. To argue convincingly that stability in this case was no more than path dependency, an alternative institutional arrangement must be presented that could deal effectively with the problems of opportunism and property rights in the Florentine countryside from the Renaissance to the late twentieth century.

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NOTES

1. On the difficulties involved in issuing detailed instructions to reduce discretion see Origo (1957, p. 293).

2. Another possibility might be for the tenant to plant the vineyard and pay the landlord only the opportunity cost of land. Such "improvement" contracts were in fact used in the centuries when cultivation was being extended, but died out as land became increasingly scarce (Jones 1968; Solmi 1923; Luzzatto 1948).

3. The incentives to undersupply labor set up for the tenant by the sharing of the marginal product did not make share tenure less attractive as some have argued (Epstein 1994) because the marginal cost of monitoring workers was extremely low once the landlord had taken steps to inspect vines or olive trees (cf. Alston and Higgs 1982, p. 340; Hoffman 1984, pp. 315-316). In fact, the "tax-equivalence" argument against sharecropping is fundamentally flawed because it compares a real-world situation to the perfect information equilibrium of a walrasian system. True, sharecropping has no place in walrasian equilibria, but neither do imperfect information or monitoring costs. Arguing that sharecropping is inefficient compared to a zero information cost situation is to miss the point entirely.

4. When the random number generator picked two page numbers in which the declarations of the same landlord were recorded, the process was repeated until 10 different landlords were collected.

5. The number of rural landlords was determined by adding more of them to the sample until the sample ratio of the value of their landed property to that of the 160 selected urban landlords was the same as the population ratio.

6. The same proxy was used by Hoffman (1984) and Galassi (1992).

7. The assessed price was 19 *soldi* per *stajo* (24.36 liters) for farms up to 8.3 km from the city; 18 *soldi* for farms between 8.3 and 20 km; 15 for those between 20 and 33 km, and 14 for those over 33 km (Conti 1966, p. 44).

8. The mean number of farms for sample landlords using fixed rent is 19.6, as opposed to 12.8 for landlords using sharecropping and only 5.8 for those using wage contracts. This, incidentally, is further evidence against the risk-spreading approach to *mezzadria* in that the poorest landlords seem to be the ones who bore the most risk with wage contracts. Dropping the wealth variable (likely to be strongly correlated with the number of farms) does not improve the fit.

9. In fact, the mean net assessed wealth of sample landlords using share contracts was 72 percent greater than landlords using fixed rent.

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