

THE CHOICE OF AGRARIAN CONTRACTS  
IN EARLY RENAISSANCE TUSCANY: RISK SHARING,  
MORAL HAZARD, OR CAPITAL MARKET IMPERFECTIONS?

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Running Head: Agrarian Contracts in Early Renaissance Tuscany

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## ABSTRACT

Historians have advanced various hypotheses regarding the spread of share cropping in late medieval Italy and early modern France. The *risk sharing hypothesis* argues that, in times of labor shortages following the Black Death, landlords used share contracts to attract risk averse tenants. The *moral hazard/multitasking hypothesis* asserts that share cropping was an ideal contract for monitoring a tenant's effort and protecting valuable assets on the farm. The *imperfect capital markets hypothesis* maintains that imperfect capital markets favored the expansion of share contracts. Unlike previous work, this article simultaneously tests all three hypotheses thanks to a unique sample of landlords and tenants in 1427 Tuscany. We conclude that there is support for both the moral hazard and imperfect capital market hypotheses, but not for the risk sharing hypothesis.

By the fourteenth century, share contracts had become the predominant agrarian arrangements in some regions of northern and central Italy. For over seven centuries they remained the primary tenure arrangement.<sup>1</sup> In 1316, more than 75 percent of the contracts between landowners and tenants in the countryside near Siena in Tuscany were share contracts (Jones 1964; 1968). Between the close of the Middle Ages and roughly 1700, the French countryside also witnessed a dramatic expansion of sharecropping (Bloch 1966; Hoffman 1984). Share contracts also spread in modern Catalan agriculture (Carmona and Simpson 1999). In contrast, in other places in Europe, such as England and Ireland, landlords preferred to lease their estates out using fixed-rent contracts (Mokyr 1981).

Various hypotheses have been advanced by historians with regard to the adoption and expansion of sharecropping in late medieval Italy and early modern France. The *risk sharing hypothesis* argues that in times of labor shortages following the Black Death, landlords offered share contracts to attract poor (and therefore risk averse) tenants by offering them partial insurance against output risk (Herlihy and Klapisch-Zuber 1978; Epstein 1994a, 1994b). The *moral hazard/multitasking hypothesis* maintains that sharecropping was an optimal contract given the tradeoff between providing incentives for current production and preventing abuse of valuable landlord assets such as perennial crops grown on the land plots (Hoffman 1984; Galassi 1992, 1994, forthcoming; and Galassi, Mealli, and Pudney 1998). The *imperfect capital market hypothesis* asserts

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<sup>1</sup> Rerolle (1888), Solmi (1923), Luzzatto (1948), Imberciadori (1961), Jones (1964; 1968), Conti (1965), Herlihy (1967), Desplanques (1969), Giorgetti (1974), Ugolini (1978), Cammarosano (1979), Cherubini (1979), Pinto (1979), Piccinni (1982), Byres (1983), Epstein (1986), Pinto and Pirillo (1987), Muzzi and Nenci (1988), Cohen and Galassi (1990), Epstein (1994), Emigh (1997), Luporini and Parigi (1996), and Galassi, Meally, and Pudney (1998).

that missing and/or imperfect capital markets favored the spread of share contracts in these areas of Western Europe. Specifically, loans and livestock were offered by landlords to poor tenants lacking farm equipment and working capital. These tenants were unable to obtain such loans on the open market. Often these landlord loans were accompanied by share contracts (Bloch 1966; Biagioli 1980; Epstein 1994, p. 118–19). Though quite different, the three hypotheses share the common assumption that in premodern economies some markets, such as insurance and/or capital markets, were either missing or imperfect.

While very insightful, these works do not simultaneously examine all three of these hypotheses. When arguing that one hypothesis is supported by the historical evidence, they cannot examine the possibility that the other hypotheses hold as well. The main contribution of this article is to test all three hypotheses thanks to a unique sample of landlords and tenants in 1427 Tuscany. The data set is similar to the one used by Galassi (1992; forthcoming) and Galassi, Mealli, and Pudney (1998) with the notable addition of tenants' characteristics. Our estimates suggest that moral hazard and imperfect capital markets were important factors in 1427 Tuscan agriculture. Landlords concerned about their valuable assets, such as the perennial crops planted on their land holdings and the livestock and draft animals they provided to their tenants, used share contracts to mitigate incentives for tenants to overuse and damage these assets. At the same time, landlords advanced loans to their landless and poorer share croppers to buy seed and tools necessary for cultivation and to smooth consumption while waiting for the harvest. On the other hand, there is no significant empirical support that risk-sharing played an important role in contractual choice. Poorer and presumably more risk averse tenants did not necessarily work under share tenancy arrangements.

# I THE ECONOMICS OF AGRARIAN CONTRACTS

There is a vast literature on contract choice in general and on agrarian contract choice in particular. The latter has been one of the earliest topics dealt with in economics going all the way back to the Classical economists, yet many of the central questions still have incomplete answers. Recently, development economists and economic historians have tried to come to grips with the question of why there exists (and existed) a mix of contracts and whether or not the mix is (was) efficient.<sup>2</sup> Risk sharing has been a central factor in the debate over the existence and distribution of various forms of agricultural contracts. Cheung (1968, 1969a, 1969b) argued that an advantage of sharecropping is in the associated saving in transactions costs and risk mitigating factors. The main advantage of a share contract, according to Stiglitz (1974), is to reduce the moral hazard or shirking problem in the presence of a risk averse tenant. Sharecropping exists as a compromise between the risk and incentive effects of a pure wage contract and a fixed-rent contract. Fixed-rent contracts provide strong incentives since the tenant is the residual claimant of the output, but the tenant bears the entire risk. Conversely, wage contracts put no risk on the tenant, but present incentives to shirk unless the tenant is monitored closely by the landlord.

More recently, attention has turned to refining or expanding the basic theory of sharecropping. Among other things, recent theory work has examined the additional implications of factors such as capital constraints, transactions costs, and multiple tasks on optimal contracts and

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<sup>2</sup> See Singh (1989), Binswanger and Rosenzweig (1984), and Newbery and Stiglitz (1979) for surveys of the development literature, and Alston (1981), Alston and Higgs (1982), Alston and Kauffman (1997; 1998), Cohen and Galassi (1990), Galassi (forthcoming), Shlomowitz (1979), and Wright (1986) for surveys of the economic history literature.

second best outcomes.<sup>3</sup> Much of the empirical work on agrarian contract choice focuses on testing two possible determinants of contract choice. On one hand, risk-sharing models stress that, in the presence of a risk-averse agent who can shirk in the performance of tasks assigned by the principal, share contracts offer insurance and, at the same time, provide incentives for the agent to be diligent.<sup>4</sup> On the other hand, transaction-cost explanations tend to downplay risk preferences and focus on enforcement costs and transaction specific assets.<sup>5</sup>

Historians have proposed diverse explanations for the adoption and spread of sharecropping in late medieval Italy and early modern France. For early modern France, Bloch (1966) suggested that sharecropping suited poor tenants, who lacked capital. A similar argument has been proposed by Epstein (1994, 118-19) for medieval Tuscany: For tenants lacking credit, seed, livestock, and draft animals, landlords offered share contracts in which landlords advanced credit and capital to tenants and reduced tenants' shirking by interlinking the agrarian contract to this provision of credit and capital. Herlihy and Klapisch-Zuber (1978) and Epstein (1994, p. 118) argue that landlords adopted sharecropping in response to the labor shortages caused by the Black Death. Having an abundance of land and a shortage of labor, landowners used sharecropping as a way to attract tenants to work on their estates by offering them partial insurance against output risk. Inflation is another factor that historians have invoked to explain the spread of sharecropping (Biagioli 1980). However,

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<sup>3</sup> See Rao (1971), Newbery (1977), Hallagan (1987), Braverman and Stiglitz (1982), Shaban, (1987), Holmstrom and Milgrom (1987; 1991; 1994), Milgrom and Roberts (1992), Allen and Lueck (1992; 1993; 1995; forthcoming), Laffont and Matoussi (1995), Lanjouw (1995), and Bandiera (1998).

<sup>4</sup> Stiglitz (1974), Newbery (1977), Newbery and Stiglitz (1979), Holmstrom and Milgrom (1987, 1991, 1994), Milgrom and Roberts (1992), and Otsuka et al (1992).

<sup>5</sup> Hallagan (1978), Alston et al. (1984), Allen and Lueck (1992, 1993, 1995, forthcoming), Eswaran and Kotwal (1985), and Bell (1986).

as Hoffman (1984) underlines, share tenancy flourished during both the inflation of the sixteenth century and the declining prices of the 1600s. Furthermore, landlords could have coped with inflation by simply making the tenant pay a rent in-kind, instead of a monetary rent.

The latest hypothesis regarding the spread of sharecropping in late medieval Italy and early modern France has been offered by Hoffman (1984), Galassi (1992; 1994; forthcoming) and Galassi, Mealli, and Pudney (1998), who apply recent insights offered by the literature on information economics and agency contracts. Their argument starts with the observation that in northern and central Italy and in those regions of France where share contracts became widespread, sharecropping seems to have been particularly dominant on those estates where perennial crops, such as olive trees and vines, were grown. Meanwhile, estates where cereals were the main crops were usually leased out for fixed-rent contracts. Both in medieval Tuscany and in early modern France, landlords tended to live in urban centers. This made monitoring the effort and diligence of tenants quite difficult. While a fixed-rent contract would provide strong incentives for current production, it could actually give the tenant an incentive to overproduce. Trying to maximize current output was fine for annual crops, but could potentially damage valuable assets on the farm, particularly vines and olive trees whose life span extends for many years. These arguments fit well into the recent theory models of multitasking by Holmstrom and Milgrom (1987; 1991; 1994).

On the other side of the Atlantic, economic historians have suggested various hypotheses for the spread of sharecropping in post-bellum Southern agriculture. Higgs (1973) and Alston and Higgs (1982) emphasize that both risk sharing and farm size were key factors affecting the choice of agrarian contracts. An increase in risk led to the adoption of share contracts over fixed-rent contracts. Controlling for risk, however, the larger the size of the farm, the less likely were wage contracts

relative to share contracts and fixed-rent contracts—This was due to the fact that a small farmer could more easily monitor wage laborers. Wright (1986) argues that asset ownership determined the type of agrarian contract chosen. Tenants without mules and agricultural tools entered into sharecropping arrangements whereby these assets were supplied by the landlord. Alston (1981) points out that wage contracts replaced share tenancy in Southern agriculture between 1930 and 1960 because mechanization after 1930 greatly reduced the costs of supervising tenants' efforts.

In section III we empirically examine these various hypotheses using data from fifteenth-century Tuscany. For clarity, we summarize their empirical implications:

1. (*Risk Sharing - risk aversion*): If risk sharing is important, then the more risk averse a tenant is, the lower the likelihood of observing a fixed rent contract (relative to a share contract).
2. (*Risk Sharing - crop variance*): Land plots with crops displaying higher output variability (i.e. more risk) are less likely to be leased out under fixed rent contracts.
3. (*Moral Hazard - monitoring costs*): The higher the marginal cost of evaluating the effort devoted by the tenant to production, the larger the probability that fixed-rent contracts are adopted since these contracts offer more high-powered incentives.
4. (*Moral Hazard - multitasking crops*): If long-lived assets, i.e. perennial crops, are planted on a land plot, there should be a lower likelihood of observing fixed rent contracts (versus share contracts or owner cultivation). Fixed-rent contracts might induce overproduction that could damage these assets and thus future production.
5. (*Moral Hazard - multitasking livestock*): Similarly, if a tenant uses a landlord's draft animals for cultivation or takes care of his livestock, then it is less likely that a fixed-rent contract is adopted. Livestock can also be damaged or overused, and fixed rent contracts might promote



overuse with their incentives on current production.<sup>6</sup>

6. (*Imperfect Capital Markets*): If credit or capital markets are imperfect, it may be hard for poor tenants with no collateral to obtain loans in outside markets to buy necessary agricultural inputs (e.g. seeds). Tenants that are more constrained in terms of wealth should be more likely to obtain loans directly from their landlords.

## II DATA

The major obstacle in simultaneously testing these hypotheses regarding the spread of share contracts in medieval and early modern Europe stems from the lack of good data on both landlords and their peasant tenants. While landlords sometimes left behind account books or diaries, peasant tenants seldom left behind evidence of this type.<sup>7</sup> Therefore, finding information on peasant tenants is always a challenging task. This paper can jointly test these hypotheses due to a unique data set we collected from the 1427 Florentine *Catasto* housed at the State Archives of Florence. In 1427, the Florentine town government, pressed by urgent financial needs due to continuous warfare with other Italian cities, tried to increase its tax revenues. To ascertain the wealth of the citizens living in all its domains, the city government of Florence undertook the *Catasto*—a comprehensive census and

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<sup>6</sup>We thank a referee for suggesting a similar argument under which the use of a landlord's livestock is associated with share contracts. If the landlord supplies the livestock, then he has increased incentives to monitor for its abuse. If he is already monitoring for the abuse of his capital assets, the marginal cost of monitoring for labor shirking falls. Therefore, it becomes less necessary to use fixed-rent contracts to provide incentives.

Herlihy and Klapisch (1978), Kauffman (1993) and Galassi and Kauffman (1996) provide evidence that landlords in early Renaissance Tuscany, the post-bellum U.S. South, and in twentieth-century Italy were concerned about overuse of the draft animals and livestock they provided to their tenants.

<sup>7</sup> A notable exception is Balestracci (1984).

property survey that includes information on 60,000 households. The heads of households compiling their declaration had to report the houses, lands, and draft animals they owned; the types of crops grown and the average crop yields of the previous three years; their debts and credits; their shares of commercial partnerships; their profession; and the composition of their families. In addition, they had to indicate whether they cultivated the lands by themselves (with or without the help of wage laborers) or whether they leased out their lands to fixed-rent tenants or share croppers. They also had to declare whether they provided livestock, seeds, and loans to their tenants. Peasant tenants had to declare whose farms they cultivated, the crops grown and the average output, and whether they owned and/or leased livestock.

## THE SAMPLES

Our samples come from Pescia and San Gimignano—two towns belonging to the Florentine domains in 1427—and their surrounding countryside. Sample A contains (i) all heads of household borrowing from Jewish lenders (146 landlords) and (ii) households with a wealth higher than 400 florins and not included in (i) (39 landlords).<sup>8</sup> The 185 landlords in sample A owned 1,504 land plots (Table 1).

The major contribution of this article, however, is sample B. This includes the land plots

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<sup>8</sup> The annual average wage of a Florentine urban worker in 1427 was 14 florins. The reason for using this sample is twofold. On one hand, there are economies of scale in archival work: the sample with the households borrowing from Jewish lenders has been used for another paper on credit markets (Botticini 2000). On the other hand, since the paper is concerned with the choice of share contracts versus fixed-rent contracts, it required a sample of landlords who rented or crop shared their land plots. Wealthier, and therefore more prominent households seem the best candidates for this purpose, given that they were more likely to leased their farms instead of self-cultivating them.

from sample A for which it was possible to match the corresponding peasant tenants to tenant data in the census. While the information on landlords is relatively easy to collect, it is much harder to match corresponding tenants in the 1427 *Catasto*.<sup>9</sup> Moving from sample A to sample B, we lose 669 observations corresponding to land plots which were self-cultivated by landlords (559) or cultivated by wage laborers (109) because, in these two cases, there are no fixed tenants. We lose an additional 185 observations for which it has not been possible to identify the corresponding tenants. Sample B thus contains data on 111 landlords with 652 land plots.

TABLE 1  
SIZE OF SAMPLES

	Sample A		Sample B	
	Landlords	Land plots	Landlords	Land plots
Pescia	105 (.25)	1,117	48	364
San Gimignano	80 (.21)	387	63	288
All	185 (.23)	1,504	111	652

Source: ASF, *Catasto* 213, 214, 215, 216, 233, 234, 235, 236, 252, 253, 254, 258, 266, 269.

Note: In parentheses are the percentages with respect to the households in the population.

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<sup>9</sup> On one hand, about 10 percent of the population, especially among the poorest, did not fill the declarations. On the other hand, landlords sometimes recorded their tenants only by their first names or even by nicknames, making it almost impossible to identify those tenants in the volumes of the *Catasto*. Moreover, people with common names like Giovanni, Agnolo, or Antonio were often difficult to identify.

TABLE 2  
SUMMARY STATISTICS FOR SAMPLES A AND B

	Sample A (Mean)	Sample B (Mean)
Owner-farmer	.444	—
Share contract	.311	.608
Fixed-rent contract	.245	.392
Annual crops - Cereals	.365	.423
Perennial crops - Vines	.413	.176
Mixed crops (annual and perennial crops)	.222	.398
<i>Cropmix</i> (=0 if annual crops, =1 if mixed, =2 if perennial crops)	1.048	0.753
<i>LLprof</i> - Landlord's occupation (= 1 if non agricultural)	.524	.675
<i>LLgender</i> - Landlord's gender (= 1 if female)	2.7	2.4
<i>LLmale</i> - Landlord's number of male dependents <sup>a</sup>	1.87	1.74
<i>LLfemale</i> - Landlord's number of female dependents <sup>b</sup>	1.30	1.12
<i>Residence</i> - Location dummy (= 1 if in San Gimignano) <sup>c</sup>	.400	.567
<i>TTwealth</i> - Tenant's wealth (gold florins) <sup>d</sup>	—	43.0
<i>TTland</i> - Tenant's land ownership (= 1 if tenant owns land)	—	.655
<i>TTlivestock</i> - Tenant's livestock (= 1 if tenant owns livestock)	—	.336
<i>TTmale</i> - Tenant's number of male dependents <sup>a</sup>	—	2.20
<i>TTfemale</i> - Tenant's number of female dependents <sup>b</sup>	—	2.29
<i>LTlivestock</i> - Landlord provides livestock to tenant (= 1 if yes)	—	.250
<i>LTloan</i> - Landlord advances loans to tenant (= 1 if yes)	—	.312
<i>N</i>	1,504	652

<sup>a</sup> Includes the household head, sons, brothers, grandfathers, and uncles.

<sup>b</sup> Includes the wife of the household head, daughters, sisters, grandmothers, and aunts.

<sup>c</sup> The land plot location indicates the residence of the landlord (Pescia or San Gimignano), the residence of the tenant and the location of the land plot (the countryside of Pescia or the countryside of San Gimignano).

<sup>d</sup> Median tenant's wealth.

## SUMMARY STATISTICS

Table 2 provides summary statistics regarding sample A and sample B. Our primary dependent variable is the agrarian contract chosen by the landlord and tenant for a given plot of land. We observe three types of contracts: (i) owner-farmer (i. e., the land plot is cultivated by the landlord himself), (ii) share contracts, and (iii) fixed-rent contracts. In sample A, there are also a small number of plots (7 percent) on which wage laborers were hired by the landlord. We classified these plots in the owner-farmer category since wage laborers were hired for short periods of time to perform very specific tasks, such as pruning, ploughing, digging ditches, etc. Also, in both cases (wage-laborers and owner-farmer), the owner retained full control over the assets and received the full proceeds from the crops.<sup>10</sup> In sample A, 44 percent of land holdings were classified as owner-farmer, 31 percent were leased to sharecroppers, and 25 percent were under fixed-rent contracts. In sample B, share contracts were chosen on 61 percent of land plots, fixed-rent contracts on the remaining 39 percent.<sup>11</sup>

There were two general types of crops grown on Tuscan lands: vines and/or other perennial crops, and annual crops, such as wheat.<sup>12</sup> Some land plots had both annual and perennial crops grown on them. In sample A, annual crops were cultivated on 36.5 percent of land plots, perennial crops

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<sup>10</sup> The results of our regressions do not change significantly if we simply drop the wage contract observations.

<sup>11</sup> These data match well the pattern of agrarian contracts in Tuscany in 1427. According to Herlihy and Klapisch-Zuber's (1978), more than half of the farms in Tuscany were directly cultivated by the landlords themselves. Our sample is slightly biased towards wealthy landlords, who usually leased their farms out.

<sup>12</sup> The crops grown on a particular plots of land were relatively exogenous to the land. Flat, fertile land was used for cereals; hilly, more rocky land for vines.

on 41.3 percent, and the remaining had both. In sample B, perennial crops represent 17.6 percent of the sample. Half of the landlords in sample A and more than half of landlords in sample B held non-agricultural occupations (i.e. notaries, merchants, artisans, and medical doctors). A small percentage of landlords were women. In sample A, 40 percent of the landlords lived in San Gimignano and owned land plots in the surrounding countryside; the percentage is higher in sample B (56.7).

Sixty-five percent of tenants owned land and 33 percent also owned livestock or draft animals. Tenants' median wealth (including the value of their land and other property) was 43 florins (mean 92) with 14 florins being the annual average wage of an unskilled worker in Florence in 1427. One-fourth of landlords provided their tenants with livestock and draft animals, and one-third advanced loans. Lastly, tenants tended to have larger families than their landlords.

## MAIN EMPIRICAL HYPOTHESES

In our primary equations, the dependent variable is the agrarian contract utilized by the landlord and tenant for a given plot of land. The first explanatory variable is *cropmix*, indicating the extent to which vines and/or other perennial crops were cultivated on a land plot. *Cropmix* takes on the value 0 when only annual crops were cultivated on a given land plot, 1 when both annual and perennial crops were grown, and 2 when only perennial crops were planted. There is evidence (Galassi, forthcoming) that vines were more weather sensitive than cereals. As such, if risk sharing was important, high values of *cropmix* should be correlated with share contracts. Another potential effect of *cropmix* is through the multitasking arguments made in Section I. Owners of land with vines might have been hesitant to sign fixed-rent contracts due to possible exploitation of these vines. Again, high values of *cropmix* would be associated with share contracts (or owner

cultivation).

We have a number of potential proxies for a landlord's monitoring ability: *LLprof*, *LLgender*, *LLmale*, and *LLfemale*. If moral hazard and monitoring were important issues, landlords practicing non-agricultural occupations (merchants, notaries, artisans, etc), female landlords, and landlords with fewer adult children who could help monitor a tenant's effort and diligence, would likely have higher costs of monitoring and thus be more inclined to use fixed-rent contracts.

An alternative look at our hypotheses uses the additional data on tenants' characteristics in sample B. The risk sharing hypothesis is tested by looking for an effect of *TTwealth* on contract choice. More wealthy tenants may have been less risk averse and therefore more willing to work under fixed-rent contracts. The multitasking hypothesis is tested by using the variable *LTlivestock*, indicating whether the landlord provided his tenant with draft animals and livestock. For the same reasons as the potential exploitation of perennial crops, if moral hazard and multitasking were important we might expect landlords providing livestock to tenants to have been hesitant to use fixed-rent contracts. Note that these tests of risk sharing and multitasking are a bit more differentiating than that using *cropmix*, since a negative coefficient on *cropmix* could represent either effect.

Lastly, we examine the imperfect capital markets hypothesis by running a second set of regressions with a dummy dependent variable *LTloan* that equals 1 if the landlord advanced loans to the tenant. If capital markets were imperfect and poor tenants with no collateral found it hard to obtain credit in these markets, tenants that were constrained in terms of wealth would be more likely to have obtained loans from their landlords. In fact, there is evidence that in early Renaissance Tuscany landless, poor peasants were not among the customers of Jewish lenders who provided

credit to many households (Botticini 2000).<sup>13</sup>

Table 3 summarizes the main empirical hypotheses to be tested.

TABLE 3  
SUMMARY OF MAIN HYPOTHESES

Hypothesis	Proxy Variable	Expected Sign Tenure Equation	Expected Sign Loan Equation
<i>Risk Sharing - risk aversion</i>	<i>TTwealth</i>	+	
<i>Risk Sharing - crop variance</i>	<i>Cropmix</i>	-	
<i>Moral Hazard - monitoring costs</i>	<i>LLprof</i>	+	
	<i>LLgender</i>	+	
	<i>LLmale</i>	-	
	<i>LLfemale</i>	-	
<i>Moral Hazard - multitasking crops</i>	<i>Cropmix</i>	-	
<i>Moral Hazard - multitasking livestock</i>	<i>LTlivestock</i>	-	
<i>Imperfect Capital Markets</i>	<i>TTwealth</i>		-

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<sup>13</sup>One could also think that imperfect capital markets might be indicated if low wealth tenants tended to work under share contracts (not having enough wealth to pay an upfront rent). However, in medieval and Renaissance Tuscany rent was paid at the end of the season, so we would not expect this relationship.



### III ESTIMATION

#### SAMPLE A

Results from a multinomial logit specification on sample A are presented in Table 4. The three dependent variable alternatives are (i) owner-farmer, (ii) share contracts, and (iii) fixed-rent contracts. Owner-farmer coefficients are normalized to zero, so reported coefficients are deviations from the owner-farmer alternative.

The *cropmix* coefficients suggest that as one moves from cereals to vines, contracts move from fixed-rent contracts to share contracts or owner cultivation. The shift from fixed-rent to share contracts is supportive of either risk-sharing or multitasking. The shift towards owner cultivation is evidence of multitasking issues being important.<sup>14</sup>

Examining the monitoring variables, the strongest coefficients are on *LLprof* and support the monitoring story. Landlords who also practiced a non-agricultural occupation were unlikely to cultivate their land holdings by themselves and relatively preferred fixed-rent to share contracts, suggesting that it was costly for them to monitor. Female landlords were also more likely to choose high-incentive contracts. The coefficients on the number of male children indicates that households with more male dependents were more likely to choose owner-cultivation (presumably as sons could help in the fields), but do not have significantly different preferences for fixed-rent versus share contracts. In contrast, the number of female dependants moved landlords towards the two extremes—owner-cultivation and fixed-rent contracts. The interpretation of this finding is not

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<sup>14</sup> It could also be evidence that risk sharing is important if landlords have a hard time attracting tenants to work on their risky vines (and thus are forced to tend them themselves).

obvious.<sup>15</sup>

TABLE 4  
REGRESSION A: AGRARIAN CONTRACT CHOICE

Dependent variable: Agrarian contract dummy				
	Owner-farmer (0) versus share contract		Owner-farmer (0) versus fixed-rent contract	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>Cropmix</i>	-0.15	0.10	-2.53	0.16
<i>LLprof</i>	1.91	0.16	3.42	0.23
<i>LLgender</i>	0.28	0.56	1.50	0.82
<i>LLmale</i>	-0.19	0.09	-0.21	0.11
<i>LLfemale</i>	-0.42	0.10	0.06	0.13
<i>Residence</i>	2.09	0.17	-0.44	0.28
Constant	-1.05	0.21	-0.63	0.23
Log likelihood	-903.71			
<i>N</i>	1,504			

Source: See Table 1.

<sup>15</sup> We also ran two binary fixed effect logit regressions on sample A to control for fixed effects given that the sample is a "panel" of landlords who owned more than one land plot. With a conditional logit, the coefficients on the variables that do not vary within the same landlord (i.e. everything except *cropmix*) are not identified. When comparing owner cultivation to (fixed-rent or share contract), the coefficient on *cropmix* is -1.62 with a standard error of 0.16. When comparing share contracts (0) to fixed rent contracts, the coefficient is -2.89 with a standard error of 0.29. These conditional logit results confirm the findings of the multinomial logit—vines imply more owner-cultivation and less rental vs. share contracts.

## SAMPLE B

The main contribution of this article is the empirical work on sample B, our matched sample of landlord and tenant data. Table 5 reports results of probit and logit fixed effect regressions. The dependent variable equals 0 for share contracts, 1 for fixed rent contracts. The probit specification controls for landlord random effects that are uncorrelated with the explanatory variables, while the logit fixed effect model allows for effects that may or may not be correlated with explanatory variables. To compare marginal effects across logit and probit specifications, the logit results should be divided by approximately 1.6.

Examining the estimates, the *Cropmix* coefficient again suggests that vines were relatively more associated with share contracts, supporting either risk-sharing or multitasking. On the other hand, *LLprof* as a proxy of monitoring costs becomes insignificant in these specifications.

Focusing on the tenant variables, *TTwealth* is insignificant in both specifications. This suggests that either risk sharing was unimportant or that tenant's wealth is not a good proxy for risk aversion. We also tried specifications with other measures of tenant wealth such as land ownership or tenant's ownership of livestock and draft animals, but again did not find significant coefficients. Interestingly, this result parallels a number of other studies of contract choice that have found little if no risk-sharing effects in various places and eras (Allen and Lueck 1995; forthcoming). *TTmale* and *TTfemale* are not significant in the more robust logit model. On the other hand, the coefficient on *LTLivestock* is significantly negative in both specifications, suggesting that using the landlord's livestock was associated with share contracts. This supports the multitasking hypothesis in which livestock could be damaged or overused and that fixed rent contracts promoted this overuse with their incentives on current production.

TABLE 5  
REGRESSION B: AGRARIAN CONTRACT CHOICE

Dependent variable: Agrarian contract dummy Share contract (0) versus fixed-rent contract				
	Probit <sup>a</sup>		Fixed Effect Logit	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>Cropmix</i>	-1.70	0.21	-3.46	0.46
<i>LLprof</i>	-0.13	0.25	—	—
<i>LLgender</i>	-0.38	0.45	—	—
<i>LLmale</i>	0.12	0.11	—	—
<i>LLfemale</i>	-0.23	0.15	—	—
<i>TTwealth</i>	0.0005	0.001	-0.0009	0.001
<i>TTmale</i>	-0.19	0.14	-0.38	0.29
<i>TTfemale</i>	0.28	0.14	0.47	0.37
<i>LLlivestock</i>	-1.35	0.37	-1.97	1.15
<i>Residence</i>	-1.24	0.27	—	—
Constant	1.50	0.37	—	—
Log likelihood	-128.22		-40.31	
<i>N</i>	652		413	

<sup>a</sup> Probit standard errors are adjusted for landlord random effects.

Source: See Table 1.

Table 6 addresses the imperfect capital markets hypothesis. Again we use discrete choice models with the dependent variable taking the value 1 when the landlord provides loans to the tenant. Our primary interest in this regression is the coefficient on tenant's wealth. The significant

and negative coefficient implies that poor tenants without capital and with no collateral often found it necessary to borrow from landlords, suggesting that they could not obtain capital elsewhere and supporting the imperfect capital markets hypothesis. Also of interest is the significantly positive coefficient on *LLprof*, likely picking up that wealthier landlords in non-agricultural professions were more able to advance loans. The significance of *TTmales* may indicate that tenants with male dependents were able to cultivate more land and thus needed more capital.

TABLE 6  
SAMPLE B: LOAN DUMMY REGRESSION

Dependent variable: Loan dummy (= 1 the if landlord advances loans to the tenant)				
	Probit <sup>a</sup>		Fixed Effect Logit	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>Cropmix</i>	-0.03	0.22	0.08	0.19
<i>LLprof</i>	0.62	0.27	—	—
<i>LLgender</i>	0.66	0.74	—	—
<i>LLmale</i>	0.04	0.12	—	—
<i>LLfemale</i>	0.13	0.15	—	—
<i>TTwealth</i>	-0.002	0.00	-0.004	0.001
<i>TTmale</i>	0.29	0.10	0.49	0.18
<i>TTfemale</i>	-0.14	0.13	-0.26	0.21
<i>Residence</i>	0.85	0.27	—	—
Constant	-1.19	0.44	—	—
Log likelihood	-351.51		-132.87	
<i>N</i>	652		347	

<sup>a</sup> Probit standard errors are adjusted for landlord random effects .

Source: See Table 1.

## CONCLUDING REMARKS

This article examines and simultaneously tests three hypotheses suggested in the literature regarding the spread of share cropping in medieval and early modern Europe. Our estimates suggest that moral hazard and imperfect capital markets were important factors in 1427 Tuscan agriculture. Landlords concerned about their valuable assets, such as the perennial crops planted on their land holdings, and the livestock and draft animals they provided to their tenants, used share contracts to mitigate the incentive for tenants to overuse and damage these assets. At the same time, landlords advanced their landless and poorer share croppers loans to buy the seed and tools necessary for cultivation and to smooth consumption while waiting for the harvest. In contrast, there is no significant empirical support that risk-sharing played an important role. Poorer and likely more risk averse tenants did not necessarily work under share tenancy arrangements.

An important issue, not addressed here, is whether the choice of agrarian contracts and tenure relationships mattered in terms of differential productivity. This article studies *why* share cropping was adopted, but does not investigate the effects of share cropping on agricultural productivity. Future research can shed light on this issue and can offer interesting comparisons with current developing countries in which sharecropping is still the predominant agrarian arrangement.

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