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A NEW SOLUTION TO THE PUZZLE OF FIFTY-FIFTY SPLIT IN SHARECROPPING

Jiancai Pi[a]

[a] Associate Professor, Ph.D, Nanjing University, School of Business, Department of Economics, 22 Hankou Road, Nanjing 210093, P. R. China.

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ABSTRACT

This paper mainly discusses the puzzle of fifty-fifty split in sharecropping through an improved principal-agent moral hazard framework. Greatly different from the existing literature, this paper finds a new solution to the puzzle of fifty-fifty split in sharecropping. Equal division between the landowner and the tenant regardless of the land's fertility is incentive compatible, and at the same time the landowner could lease out more fertile land to the relational tenant to improve his utility by using the right of priority. Although fifty-fifty split in sharecropping happens to be fair and comes to be taken for granted as a norm, it is an efficient contractual arrangement in essence.

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I. INTRODUCTION

Sharecropping is an important research area in agricultural economics. Marshall (1920) argues that sharecropping is inefficient because the tenant is paid only a percentage of marginal product. However, sharecropping is prevailing in agriculture in many regions around the world (Cheung, 1968, 1969a, 1969b; Byres, 1983; Bardhan, 1984; Garrett and Xu, 2003). This phenomenon has greatly bewildered economists and many theoretical explanations have been put forward. According to Pi (2011), these explanations can be mainly categorized into four strands. The first strand of literature focuses on risk sharing, which holds that risk dispersion makes sharecropping a dominant arrangement under some conditions (Cheung, 1969a, 1969b; Stiglitz, 1974; Braverman and Stiglitz, 1982; Sen, 2011). The second strand of literature centers on self-selection effects, which supports that sharecropping can effectively tackle the tenant's adverse selection problem (Hallagan, 1978; Allen, 1982). The third strand of literature concentrates on moral hazard, which stresses that sharecropping can handle different types of opportunistic behavior on the part of the landlord or the tenant under different restraints (Eswaran and Kotwal, 1985; Agrawal, 1999; Laffont and Matoussi, 1995; Ghatak and Pandey, 2000; Dubois, 2002). The fourth strand of literature gives prominence to limited liability, which shows that limited liability plays a key role in determining the emergence of sharecropping (Basu, 1992; Sengupta, 1997; Ray and Singh, 2001; Dam and Pérez, 2012). Although the existing mainstream literature sheds some light on the prevalence of sharecropping, it neglects the reason behind the puzzle of fifty-fifty split in sharecropping to a great degree. The fact is that most sharecropping contracts specify to divide the crop equally between the landowner and the tenant regardless of the fertility of the land (Zhao, 2000a; Young and Burke, 2001; Bowles, 2004). For example, equal division in sharecropping has been prevalent in traditional China for more than two thousand years (Zhao, 2000a, 2000b).

According to Bowles (2004, p.94), "The puzzle of fifty-fifty sharecropping is the following: an equal split of the crop means that tenants on fertile land will have higher payoffs to their effort and other inputs than those on poor land. But if tenants are willing to work for the lower returns on the less good land, why should the owners of good land concede half of the crop to their tenants? The conventional economic theory of sharecropping predicts that the owner will capture the returns to land quality through variations in the crop share (Stiglitz, 1974). But Burke and Young (2000) show that the Illinois sharecropping contracts allow the tenants on good land to capture a third of the differential return attributable to land quality, effectively transferring millions of dollars from owners to farmers. A plausible interpretation of these facts is that farmers and owners around the world have hit on fifty-fifty as a seemingly fair division, and that attempts by owners to capture all of the returns to high quality land through the use of variable shares would be defeated by the tenants' retaliation. If true, this interpretation suggests that a predisposition to fairness, as well as the desire to punish those who violate local norms, may be motives as powerful as profit maximization and the pursuit of individual gain." Zhao (2000a) provides another solution to the puzzle of fifty-fifty split in sharecropping which focuses mainly on the reduction of transaction cost in the crop distribution. In the case of equal division, there is no need for the landowner and the tenant to meter the crop exactly, which avoids all the troubles related to metering. The reason behind this point is as follows. When the crop is divided into two seemingly identical piles, the landowner and the tenant choose one of them by casting lots.

Because both the landowner and the tenant do not know which pile will be picked up by themselves, the crop must be divided into two parts as fairly as possible ex ante. Zhao (2000a) looks upon 50% as a magic number which could play a bizarre role, and it is just this role that makes equal division become a norm in practice.

Greatly different from Bowles (2004) and Zhao (2000a), in this paper we show that equal division between the landowner and the tenant regardless of the land's fertility is incentive compatible, and that the landowner could lease out more fertile land to the relational tenant to improve his utility. Equal division not only expresses a relationship of fairness between the landowner and the tenant, and at the same time not only reflects the power of local norms, but also actually stands for the result of an efficient contractual arrangement. Reducing the tenant's share on more fertile land would cause the tenant to exert less effort, which in turn decreases the landowner's utility. The landowner tends to cultivate more fertile land by himself if he has enough physical vigor or to lease out more fertile land to the relational tenant if he has close relatives. This phenomenon often took place in China's history, which just illustrates that the landlord could reduce rent dissipation in Bowles' (2004) sense by using his right of priority (Zhang, 1984; Gao and Yang, 2008). This paper argues that it is fairness that gets a free ride from efficiency, not vice versa.

The rest of the paper is organized as follows. Section II is the basic setup. Section III provides the model of formal sharecropping. Section IV offers the model of relational sharecropping. Section V conducts a comparative analysis of the outcomes derived from two different models. Section VI gives some empirical evidences. Some concluding remarks are made in Section VII.

II. THE BASIC SETUP

In this section, we follow Laffont and Martimort (2002) and Bolton and Dewatripont's (2005) analytical framework. In a principal-agent game with moral hazard, the landowner and the tenant are both risk-neutral.If the tenant exerts effort level e, the land's added-value (also called crop here) will be $V>0$ with probability e, where e is normalized to $e\in[0,1]$.

The tenant's private cost when he exerts effort e is:

$$\Psi(e)=\frac{c}{2}e^2 \tag{1}$$

Here, $c>0$ can be seen as a parameter to capture the land's fertility. The more fertile the land is, the less the value of c is. It is should be noted that there is other parameters that could depict the land's fertility. For example, we can introduce a parameter $k>0$ which affects V. That is, the land's added-value (also called crop here) will be kV. The more fertile the land is, the bigger the value of k is. Although we adopt the parameter c in this paper, the use of the parameter k will not have an essential effect on our new solution to the puzzle of fifty-fifty split in sharecropping.

In order to make our analysis interesting, $\frac{V}{c}$ is normalized to $\frac{V}{c} \in (0,1)$.

The landowner and the tenant sign a share contract which specifies that the landowner gets $1-\alpha$ proportion and the tenant gets α proportion, where $0<\alpha<1$. According to Otsuka et al. (1992), this is a "pure" share contract since the fixed payment is set equal to zero, and at the same time it is also known as the most common form of sharecropping tenancy in practice.

Under the formal sharecropping, both the landowner and the tenant are selfish, and the signed share contract is arm's length. Here, we use the words "formal" and "selfish" in the sense that both the landlord and the tenant do not care about the other side's sharecropping share. In Beckerian (1976) language, the other side's sharecropping share does not enter into the utility function of one's own side. In this case, the landowner and the tenant's utility functions are respectively:

$$U_L^F = (1-\alpha)eV \tag{2}$$

$$U_T^F = \alpha eV - \frac{c}{2}e^2 \tag{3}$$

Throughout the paper, the superscript F denotes the formal sharecropping, and the subscripts L and T stand for the landowner and the tenant, respectively

Under the relational sharecropping, both the landowner and the tenant are tied down to a mutual relation, which results in some kind of altruistic behavior between them in the sense of kinship. Sadoulet et al. (1997) stress that the relation between the landowner and the tenant plays an important role in providing the incentive for cooperative behavior in sharecropping among kin. The relation strength is set as μ, where $0<\mu<1$. $\mu \to 0$ implies that the landowner and the tenant are almost completely selfish, and $\mu \to 1$ means that the landlord and the tenant are almost completely altruistic. On the basis of Khalil (2004), our paper adopts the egocentric perspective which belongs to the rationalistic theory of altruism. The egocentric view maintains that the altruist helps the other because the status of the other is incorporated in the altruist's utility function (see, e.g., Becker, 1976). As far as the mathematical treatment method is concerned, we follow Dur and Sol (2010) by introducing the separatable utility related to altruistic behavior. When the landowner is altruistic, his utility function includes both his own income and his concern for the tenant's sharecropping share. When the landowner is not altruistic, his utility function only includes his own income. The same logic is also applied to the tenant. It should be noted that Beckerian altruism in this paper is outcome-oriented, not pure-utility-oriented, because the focus of everyone's attention is only on the eventual sharecropping share and at the same time the effort exerted by the tenant can be simply seen as sunk cost.

In this case, the landlord and the tenant's utility functions are respectively:

$$U_L^R = (1-\alpha)eV + \mu\alpha eV \tag{4}$$

$$U_T^R = \alpha eV - \frac{c}{2}e^2 + \mu(1-\alpha)eV \tag{5}$$

Throughout the paper, the superscript R denotes the relational sharecropping.

III. FORMAL SHARECROPPING

When it is under the formal sharecropping, the landowner's programming problem will be:

$$\max_{\{\alpha\}}(1-\alpha)eV$$

$$s.t.\ e \in \arg\max\{\alpha eV - \frac{c}{2}e^2\} \tag{6}$$

$$\alpha eV - \frac{c}{2}e^2 \geq 0 \tag{7}$$

(6) and (7) are the tenant's incentive compatibility and participation constraints, respectively. It is easy for us to find that (7) is always satisfied.

From (6), we obtain:

$$e = \frac{\alpha V}{c} \tag{8}$$

Solving this programming problem, we get:

$$\alpha^{F*} = \frac{1}{2} \tag{9}$$

$$e^{F*} = \frac{V}{2c} \tag{10}$$

$$U_L^{F*} = \frac{V^2}{4c} \tag{11}$$

$$U_T^{F*} = \frac{V^2}{8c} \tag{12}$$

Throughout the paper, the superscript $F*$ stands for second-best state under the formal sharecropping.

It is easy for us to find that $\alpha^{F*}/(1-\alpha^{F*})$ is just equal to fifty-fifty under the formal sharecropping, and that α^{F*} and $1-\alpha^{F*}$ are not related to the land's fertility at all.

IV. RELATIONAL SHARECROPPING

When it is under the relational sharecropping, the landowner's programming problem will be:

$$\max_{\{\alpha\}}(1-\alpha)eV + \mu\alpha eV$$

$$s.t.\ e \in \arg\max\{\alpha eV - \frac{c}{2}e^2 + \mu(1-\alpha)eV\} \tag{13}$$

$$\alpha eV - \frac{c}{2}e^2 + \mu(1-\alpha)eV \geq 0 \tag{14}$$

(13) and (14) are the tenant's incentive compatibility and participation constraints, respectively. It is easy for us to find that (14) is always satisfied.

From (13), we obtain:

$$e = \frac{\alpha V + \mu(1-\alpha)V}{c} \tag{15}$$

Solving this programming problem, we get:

$$\alpha^{R*} = \frac{1}{2} \tag{16}$$

$$e^{R*} = \frac{(1+\mu)V}{2c} \tag{17}$$

$$U_L^{R*} = \frac{(1+\mu)^2 V^2}{4c} \tag{18}$$

$$U_T^{R*} = \frac{(1+\mu)^2 V^2}{8c} \tag{19}$$

Throughout the paper, the superscript $R*$ stands for second-best state under the relational sharecropping.

Similar to the case of the formal sharecropping, it is easy for us to find that $\alpha^{R*}/(1-\alpha^{R*})$ is just equal to fifty-fifty under the relational sharecropping, and that α^{R*} and $1-\alpha^{R*}$ are not related to the land's fertility at all.

V. A COMPARATIVE ANALYSIS

In this section, we will conduct a comparative analysis of the equilibrium outcomes under different modes of sharecropping.

By comparison, it is easy for us to obtain the following three propositions.

Proposition 1: In equilibrium, the landowner gets the same proportion whether under the relational sharecropping or under the formal sharecropping.

Proof: From (9) and (16), we obtain: $(1-\alpha^{R*}) - (1-\alpha^{F*}) = 0$.

Proposition 1 implies that fifty-fifty split is robust irrespective of sharecropping modes.

Proposition 2: In equilibrium, the tenant exerts more effort under the relational sharecropping than under the formal sharecropping.

Proof: From (10) and (17), we obtain: $e^{R*} - e^{F*} = \frac{\mu V}{2c} > 0$.

Proposition 2 implies that the relation it self can act as a tool to reduce the tenant's moral hazard.

Proposition 3: In equilibrium, both the landowner and the tenant obtain a more utility under the relational sharecropping than under the formal sharecropping.

Proof: From (11) and (18), we obtain: $U_L^{R*} - U_L^{F*} = \frac{(\mu^2 + 2\mu)V^2}{4c} > 0$.

From (12) and (19), we obtain: $U_T^{R*} - U_T^{F*} = \frac{(\mu^2 + 2\mu)V^2}{8c} > 0$.

Proposition 3 implies that the relation itself has a self-enforcing mechanism, which causes the landowner to hire the relational tenant and the tenant to seek the relational landowner with great eagerness. In Chinese language, there is a well-known proverb describing this phenomenon. It is said that "water beneficial to crops should not pass to other people's fields" ("feishui bu liu wairen tian" in Chinese). That is to say, "benefits should not be allowed to go to others."

Propositions 1-3 show that using the right of priority is an important step to increase the landowner's utility, and that the mechanism behind this process is just relational incentives (Zhang, 1984; Gao and Yang, 2008). However, there are two points that should be noted. Firstly, the landowner's number of relatives is generally limited. Secondly, the majority of the landowner's land is most likely of average quality. For example, Li (2006) find that the infertile land in China does not enter into the lease market at all. These two points can ensure that the landowner's priority right may not be exerted.

VI. EMPIRICAL EVIDENCES

Sharecropping contracts are very striking and popular in agriculture. Here we will show the relative importance of sharecropping from Zhao and Chen's (2006) historical data at the province level in China. The data were collected by the Central Research Institute of Agriculture and issued in 1935. Table 1 reflects that the tenants who adopted sharecropping contracts occupied a significant proportion of the total tenants.

According to Table 1, it is easy for us to find that the average of the sharecroppers' proportion in the surveyed 22 provinces is about 28.1%. This indicates that sharecropping is an important phenomenon worth being analyzed.

In practice, although 50% is benchmark number in sharecropping contracts, there are different possibilities in different situations. In the light of great complexities of actualities, it is not a surprise for us to find different outcomes (Shi, 1997, 1998; Gao, 2005; Long and Peng, 2010). However, our theoretical prediction is that the real-life sharecropping proportion will vary around 50% according to the landowner and the tenant's specific inputs. For example, if the landowner provides some inputs such as farm cattle, agricultural implements, seeds, and so on, then the tenant's sharecropping proportion will be less than 50% (Zhao, 2000a, 2000b; Zhang, 2006). However, if the tenant provides all the important inputs and offers a cash pledge to the landowner, then the tenant's sharecropping proportion will be larger than 50%. Inputs or cash pledges can be seen as proxies for shares in sharecropping contracts, which play an important role of addition or subtraction in mathematical sense. In short, our theoretical prediction is that in most circumstances the tenant's average sharecropping proportion will be in the neighborhood of 50%.

TABLE 1: THE SHARECROPPERS' PROPORTION IN DIFFERENT PROVINCES (1930)

Province	*Average Proportion (%)*	*Province*	*Average Proportion (%)*
Chahar	29.7	Henan	44.0
Suiyuan	45.7	Hubei	21.8
Ningxia	35.4	Sichuan	15.8
Qinghai	35.6	Yunnan	24.9
Gansu	34.5	Guizhou	50.5
Shaanxi	25.9	Hunan	18.4
Shanxi	26.7	Jiangxi	12.8
Hebei	26.1	Zhejiang	7.1
Shandong	39.1	Fujian	25.3
Jiangsu	19.5	Guangdong	17.7
Anhui	33.4	Guangxi	28.5

Source: Zhao and Chen (2006, p. 287)

Shi (1997, 1998), Zhao (2000a, 2000b), and Zhang (2006) show that equal division is the most popular form in sharecropping contracts in traditional China through multidimensional and thorough historical case studies. Zhao and Chen (2006) provide some historical data in China to prove the prevalence of equal division. Their data are contained in Table 2 as below.

TABLE 2:THE TENANT'S AVERAGE SHARECROPPING PROPORTION (1930)

Province	*Average Proportion (%)*	*Province*	*Average Proportion (%)*
Jiangsu	43.6	Shaanxi	46.9
Zhejiang	48.1	Gansu	41.0
Anhui	44.0	Qinghai	60.0
Hubei	42.5	Guangdong	44.7
Hunan	49.1	Guangxi	43.8
Hebei	47.5	Yunnan	45.1
Shandong	53.8	Chahar	35.0
Shanxi	51.4	Suiyuan	37.5
Henan	49.9		

Source: Zhao and Chen (2006, p. 287)

According to Table 2, it is easy for us to find that the tenant's average sharecropping proportion in most of the surveyed 17 provinces is about 50%. If we average all the related proportions in the seventeen provinces, we can obtain 46.1%.

VII. CONCLUDING REMARKS

This paper mainly discusses the puzzle of fifty-fifty split in sharecropping through an improved principal-agent moral hazard framework. Greatly different from the existing views, this paper finds a new solution to the puzzle of fifty-fifty split in sharecropping. Equal division between the landowner and the tenant regardless of the land's fertility is incentive compatible, and at the same time the landowner could lease out more fertile land to the relational tenant to improve his utility by using the right of priority. Although fifty-fifty split in sharecropping happens to be fair and comes to be taken for granted as a norm, it is an efficient contractual arrangement in essence. As far as equal division in sharecropping is concerned, it is fairness that gets a free ride from efficiency, not vice versa. In a word, this paper provides a new perspective on the puzzle of fifty-fifty split in sharecropping, which focuses mainly on the role of incentive systems in agricultural land lease contracts.

We should pay much closer attention to three respects on the basis of our findings. Firstly, the kinship-based relation plays an important role in sharecropping. The landowner has the incentive to hire the relational tenant. Secondly, equal division in sharecropping will influence the landowner's choice between different contractual arrangements in agriculture. Thirdly, there are different variants of fifty-fifty split in sharecropping because the landowner and the tenant may provide different specific inputs, but the existence of different variants could not deny that equal division is a benchmark in incentive compatible sense.

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NOVO RJEŠENJE ZAGONETKE DIJELJENJA POLA-POLA U NAPOLIČARENJU

SAŽETAK

Ovaj rad uglavnom analizira zagonetku dijeljenja po pola u napoličarenju putem poboljšanog okvira moralnog rizika na relaciji principal-agent. Vrlo različit od postojeće literature, ovaj rad nalazi novo rješenje zagonetke podjele po pola u napoličarenju. Jednaka podjela između vlasnika zemlje i zakupca bez obzira na plodnost zemlje je kompatibilna s poticajima dok istovremeno vlasnik zemlje može iznajmiti plodniju zemlju odnosnom zakupcu kako bi poboljšao svoj položaj koristeći pravo prvenstva. Iako je podjela pola-pola u napoličarenju pravedna i uglavnom se uzima zdravo za gotovo kao norma, u biti je to efikasan ugovorni odnos.

Ključne riječi: zagonetka dijeljenja pola-pola, napoličarenje, moralni rizik, odnos