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Robin Hood's Compromise: The Economics of Moderate Land Reforms

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Robin Hood's Compromise: The Economics of Moderate Land Reforms*

Oriana Bandiera and Gilat Levy

Abstract

This paper analyses the consequences of an unusual type of land redistribution; we take land from the very rich, as usual, but give it to the rich instead of the poor. We show that such "moderate" reform reduces agency costs and thereby increases productivity, total surplus in the economy, and the welfare of rural workers. Compared to the classic redistribution "to the tiller", moderate reforms do worse in terms of equity and do not give the poor a collaterizable asset. They can however do equally well in terms of efficiency and might be more sustainable both financially and politically.

KEYWORDS: land reform, moral hazard

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1 Introduction

Land redistribution from large owners to landless peasants has long been key in the agenda of policy makers in developing countries. Besides reducing inequality and social unrest, the general consensus is that redistributing land "to the tiller" lowers agency costs and increases agricultural productivity. However, while in the last fifty years most countries have attempted redistributive reforms, very few have been successful and it is unclear whether the equity and efficiency gains are large enough to cover the political and economic costs (see, for instance, Banerjee 1999). Unless they are generously compensated, landowners can stage strong political resistance which makes redistribution "to the tiller" either too expensive or politically unsustainable. In addition, due to the lack of credit or complementary inputs the effects of such reforms are often short-lived as the poorest beneficiaries are forced to sell back (see, for instance, Binswanger *et al* 1995).

This paper analyzes an alternative and more "moderate" type of reform; we focus on land transfers that increase equality only *within the class of large landowners*. The issue has practical relevance because land concentration among the wealthiest exhibits strong variation across countries, even among those with a similar degree of inequality overall. For instance, the Gini coefficient on landholdings in Brazil and Colombia is very similar (84.1 and 82.9 respectively) but land concentration among the wealthiest is quite different. In Brazil, seventy percent of cultivated land belongs to the largest five percent of landowners while in Colombia the percentage rises to sixteen percent. Differences across continents are more striking. In India and Korea, for instance, seventy percent of the land belongs to the top twenty-four and forty percent of landowners, respectively.[1]

This paper makes one simple point: "moderate" reforms can reduce agency costs and increase agricultural productivity, even if the number of landless workers subject to moral hazard does not decrease. The key intuition is that the distribution of landholdings among large owners determines the degree of competition in the market for rural laborers and consequently the bargaining power of the landowners vs. the workers. This, in turn, affects incentives and productivity.

We develop a simple model in which landowners hire workers to cultivate their land. We assume that output depends on workers' effort, which cannot be observed by the landowners, and that workers are subject to limited liability. Each landowner chooses the number of workers she hires and the contract she offers them, taking as given the other landowners' actions. In this con-

[1] World Census of Agriculture 2000, FAO.

text, we analyze the effect of land distribution among owners on agricultural productivity and welfare.

Our main result is that starting from a relatively unequal landownership, an equalizing redistribution among landowners increases productivity and total surplus. The intuition is as follows. Limited liability imposes an upper bound on the punishment that can be borne by the worker, implying that incentives must be provided by offering rewards. This makes incentive provision costly and therefore makes landowners offer low-powered incentives. Reducing land concentration may mitigate this effect as landlords compete more fiercely in the labor market and hence offer higher compensation to workers in equilibrium. Higher compensation translates into higher rewards for success and hence stronger incentives.

Agency issues give a new twist to the familiar relation between concentration, competition and efficiency: the fiercer competition that follows an equalizing redistribution increases not only employment but also the productivity of each worker. In particular, we show that, for some parameter values, a moderate reform may yield the first best level of effort.

Finally, our welfare analysis reveals that moderate land reforms increase the welfare of peasants as well as the welfare of the landowner on the receiving end while the joint welfare of landowners decreases. This has the important implication that although such redistribution increases efficiency, it will not be executed by the market. Thus, a productivity-enhancing equalizing redistribution can be implemented only by the redistribution of land; such redistribution can be a result of land ceilings or of an outright confiscation and redistribution.

The results rely on the existence of moral hazard, which, in agriculture, can hardly be disputed. By its own nature, agricultural work requires effort that is hard to monitor and whose effect on outcomes cannot be separated from other exogenous factors. Empirical evidence suggests that farmers achieve higher yields and choose different techniques on the plots they own rather than on the ones they rent (Shaban 1987, Bandiera 2003). In addition, productivity per unit of land is higher in small family farms than in large farms relying on hired labor who are subject to moral hazard (Berry and Cline 1979, Binswanger *et al* 1995, Rosenzweig and Binswanger 1993).

The available evidence also provides support for our main result, by showing that inequality within the landowning class matters over and above the effect of inequality between classes. First, the productivity differential between small and large farms is largest where the difference in size is largest, as in Latin America where a few landlords own very large holdings (Berry and Cline, 1979). Second, existing estimates of agency costs, which are based on Asian data, are far too small to account for the productivity differentials in

Latin America (Banerjee, 1999). This is in line with our results which show that due to the lack of competition among landlords, agency problems might be more serious when most of the land belongs to (very) few.

This paper contributes to the large theoretical literature on the effects of redistributive land reforms and in particular to the literature on bargaining power in agrarian relations under moral hazard. The theoretical link between the inefficiency deriving from limited liability and the relative bargaining power of the two parties has been analyzed, for instance, by Banerjee *et al* (2002), Dutta *et al* (1989) and Mookherjee (1997). These papers show that an increase in the agent's bargaining power, or equivalently in his reservation utility, reduces inefficiency and increases productivity.[2] Our paper contributes to this literature by identifying and formalizing a mechanism that endogenously determines the allocation of bargaining power between classes, namely, the distribution of land within large landowners.

The remainder of the paper is organized as follows. The next section presents the model. In Section 3 we analyze the effects of redistribution on productivity and welfare. In section 4, we use our results to shed some light on an interesting policy question, that is, the comparison between a full scale redistribution (redistribution to the tiller) and a moderate redistribution between landowners. Both increase the productivity of workers and employment levels but moderate reforms may be more economically and politically sustainable compared to redistribution from landowners to landless peasants. We conclude in section 5 and the appendix contains all proofs.

2 The Model

2.1 Set-up

Landowners and workers meet in the labor market where landowners hire workers to cultivate their land. Cultivation is subject to moral hazard since the worker's effort, which affects output, is neither observable nor verifiable. Landowners compete in the labor market *a la* Cournot; each landowner hires workers to maximize profits, given the labor demand of the other landowners. The equilibrium in the labor market determines the workers' compensation. Given this, landowners optimally choose the terms of the contract they offer

[2] Banerjee *et al* (2002) also present empirical evidence suggesting that, in West Bengal, the introduction of laws that exogenously increase the bargaining power of tenants vs. landowners generally leads to an increase in productivity. Using data from the 16 main Indian states, Besley and Burgess (2000) show that similar tenancy laws have decreased poverty but also output.

to their workers. We solve for the equilibrium contracts, employment level and workers' productivity and analyze how these change as a function of the distribution of land among landowners.[3]

We analyze a one period game, or equivalently, a situation in which landowners and workers match only once.[4] For simplicity of exposition, we assume that there are only two landowners and that landowners and workers are risk neutral.[5] We also assume that landowners are price takers in the market for agricultural produce.[6] Finally, we assume that when landowners employ workers, they make a take-it-or-leave-it offer. This assumption is not important and our results go through as long as the landowners have some bargaining power.

The labor market.

Labor supply. We assume that different workers have different values of reservation utility v, according to a continuous density function $f(v)$. Labor supply is then defined as $F(v)$, the cumulative distribution of v. For future purposes, denote the inverse labor supply function by $v(L) = F^{-1}(L)$. We focus on distributions of v that yield a concave labor supply schedule.[7] Our analysis does not rely on this assumption but it simplifies matters (see the appendix).

Labor demand. Each landowner i, $i \in \{1, 2\}$, chooses how many workers L_i to hire. All workers are equally good at cultivation. We define one plot as the unit of land that can be cultivated by one worker. We denote by N the total number of plots in the economy and by N_1 the number of plots owned by landowner 1.

Landowners, obviously, can hire as many workers as they wish and need not employ all of them as cultivators. It is however trivial to show that landowners strictly prefer not to pay for workers who do not produce anything. Thus, landowners effectively act as if they are subject to a "capacity constraint", that is, the number of workers they hire cannot be larger than the

[3] The assumption that landowners compete *a la* Cournot is not critical. Similar results obtain if one assumes that landowners compete in a Bertrand fashion and that workers are heterogenous for instance because they face different travel costs to the farms.

[4] We discuss later on the consequences of relaxing this assumption.

[5] In Bandiera and Levy (2004) we relax these assumptions and illustrate the robustness of our results for the cases of many landlords and risk averse agents.

[6] Relaxing this assumption opens a third channel through which redistribution among landowners increases production. We prefer not to take this into account to highlight the effect of redistribution on agency costs. Assuming that landlords have market power in the product market leaves the basic conclusions unchanged.

[7] For example the exponential density yields $F(v) = (1 - e^{-v/\mu})$ where μ is the mean and $F_v > 0$, $F_{vv} < 0$.

number of plots they own.

Without loss of generality we analyze the case of $N_1 \leq \frac{N}{2}$ and refer to landowner 1 as the "small owner" and to landowner 2 as the "large owner". N_1 and N characterize the distribution of land holdings among owners. Specifically, the smaller is N_1, the more unequal is the distribution of land holding.

Denote by $\Pi_1(.)$ landowner 1's expected profits. These are maximized subject to the capacity constraint (the first constraint, below) and the labor market clearing condition (the second constraint, below).[8] The maximization problem for landowner 1 is therefore:

$$\max_{L_1} \Pi_1(L_1, L_2)$$

subject to:

$$L_1 \leq N_1$$

$$L_1 + L_2 = F(v),$$

where landowner 2's maximization problem is defined analogously. Equilibrium values of the employment level and of pay in utility terms are denoted by $\bar{L}$ and $\bar{v}$ respectively.

We next provide the details of the production technology and of the contracts that landowners offer to their workers. These determine the precise form of the profit function $\Pi_i(L_1, L_2)$ for landowner i.

Production technology.

Production on each plot is stochastic and depends on workers' non-observable effort. Production can either succeed, in which case the value of output is 1 (a 'good' state), or fail, in which case the value of output is 0 (a 'bad' state). The probability of success depends on the effort e according to a function $p(e)$, for $p(e) \in (0, 1)$, $p'(e) > 0$, $p''(e) \leq 0$. Effort entails disutility $d(e)$ for the worker, where $d'(e) > 0$ and $d''(e) \geq 0$. It will also be convenient to assume $p'''(e) \leq 0$ and $d'''(e) \geq 0$, although it is not necessary for our results (see the appendix).

Define $S(e)$ as the expected total surplus from cultivation. This is equal to the expected value of production minus the disutility of effort, that is, $p(e) - d(e)$. To guarantee an interior solution, we assume that $p(e) - d(e) > 0$ for any e, namely cultivation is profitable for any e.

Contracts and constraints.

[8] We assume throughout that the labor market clears, i.e. that there is no involuntary unemployment. This is without loss of generality in a one-period framework but might make a difference if the time horizon is longer. In this case, efficiency wages or eviction threats could be used as an incentive mechanism. See the discussion in Bandiera and Levy (2004).

Since the expected value of output depends on workers' non-observable effort and effort entails disutility, contracts must be designed to provide incentives. In this setting incentives can be provided by giving the worker a stake, that is, by conditioning his pay on the observed outcome. A contract is then defined by the pair (g, b) where g is the pay in the good state and b is the pay in the bad state. We assume that landowners cannot discriminate among workers, and hence they must offer the same contract (g, b) to all.[9]

The contract must satisfy three constraints. First, it must provide each worker with $\bar{v}$, the equilibrium compensation determined in the labor market. This is the equivalent of the participation constraint in the standard principal-agent problem. There are two differences compared with the standard problem; first, $\bar{v}$ is endogenously determined in our model and second, since landowners cannot observe the individual worker's true reservation utility v, all workers must be guaranteed the same utility $\bar{v}$.

The second constraint is the incentive compatibility constraint. That is, the landowner has to take into account that the worker will choose an effort level e to maximize his utility, given the contract (g, b). Note that since all farmers receive the same contract, (g, b), they all exert the same effort level e.

Finally, we assume that workers are subject to limited liability. The terms of the contract must be such that in each state of nature the worker is left with enough resources to survive. We assume that all workers possess the same initial wealth w and, without loss of generality, set the subsistence level of consumption at 0.

Given the above, profits per plot are the same for all workers, and hence landowners set (g, b) to maximize profits per plot. Both landowners face the same contractual environment and therefore offer the same contract in equilibrium. In particular, maximizing profits per plot yields the following problem:

$$\max_{g,b} p(e)(1-g) + (1-p(e))(-b)$$

subject to:

$$e = \arg\max_{e'} \{p(e')g + (1-p(e'))b - d(e')\} \tag{IC}$$

$$p(e)g + (1-p(e))b - d(e) = \bar{v} \tag{PC}$$

$$b \geq -w \tag{LL}$$

[9]Note that $g - b = 0$ is equivalent to a fixed wage; $g - b = sp(e)$ with $s < 1$ is equivalent to a sharecropping contract where s is the worker's share and $g - b = p(e)$ with $b < 0$ is equivalent to a fixed rent contract.

Denote the optimal values as $(\bar{e}, \bar{g}, \bar{b})$. These are functions of w (which is exogenous) and of $\bar{v}$ which is determined in the first stage of the model.

Timing.

Given the above, we can summarize the profit per plot function for any landowner by $\pi(w, \bar{v})$. The compensation $\bar{v}$ is determined in the first stage and depends on the level of labor demand, L_1 and L_2. Thus, the profit function that each landowner i perceives at the first stage, $\Pi_i(L_1, L_2)$, is equal to profits per plot multiplied by the number of employed workers, and can be expressed as:

$$\Pi_i(L_1, L_2) = L_i \pi(w, v(L_i + L_j)).$$

The timing of the game is as follows. In the first stage each landowner chooses how many workers to hire L_i subject to a capacity constraint, $N_i \geq L_i$. From market clearance, equilibrium pay in utility terms $\bar{v}$ is determined as $\bar{v} = F^{-1}(\bar{L}_1 + \bar{L}_2)$ where $\bar{L}_i$ is the equilibrium level of employment of landowner $i, i = 1, 2$.

In the second and final stage each landowner offers her workers a contract (g, b) subject to the incentive compatibility, the limited liability and the participation constraints. The relevant level of reservation utility in the participation constraint is $\bar{v}$, as determined in the first stage.

2.2 Equilibrium analysis

We analyze the game by backward induction and solve first for the optimal contract, namely, the contract that maximizes the profits per plot for each landowner in the second stage of the game.

2.2.1 The Optimal Contract

To solve for the optimal contract, we follow a similar analysis as the one in Banerjee *et al* (2002), Dutta *et al* (1989) and Mookherjee (1997). The solution, as we show in the appendix, depends on the wealth of the workers, w. In particular there is a wealth threshold, $\bar{w}(\bar{v})$ such that:

(i) when $w \geq \bar{w}(\bar{v})$ the limited liability constraint does not bind and the optimal contract yields the first best level of effort, that is the level of effort that maximizes total surplus;

(ii) when $w < \bar{w}(\bar{v})$, the limited liability constraint binds and the equilibrium level of effort is lower than first best.

The intuition behind this result is as follows: incentives are provided by creating a spread between the payment in the good and in the bad state, which can be done either by rewarding the worker in the good state or by punishing him in the bad state. Limited liability imposes an upper bound on the punishment that can be inflicted in the bad state and makes incentive provision costly. This, in turn, results in a level of effort which is lower than first best.

The terms of the contract, as well as the induced effort level, may therefore depend on $\bar{v}$, the compensation which must be guaranteed to all workers. As we now show, for some values of wealth, an increase in $\bar{v}$ increases the effort level exerted in equilibrium:

Lemma 1 *(i) When workers are poor, namely, $w < \bar{w}(\bar{v})$, the optimal contract elicits effort which is strictly increasing in $\bar{v}$. (ii) The threshold $\bar{w}(\bar{v})$ decreases in $\bar{v}$ implying that a large enough increase in $\bar{v}$ results in the first best level of effort.*

The intuition behind the Lemma is as follows. A higher value of $\bar{v}$ implies that the landowner has to provide the worker with a higher utility. The landowner can achieve this by either increasing g, the payment in the good state, by increasing b, the payment in the bad state, or by increasing both. Increasing b alone however, is not optimal. Increasing the reward in the bad state reduces the spread between the good and the bad state thus resulting in lower incentives to exert effort. The landowner would end up paying more for less as workers would receive higher compensation but exert lower effort. Similarly, increasing both g and b to keep the spread constant cannot be optimal as the workers would receive higher compensation but exert the same level of effort. The optimal way for the landowner to increase the utility of the worker from the contract is by increasing only the payment in the good state. This, in turn, provides more powerful incentives to exert effort. Clearly, then, a large enough increase in $\bar{v}$ can decrease the threshold to the point that first best effort level is induced.

The lemma illustrates therefore that when workers are poor so that the limited liability constraint binds, the value of $\bar{v}$ plays a role in determining effort and surplus. The value of $\bar{v}$ is determined endogenously in our model, and results from the interaction of labor demand and supply, to be analyzed next.

2.2.2 Equilibrium employment

When landowners choose how many workers to hire, they take into account that their profit per plot is a function of the compensation $\bar{v}$, which in turn is a function of the total employment level in equilibrium. This is summarized by the function $\pi(w, v(L))$. Landowner i therefore chooses L_i in order to maximize:

$$\max_{L_i} L_i \pi(w, v(L_i + L_j))$$

given L_j and subject to the capacity constraint:

$$L_i \leq N_i.$$

Hiring one extra worker affects profits in three ways. First, the landowner gains from one more plot being cultivated. Second, as she hires one more worker each inframarginal worker has to be paid more. Third, as shown in Lemma 1, higher pay results in a higher effort level for all inframarginal workers and hence higher expected profits on all inframarginal plots. The first two effects capture the standard trade-off deriving from market power. The third arises from the combination of moral hazard and limited liability and is unique to this setting.

Recall that we refer to landowner 1 as the "small" owner as $N_1 \leq \frac{N}{2}$. We next show that the equilibrium employment level is a function of the land distribution, characterized by the number of plots held by the small owner, N_1:

Lemma 2 *For each distribution of land there is a unique equilibrium;*

(i) When N is sufficiently large and land distribution sufficiently equal, both landowners employ the same number of workers in equilibrium.

(ii) When N is sufficiently large and the land distribution is sufficiently unequal, then the small owner employs N_1 workers, and the large owner employs $L_2(N_1)$ workers, where $L_2(N_1) > N_1$. Labor demands are strategic substitutes.

(iii) When N is small, landlord i employs N_i and total employment is N, regardless of the distribution of land.

When the total land endowment is small, the capacity constraint binds for both landowners and the total employment level is N, regardless of the degree of inequality. When the total land endowment is sufficiently large, there are two types of equilibria, depending on the degree of inequality. First, if inequality is high the small owner's capacity constraint binds. She then employs N_1 workers, and the large owner employs the best response employment given N_1, $L_2(N_1)$. Second, if the distribution is sufficiently equal neither constraint binds. The equilibrium level is as in a standard Cournot game, namely, it is a symmetric level of employment which does not depend on N_1. We denote the critical level of N_1, namely, the level beyond which the equilibrium is symmetric and the capacity constraint does not bind for the small owner, as $\tilde{N}_1(N)$, or simply $\tilde{N}_1$. We therefore say that the distribution of land is sufficiently unequal (equal) if $N_1 < (\geq)\tilde{N}_1$. Note that since we maintain the convention that landowner 1 is the small owner, then $\tilde{N}_1 \leq \frac{N}{2}$.

Clearly, each unique equilibrium level of employment determines the equilibrium level of pay in utility terms $\bar{v}$ and, as a result, the level of effort $\bar{e}$ in the second stage. We are now ready to analyze the effect of redistribution on total surplus in the economy.

3 The effect of redistribution

The purpose of this section is to analyze the consequences of an equalizing redistribution, namely, a land transfer from the large to the small owner, on employment, productivity, total surplus and the welfare of all parties involved.

From Lemma 2 we know that when the total land endowment is small, employment is set at N and does not depend on the distribution of landholdings. Thus, equilibrium values of employment, $\bar{L}$, pay in utility terms $\bar{v}$, and consequently the terms of the contract $\bar{e}, \bar{g}$ and $\bar{b}$, cannot be affected by redistribution. In what follows we focus on the more interesting case in which N is large enough.

3.1 Redistribution, productivity and total surplus

Let TS denote total surplus in equilibrium, defined as the surplus generated by each worker multiplied by the number of employed workers. Recall that the surplus generated by each worker is $S(e)$.[10] Thus, $TS = \bar{L} \cdot S(\bar{e})$. We now analyze the impact of redistribution on total surplus, via equilibrium employment and workers' effort. The next lemma characterizes the effect of redistribution on total employment $\bar{L}$:

Lemma 3 *Starting from an unequal distribution of land, an equalizing redistribution increases total employment.*

When the distribution of land is sufficiently unequal, the capacity constraint binds for the small owner. Redistribution leads then to an increase in the number of workers she hires. The large landowner, as a response, decreases her demand for workers as labor demands are strategic substitutes. But the large landowner does not internalize the full effect of labor demand, implying that total labor demand increases. As a result, the equilibrium level of employment increases following redistribution.

A large enough redistribution can even increase N_1 beyond the threshold $\tilde{N}_1$, in which case neither capacity constraint binds. This induces the maximum level of employment for this economy. On the other hand, if the initial land

[10] Total surplus is equal to $p(e) - d(e)$.

distribution is sufficiently equal, the capacity constraint does not bind for either landowner. In this case, redistribution has no effect on employment.

To clear the labor market, higher level of employment results in higher compensation for the workers, that is, higher $\bar{v}$. Lemma 1 shows that higher compensation leads to higher effort when farmers are poor. Combining Lemma 1 and Lemma 3 we can then state:

Proposition 1 *Starting from a sufficiently unequal distribution of land, an equalizing redistribution among landowners results in higher employment and, when workers are poor, also higher effort and productivity for each worker. Total surplus increases as a consequence and reaches its maximum when the distribution of land becomes sufficiently equal.*

Redistribution leads to more competition in the labor market. The large landowner loses market power and this, as in standard models, induces higher employment and higher pay for workers in equilibrium. Moral hazard and limited liability add a new twist: when workers are poor, so that the limited liability constraint binds, higher compensation results also in stronger incentives and hence higher effort exerted by all workers. We therefore detect an efficiency enhancing effect of redistribution, which is over and above the standard effect on the marginal worker. As in the standard model, the marginal worker becomes employed and hence total surplus increases. In addition, in our model, inframarginal workers also work harder and produce more if they are sufficiently poor.[11]

For some parameters values, equilibrium effort might reach its first best level after redistribution, as specified in corollary 1:

Corollary 1 *If the effort level is at first best when the land distribution is relatively equal, then starting from an unequal land distribution, there exists an $\hat{N}_1 \leq \tilde{N}_1$, such that an equalizing redistribution which leads to $N_1 \geq \hat{N}_1$, induces the first best effort level for all employed workers.*

It is important to note that our results are robust to several other specifications of the model, such as increasing the number of landowners or allowing for risk averse workers. Finally, in a multi-period setting incentives can also be provided via eviction threats (Dutta *et al* 1989, Shapiro and Stiglitz 1984). Since eviction threats are most effective at eliciting effort when there is a low probability of finding a new job, equalizing redistributions that increase employment may weaken the role of eviction threats as an incentive mechanism.

[11] In addition to their effect on moral hazard, higher wages might also increase workers' productivity as they are able to improve their nutrition status (see for example Dasgupta and Ray (1986, 1987) and Moene (1992)). This effect, if present, would reinforce our main result.

We discuss these issues in a companion working paper (Bandiera and Levy 2004).

3.2 Redistribution and welfare

We now consider how the welfare of landowners and workers changes as a result of an equalizing redistribution:

Proposition 2 *Starting from a sufficiently unequal distribution of land, an equalizing redistribution among landowners leads to:*

(i) an increase in the welfare of each inframarginal worker;

(ii) an increase in the profits of the small landowner;

(iii) a decrease in the profits of the large landowner and in the joint profits of both landowners.

The intuition for (i) is straightforward: redistribution increases workers' compensation net of disutility costs, implying that all inframarginal workers are better off. As for (ii) and (iii), note that redistribution affects landowners' welfare in three ways. First, their welfare increases because total surplus from each plot increases as each worker puts in more effort. Second, welfare decreases because they have to reward their workers with a higher compensation. Third, the number of cultivated plots increases for the small owner and decreases for the large owner. This increases welfare for the former and decreases it for the latter.

Overall the welfare of the small owner must increase. This is a feature of both labor demands being strategic substitutes and of her capacity constraint being initially binding. These imply that the small landowner hires more workers while at the same time the large landowner hires less, which results in an increase of the small owner's profits. In fact, the small owner's profits are highest when the land distribution becomes relatively equal.

The joint welfare of landowners is maximized at $N_1 = 0$, that is, when one landowner acts as a monopolist and internalizes all externalities. It then follows that as N_1 increases their joint welfare falls. Since the welfare of the small landowner increases, that of the large owner must decrease.

Importantly, the welfare analysis implies that *although redistribution increases efficiency, it will not be executed by the market.* The joint welfare of the landowners decreases and hence they cannot agree on any price for land transaction.[12] The welfare analysis also sheds some light on the political sustainability of moderate reforms, as we discuss in the section below.

[12] This is similar to the standard monopoly/duopoly theory in which the market forces push towards a cartel. Our result simply maintains that this holds in the presence of asymmetric information as well.

4 Discussion: redistribution within classes compared to redistribution across classes

We have shown that a moderate redistribution of land within the landowning class can enhance efficiency, increasing both employment and productivity in the rural sector. An interesting policy question is how moderate redistributions compare to full scale redistributions to the tiller, in terms of benefits and costs. While a formal comparison is beyond the scope of the paper, we can still use the insights gained by our model to shed some light on this question.

Both reforms can be beneficial in terms of the productivity of each worker as well as the total employment in the economy. Moderate reforms increase productivity and as corollary 1 shows, may induce the first best level of effort when tenants are not too poor. Redistribution of land from landowners to workers has similar effects. It increases the incentives to exert effort by making the worker the residual claimant. However, if workers are too poor, agency problems still exist to the extent that the new owner needs to borrow to finance cultivation (Mookherjee 1997). In the presence of liquidity constraints and moral hazard problems for workers-borrowers, first best effort levels are not necessarily achieved even if land is redistributed to the tiller.

In terms of employment, as long as landowners retain some market power, a moderate land redistribution would result in a lower employment level compared with redistribution to the tiller. Both types of redistribution would increase employment, but after a full scale redistribution, all plots are cultivated whereas powerful landowners tend to employ inefficiently low numbers of workers. However, since total surplus is a combination of both employment and productivity, given the above discussion about productivity and effort levels, there is no clear cut comparison between the two reforms in terms of their benefits.

Redistributing land entails both financial and political costs. The welfare analysis suggests that, compared to a full scale redistribution, moderate reforms could be more politically viable. A full scale redistribution increases workers' welfare at the expense of all landowners' and is therefore likely to be opposed by the landowning class as a whole. This, combined with the fact that landowners have a comparative advantage at lobbying if not overwhelming political power,[13] implies that full scale redistributions are unlikely to be

[13] Baland and Robinson (2003) present evidence indicating that large landowners have control over their workers' votes, especially in areas with large land inequality. Landowners' control seems to have diminished after the introduction of the secret ballot but remains endemic throughout the developing world.

politically sustainable.[14] Not surprisingly very few large scale redistributions have succeeded in peacetime (Binswanger et *al* 1995, Bell 1990). On the other hand, reforms which redistribute land within the landowning class, break its cohesion and might be politically easier to implement.

Moderate land redistributions are also likely to be more sustainable financially. Full scale redistributions between classes are very costly: the state must compensate landowners since, by definition, landless beneficiaries cannot. Due to the lack of credit and other complementary inputs, the poorest beneficiaries, who are the main targets of full scale reforms, are often forced to sell back. While this concern is still relevant when redistributing within the class of landowners, it is likely to be less serious. Compared to landless peasants, landowners have better access to credit which reduces the need for government subsidies and the incidence of distress sales. Thus, the effect of moderate reforms is more likely to be long lasting. Indeed, existing evidence indicates that while being unsuccessful at redistributing to landless peasants, redistribution policies have often managed to transfer land to the rural middle class (Binswanger *et al* 1995, Deininger and Feder 1998).

Furthermore, a full comparison between the two policies should take into account equity considerations and general equilibrium effects. Here we note that, compared to a redistribution between rural classes, redistribution among large landowners does worse in terms of equity and does not give the poor a collaterizable asset that can be used for other forms of investment.

Finally, an equally important question is that concerning implementation– namely how to transfer land among landowners, and which land and landowners need to be targeted. Scholars of economic development have devoted great attention to this question focusing, however, on land redistribution to small owner cultivators (see Banerjee 1999). While providing a detailed account of all possible implementation strategies goes beyond the scope of this paper, here we note that the imposition and enforcement of land ceilings has a much smaller information requirement and leaves more room to market forces compared to outright confiscation and redistribution. The latter indeed entails the government to choose which land to confiscate and whom to give it to. With land ceilings, in contrast, owners whose landholdings are larger than the maximum allowed and potential buyers are left free to bargain on which land gets transferred at what price. Crucially, scholars point to the importance of not

[14] Landowners may be willing to agree to full scale redistribution, if they are generously compensated. Compensation can rarely be paid by the beneficiaries as these could not afford to buy the land in the first place. If farmers have to borrow to compensate previous owners, the efficiency gains of full scale redistribution are greatly reduced. The debt diminishes effort incentives because of limited liability. Thus, compensation must be paid with government revenues, raising the issue of fiscal sustainability.

making ceilings conditional on variables that can be chosen by the landowner and therefore be used as loopholes to make the ceilings legislation ineffective.[15]

5 Conclusion

This paper analyzes land redistribution within the class of large landowners, focusing on its effects on agricultural employment and productivity. We have shown that "moderate" land redistribution reduces agency costs and increases workers' productivity and welfare, even if the number of workers subject to moral hazard is unchanged. This result follows from the fact that redistributing land among landowners can lead to higher competition in the market for rural labor, which, in a world with moral hazard and limited liability, results in higher pay and stronger incentives for rural laborers.

The analysis also indicates that moderate redistributions can do as well as a full scale redistribution to the tiller in terms of efficiency. This result is of interest because full scale redistributions are typically very costly, both financially and politically.

While we have focused on the static gains, in a dynamic setting a one-off reduction in inequality within the landowning class might also have strong long run consequences for growth. As shown in Mookherjee and Ray (2002) poverty traps can emerge due to limited liability because workers have no incentive to save when landlords have all the bargaining power. A reform that reduces the bargaining power of landlords might give workers incentives to accumulate wealth and thus promote growth.

[15] For instance, land ceiling laws often exempt certain crops (e.g. tea, coffee and cocoa), which then pushes large owners to plant these crops to retain the land, even if that is not its most productive use. See Banerjee (1999) for a detailed discussion.

Appendix

1. **The optimal contract and proof of Lemma 1**
The landlord solves:

$$\max_{g,b} p(e)(1-g)+(1-p(e))(-b)$$

subject to:

$$e=\arg\max_{e'}\{p(e')g+(1-p(e'))b-d(e')\} \tag{IC}$$

$$p(e)g+(1-p(e))b-d(e)=\bar{v} \tag{PC}$$

$$b\geq -w \tag{LL}$$

The incentive compatibility constraint yields $(g-b)=\frac{d'(e)}{p'(e)}$, the landowner's problem can therefore be expressed as the optimal choice of b and e. The Lagrangian is:

$$p(e)\left(1-\frac{d'(e)}{p'(e)}\right)-b+\mu\left(p(e)\frac{d'(e)}{p'(e)}+b-d(e)-\bar{v}\right)+\eta(b+w)$$

The first order conditions are:

$$p'(e)-d'(e)-(1-\mu)p(e)\frac{\partial}{\partial e}\frac{d'(e)}{p'(e)}=0 \tag{FOC$_e$}$$

$$\mu+\eta=1 \tag{FOC$_b$}$$

There are two cases, depending on whether the limited liability constraint binds.

(a) Limited Liability does not bind $\rightarrow \eta=0\rightarrow\mu=1$. Equilibrium effort is e^* that solves $p'(e)-d'(e)=0$. Note that this is the first best level of effort, that is the effort that maximizes total surplus. Payment in the bad state is $b=\bar{v}+d(e^*)-p(e^*)$. This case applies for all w such that $b>-w$, that is for $w\geq\bar{w}(\bar{v})=p(e^*)-d(e^*)-\bar{v}$.

(b) Limited Liability binds $\rightarrow \eta>0\rightarrow\mu<1$. Equilibrium effort is $\hat{e}$ that solves $p'(e)-d'(e)-(1-\mu)p(e)\left(\frac{\partial}{\partial e}\frac{d'(e)}{p'(e)}\right)=0$. Note that $\hat{e}$ is less than first best; comparing FOC$_e$ in the two cases we see that they differ by the $(1-\mu)p(e)\left(\frac{\partial}{\partial e}\frac{d'(e)}{p'(e)}\right)$ term only, which is positive since $p''<0$ and $d''>0$ and hence $\frac{\partial}{\partial e}\frac{d'(e)}{p'(e)}=\frac{d''p'-d'p''}{(p')^2}>0$ for any e. Using the fact that $p''<0$ and $d''>0$

(namely, surplus is a concave function of e) we see that $\hat{e}$ must be smaller than e^* to satisfy the first order condition. Payment in the bad state is $b = -w$. This case applies for $w < \bar{w}(\bar{v})$.

Proof of Lemma 1: (i) Consider $w < \bar{w}(\bar{v})$, that is, the limited liability constraint binds. At the equilibrium level of effort $\hat{e}$, $p(\hat{e})\frac{d'(\hat{e})}{p'(\hat{e})} + b - d(\hat{e}) - \bar{v} = 0$. Taking the total differential yields: $\frac{d\hat{e}}{d\bar{v}} = \frac{1}{p\frac{\partial}{\partial e}\frac{d'(e)}{p'(e)}} > 0$. (ii) This is obvious since $\bar{w}(\bar{v}) = p(e^*) - d(e^*) - \bar{v}$.■

2. **The labor market equilibrium and proof of Lemma 2**

Note that by using backward induction, landowners perceive effort induced in equilibrium as $e(\bar{v}, w)$. Their profit per plot can be expressed as the surplus produced on each plot, $S(e(\bar{v}, w)$, minus the compensation given to workers, $\bar{v}$. In the first stage, $\bar{v}$ is determined as a function of labor demand. Thus, landowner i chooses L_i given L_j, in order to maximize:

$$\max_{L_i} L_i \pi(w, v(L)) = L_i(S(e(v(L), w) - v(L))$$

where $L = L_i + L_j$, subject to the capacity constraint:

$$L_i \leq N_i.$$

The first order condition is:

$$[S(e(v(L), w) - v(L)] - L_i v_L + L_i S_e e_v v_L - \lambda_i = 0$$

where λ_i is the Lagrange multiplier for the capacity constraint.[16]

Proof of Lemma 2: we first show that there cannot be an equilibrium in which the capacity constraint binds for the 'large' landlord but not for the small landlord.

Indeed, if the 'large' landlord's constraint binds, it must be that $L_2 = N_2 \geq N_1$. If the capacity constraint for the small landlord does not bind, it must be that $L_1 < N_1$. That is, it has to be that $L_1 < L_2$. However, since $\lambda_2 > 0$ and $\lambda_1 = 0$, by the FOC:

$$L_1 = \frac{S(e(v(L)) - v(L)}{v_L - S_e e_v v_L} > L_2 = \frac{S(e(v(L)) - v(L) - \lambda_2}{v_L - S_e e_v v_L},$$

a contradiction.

[16] When no confusion is created, we drop the exogenous variable w from the function $e(\bar{v}, w)$.

Hence, there are three possible equilibrium solutions: (a) neither capacity constraints bind, (b) the constraint binds for the 'small' landlord only, and (c) the constraint binds for both.

Proof of Part (i). Case (a) If neither constraint binds then $\lambda_1 = \lambda_2 = 0$. This implies that each landlord solves:

$$L_i = \frac{S(e(v(L)) - v(L)}{v_L - S_e e_v v_L} \tag{1}$$

The right-hand-side of (1) depends only on L. Hence, the equilibrium solution is symmetric, in which $L_1 = L_2$. This implies that $L_i = \frac{L}{2}$. Denote the solution of L to the equation

$$\frac{L}{2} = \frac{S(e(v(L)) - v(L)}{v_L - S_e e_v v_L}$$

by $\bar{L}$. This equilibrium holds if $\frac{\bar{L}}{2} \leq N_i$ for all i.

Case (b) If the constraint binds for the 'small' landlord only, then $\lambda_2 = 0$ and $\lambda_1 > 0$. Then, $L_1 = N_1$ and

$$L_2 = \frac{S(e(v(N_1 + L_2)) - v(N_1 + L_2)}{v_L - S_e e_v v_L}$$

Denote the solution to this equation by $\bar{L}_2(N_1)$. We find λ_1 by:

$$N_1 = \frac{S(e(v(N_1 + L_2)) - v(N_1 + L_2) - \lambda_1}{v_L - S_e e_v v_L}$$

This equilibrium holds if $2N_1 < \bar{L}$ and if $\bar{L}_2(N_1) \leq N_2$. Note that $N_1 < \bar{L}_2(N_1)$ since the FOC has to be satisfied for the small owner as well. In both cases, the FOC's right-hand-side is the same but for the small owner there is also a $-\lambda_1$ term. Moreover, if indeed $N_1 < \bar{L}_2(N_1)$ then it must be that $\lambda_1 > 0$ by the FOCs and the non-symmetric solution.

Finally, we show that labor demands are strategic substitutes. The FOC for the large owner has $\lambda_2 = 0$. We take a total differentiation of the FOC:

$$[A]dL_1 + [S_e e_v v_L - v_L + A]dL_2 = 0$$

for

$$A = S_e e_v v_L - v_L + L_2(S_{ee} {e_v}^2 v_L^2 + S_e e_{vv} v_L^2 + S_e e_v v_{LL} - v_{LL})$$

Hence,

$$\frac{dL_2}{dL_1} = \frac{A}{-(S_e e_v v_L - v_L) - A}$$

Note that $S_e e_v v_L - v_L < 0$, otherwise the FOC has no solution when $\lambda_2 = 0$. We know that $S_{ee} = p'' - d'' < 0$ and note also that $e(\bar{v}, w)$ is concave in each element that is $e_{vv} < 0$.[17] Also $v_{LL} > 0$ by the assumption that this is the inverse labor supply function. Hence, $A < 0$, implying that $\frac{dL_2}{dL_1} < 0$.

Proof of Part (ii): When both constraints bind $L_1 = N_1$ and $L_2 = N_2$ and hence $v(L) = v(N_1 + N_2)$. From the FOCs, indeed the Lagrange multipliers are positive. This equilibrium holds when $2N_1 < \bar{L}$ and $\bar{L}_2(N_1) > N_2$, that is when N is small or $N < N_1 + \bar{L}_2(N_1)$.■

3. **Proof of Lemma 3**

Let total employment be defined as $L(N_1)$. Consider then the equilibrium in which the distribution is sufficiently unequal so that the capacity constraint binds for the small owner (case (a) above). Then,

$$\begin{aligned}\frac{\partial L(N_1)}{\partial N_1} &= \frac{\partial N_1 + \partial \bar{L}_2(N_1)}{\partial N_1} \\ &= 1 + \frac{A}{-(S_e e_v v_L - v_L) - A} \\ &= \frac{-(S_e e_v v_L - v_L)}{-(S_e e_v v_L - v_L) - A} > 0.\end{aligned}$$

When the distribution is equal enough so that neither capacity constraint bind, and as long as redistribution does not alter the ranking (that is, the small owner always owns at most the same number of plots as the large owner) we get the same symmetric solution and hence $\frac{\partial L(N_1)}{\partial N_1} = 0$. ■

4. **Proof of Proposition 1**

Total surplus is equal to:

$$TS(N_1) = L(N_1) \cdot S(N_1) = L(N_1) S(e(v(L(N_1))))$$

[17] To see this, denote $f(e) = p(e)\frac{d'(e)}{p'(e)} - d(e)$. Then under mild restrictions on p''' and d''', $f_{ee} > 0$:

$$f_{ee} = p' \frac{\partial}{\partial e}\left(\frac{d'}{p'}\right) + p \frac{p'^2(d'''p' - d'p''') - 2p'p''(d''p' - p''d')}{p'^4} > 0$$

since $e = f^{-1}(w + \bar{v})$, this implies that $e_{vv} < 0$.

Taking the derivative w.r.t. N_1 :

$$\begin{aligned}\frac{\partial TS(N_1)}{\partial N_1} &= \frac{\partial L}{\partial N_1}S + \frac{\partial S}{\partial N_1}L \\ &= \frac{\partial L}{\partial N_1}S + S_e e_v v_L \frac{\partial L}{\partial N_1}L \\ &= \frac{\partial L}{\partial N_1}(S + S_e e_v v_L L) > 0.\end{aligned}$$

From Lemma 3 we know that $\frac{\partial L}{\partial N_1} > 0$ when the initial distribution is unequal (that is the capacity constraint binds for the small owner) and from Lemma 1 we know that $e_v > 0$ when the limited liability constraint binds. Hence when workers are poor and the initial distribution is unequal, redistribution increases both employment and effort. When workers are relatively rich and the initial distribution is unequal, redistribution increases employment and maintains the same effort level. When the initial distribution is sufficiently equal (namely when neither capacity constraint binds), Lemma 3 shows that $\frac{\partial L}{\partial N_1} = 0$ and hence total surplus is unchanged.■

5. **Proof of Corollary 1**

Since an equalizing redistribution from N_1 to $\tilde{N}_1$ induces the first best level of effort and effort is increasing in N_1, there must be $\hat{N}_1 \leq \tilde{N}_1$ such that for all $N_1 \geq \hat{N}_1$ effort is at first best.■

6. **Proof of Proposition 2**

(i) When N_1 increases all the inframarginal workers earn more net of disutility costs and hence their welfare increases.

(ii) Recall that the first order condition for the large landlord is:

$$S(e(v(L(N_1))) - v(L(N_1)) + L_2(S_e e_v v_L - v_L) = 0$$

The welfare of the small landlord is equal to $N_1(S(e(v(L(N_1))) - v(L(N_1))),$ therefore:

$$\begin{aligned}&\frac{\partial N_1(S(e(v(L(N_1))) - v(L(N_1)))}{\partial N_1} \\ =\ & S(e(v(L(N_1))) - v(L(N_1)) + N_1 \frac{\partial L(N_1)}{\partial N_1}(S_e e_v v_L - v_L) \\ =\ & S(e(v(L(N_1))) - v(L(N_1))(1 - \frac{N_1}{L_2}\frac{\partial L(N_1)}{\partial N_1})\end{aligned}$$

but $S - v > 0$ for any level of employment, $\frac{N_1}{L_2} < 1$, and

$$\frac{\partial L(N_1)}{\partial N_1} = \frac{\partial (N_1 + L_2(N_1))}{\partial N_1} = 1 + \frac{\partial L_2(N_1)}{\partial N_1} < 1.$$

because $\frac{\partial L_2(N_1)}{\partial N_1} < 0$. It follows that

$$\frac{\partial N_1(S(e(v(L(N_1))) - v(L(N_1)))}{\partial N_1} > 0$$

that is, the welfare of the small landlord increases.

(iii) The joint welfare of landlords $L(S(e(v(L)) - v(L))$ is obviously maximized when one of them is a monopolist, i.e. when $N_1 = 0$. It then follows that, by curtailing monopoly power, redistribution causes the joint welfare to fall. Since the joint welfare of the landlords decreases and the welfare of the small landlord increases, the welfare of the large landlord must decrease.■

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