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Interlinked Factor Markets in Sharecropping

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INTERLINKED FACTOR MARKETS IN SHARECROPPING

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A Research Paper

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CHAPTER 1

Agriculture has played an important role in economics throughout all of history and continues to play a vital role in the economies of underdeveloped societies. This fascinating relationship with underdeveloped areas is primarily due to the fact that an agricultural sector is one of the only existing industries of any consequence. Naturally, it usually holds a significant share of the total market activity for this same reason. Typically, total output from the agriculture sector accounts for a range between 40-60% of the underdeveloped economy, and engages 50-80% of the entire labor force. These labor and capital demands place a substantial burden on the agricultural sector of an economy in the process of transformation. (Mellor 1961) So it is common and relatively easy to show, especially in developing countries, that the agricultural sector as a staple economic force that is usually already established and as most likely to play a key role in the society's growth. The realization of this role places an immense need for economists to focus their attention towards policies, their implementation, and respective implications on growth. According to Mellor and Johnston, policy makers should implement tools that incentivize a net flow of capital, labor, and other resources from the agricultural sector to the industrial sector. These policies should be focused on transformation of the economic structure by maintaining the long run interests of all parties; including the farm population as well as the population at large. (Mellor 1961) Investigating the nature and efficiency of share contracts appears to be the next natural inquiry since they have long been prevalent in low-income developing countries. Share contracts One simple explanation is that share contracts offer a joining of both the tenant's and the landlord's interests. (Reid 1975) The tenant's interest is seeking to maximize profit, which includes well-being, while the landlords are looking to optimally choose their factors of

production and ultimately maximize their profit. Many researchers are continuing to ask the question, why are there still vast differences between developing agrarian economies and their transformed industrial neighbors? Why do we not see changes in the interest rate of rural credit markets and ultimately the inhabitant's well-fare? Many of these questions date back to the well-known works of people like Alfred Marshall, and Adam Smith. However, agriculture, specifically sharecropping, has intrigued economists for centuries because of the interesting nature of it's contracts and construct. The distinctness of the sharecropping contract is the continuing incentive for both the landlord and the tenant to maximize the efficiency of agricultural production. (Reid 1975) Backward agrarian societies and economies have persisted throughout time with land owners charging seemingly high interest rates. Unusually high interest rates in agrarian societies have puzzled many researchers in economics. (Bailey 1964; Rahman 1979; Reserve Bank of India 1977; Wharton 1962) Many authors have claimed potential risk as a competing explanation. Potential risk is best defined by examining the lender's risk hypothesis. This outcome can occur when conditions appear to be advantageous for landlords to conduct arbitrage in taking loans from the urban market and supplying the rural market, since urban loans' interest rates are significantly lower. (Tun Wai 1958) If a significant amount of people indulged in taking advantage of such arbitrage, it would lead to a lower interest rate in rural markets and eventually parity to urban credit markets. (Bottomley 1975; Raj 1979) However, we don't see backward agrarian economies doing this. In fact, moneylenders are not taking advantage of this easy money because of the significantly high risk of default, therefore leveling the effective interest rate of these backward agrarian economies to no more than that of the developed sector. A market that exhibits a sufficient amount of potential risk will innately seek to interlock itself with another market. (Basu, 1983a) Interlinkage often occurs because of what

the literature refers to as this potential risk. This risk led governments to intervene in markets and propose the solution path to the problem of the credit availability in low-income countries by providing institutional credit for those in need. However, whenever credit was given out, the recovery of the asset was seldom successful and eventually led to the abandonment of these projects. It seems reasonable to think about and discuss the nature of interlinked factors and their feasibility in economies. "An interlinked deal is one which two or more interdependent exchanges are simultaneously agreed upon." (Basu 2003, p.281) A notable feature of less-developed agrarian economies is the existence of interlinkages among the land, labor, credit, and product markets. In these less developed economies, often a landlord will supply a line of credit; purchase and market the output of the tenant farmers; and will often sell raw materials (fertilizers) and consumption goods to his tenant farmers. (Braverman and Stiglitz 1982) Backward low-income developing regions have been known to suffer from credit shortages. Historically, the conditions of sharecropping production coexisted with rental and owner cultivation. Landowners and tenants chose among alternative common contracts of tenure. Landlords took costly measures of monitoring, fines, bonuses, and arbitration to ensure that contracts would be fulfilled. The contracts varied significantly over time. (Reid 1975) Among the least developed countries, sharecropping is still very prominent. Sharecropping is where a landlord engages in a contract with a tenant, in which the tenant cultivates the land for a share of the productivity. Alfred Marshall set a discourse on sharecropping that concluded with a less than favorable outcome. He believed and developed a geometric proof showing that sharecropping was inefficient because the tenant doesn't have any incentive to put forth his best effort. He goes on to explain, "For when the cultivator has to give his landlord half of the returns to each dose of capital and labor he applies to the land, it will not be to his interest to apply any

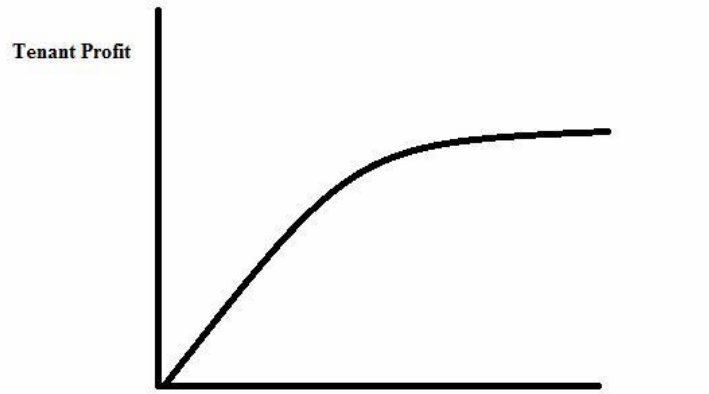

Figure 1

doses the total return to which is less than twice enough to reward him." (Marshall 1964) Figure 1 displays a visual representation of why the tenant doesn't have an incentive to work hard. As the tenant puts more work and effort into the land, he/she exhibits diminishing returns to profit. Sharecropping was deemed part of a "semi-feudal" relationship of the agriculture in West Bengal, primarily because of the perpetual indebtedness of tenants, the landlord acting as a lender of consumption credit, and tenant's inaccessibility to markets. He uses this term to

describe the ‘relations of production as more similar to classical feudalism than to modern capitalism’ via the characteristics described above. (Bhaduri 1973) Rao found that sharecropping was more productive than that of owner-cultivated land. (1971) The facts of sharecropping did not support Marshall’s conclusion as well, “landowners’ returns from sharecropped land were somewhat higher, not lower than their returns from rented land; the ratio of labor and average yield were at least as high on sharecropped land; and the ratio of labor to land fell, rather than rose, as the tenants’ share rate increased.” (Reid 1975) Different combinations of product factor activities among India’s agriculture were investigated by Bharadwaj, and she concluded that

different market outcomes can be achieved through the means of interlinkage. She did this by no longer having wages as payment for labor and the interest rate as payment for loan, but by the creation of a joint vector (w,i) she reflects the price of labor and loans. (1974) Sharecropping contracts with interlinkage offer several different explanations as to why it can achieve better

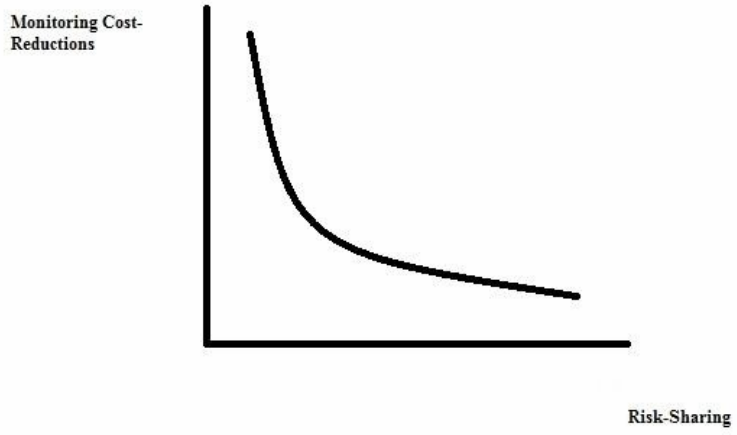

Figure 2

economic outcomes. One discourse it offers as incentive is through risk sharing. It allows landlords to reduce costs by not having to conduct as much supervision. Figure 2 shows that interlinkage via risk-sharing will decrease the overall cost for landlords because he/she can shift it towards the tenant. The tenant will have more of an incentive to work hard because his profit

outcome has more dependency upon his effort, which he can control. Having the ability to 'mix contracts', where landlords can hire different tenants and tenants can work for several different

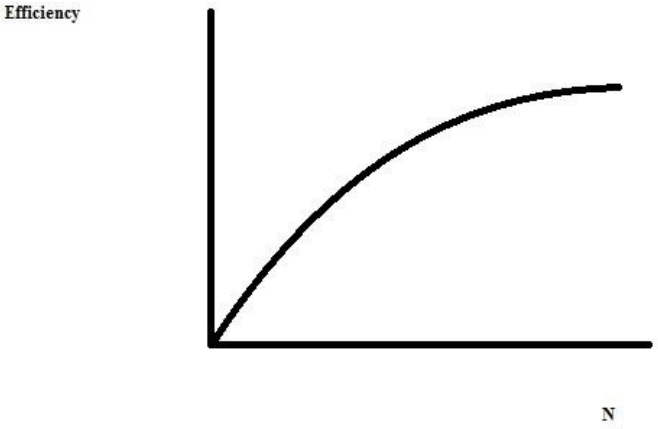

Figure 3

landlords makes an efficient use of the land. (Stiglitz 1974) It has been estimated that the share of productivity for landlords is between 25%-50%. (Maitra 2006)

Figure 3 shows the relationship of having the ability to mix contracts, showing that efficiency of the land will increase as the tenant is able to mix their contract choice, with capital N being the different choices of landlords. Another problem with sharecropping that interlinkage has helped address is the monopolist-moneylender attempt to extract the consumer's surplus a borrower

would get under normal monopoly conditions. (Basu 2003) The market difference between a monopoly landlord and a competitive landlord in the sharecropping industry lies within the tenant's utility, since they both are attempting to maximize profit. In the monopoly market outcome, the workers are limited to a subsistence level of utility. In a competitive outcome, the utility will be at the equilibrium level of supply and demand of tenants. It has been shown that moneylender's options to maximize their profit are limited to what Bhaduri refers to as "price strategies", because tenants will act upon their reservation frontier or utility in the negotiation of a contract. That is to say, if the tenant's reservation utility is not met by the landlord, he will refuse to accept the contract. (1977) The reservation utility is shown as exogenous in the model. (See Figure 4 for a graphical representation of the reservation utility frontier.) Braverman and Stiglitz attacked the moral hazard problem with interlinkage as a method for maintaining work effort. Without interlinkage the tenant has an incentive to shirk, and put less labor or diligence than the landlord would deem fit. Interlinkage in the factor markets would help monitor this phenomenon. (1982) Braverman and Stiglitz's research contribution shows that tenants have an incentive via competition to work harder because in the end they will be better off. For example, the landlord can create an incentive to work harder by offering the tenants a subsidized loan. Another option landlord may take is to reduce the size of the share or land plot the tenant is working, but he doesn't have an incentive to do so because the expected profit would also diminish. Also, a landlord could set a wage that minimizes his labor cost per unit, but workers will be less efficient. In fact, efficiency is so low that the wage cost per unit of effective labor is significantly larger than at the 'efficiency wage'. One final hypothesis that contested interlinkage as an efficient market outcome was what is referred to as "triadic" relations. This model brings up some important questions regarding the meaning of coercion, and conversely, voluntariness.

This asymmetric power enables them to obtain this more efficient outcome, but what is the driving force of this power, and can that power works in many ways? (Basu 2003) People are assumed to interact amongst each other in pairs, but in this set up can be triangular, or more generally, polygonous. For example, an agent may take a contract because he/she fears that the landlord has the ability to inflict harm upon the agent that is not related to the market transaction. Some speculate that castes, customs, and other social constructs are more obvious in economic outcomes than power. Perhaps the most broad and earliest rendition of the idea of interlinkage is found in Gluckman's work on the Barotse. (1955) In this paper, he identifies the Barotse society to use "multiplex relationships", 'where almost every social relationship serves many interests', and in modern societies it is found that relationships are "confined to a single interest". (Gluckman 1975, p.18) Mohammed Yunus, a Nobel Prize winning economist, began an effort help the poorest of the poor in Bangladesh by developing and implementing a model that implements peer pressure or group lending to insure repayment to moneylenders. (Yunus, 2010) Yunus and Gluckman tackle a large perspective of interlinkage within political and social relationships, but for the nature of this discourse it is reasonable to limit our domain to that of economic interaction and exchange. The objective of this paper is to better understand the interlinkage relation between factor markets. Specifically, this paper seeks to identify how well-being for both the tenants and landlords in the agrarian societies of sharecropping are affected by adding a share of productivity to the landlords and tenants. This share of productivity will hopefully affect the tenant’s reservation frontier. It is common for policy maker to enforce that the tenant receives a greater share in the productivity of the land or that the landlord might offer this increase in share to be more attractive to the prospective tenant, knowing that he will make more profit from the tenant in the informal credit market. This policy is at first seems to be

executed in an effort to increase the well-being of the tenant, but in what case could that be negligible? Does an increase in the share of productivity cause a movement along the tenant's reservation frontier because of the interlinkage of credit markets? The paper will proceed as follows, in section two there is a detailed model explanation with applied game theory of Basu's findings. Finally, there is section that explores a number of possible research projects for the future on the role of interlinked sharecropping, focusing specifically on one case of the share of land productivity.

CHAPTER 2

Similarly to the entirety of Basu's (2003) model, consider a rural region that has one landlord and n identical tenants. The tenant is not obligated by law to repay a loan to the landlord. Suppose the tenant ties himself to the landlord as an employee for one year. For simplicity, assume that the tenant does not have any alternate forms of employment, and does not default. Also assume that there are a limited number of identical landlords. Now consider a utility function with the nature of a higher value of u, the more attractive the contract will be from a tenant's point of view. The utility function is comprised of a wage (w), which the tenant receives from the landlord for a year's work. It also depends on an interest rate (i). It is simple to think of utility as an index. Therefore, we can assume that the function is positive in its first derivative and negative in its second. This seems reasonable being that utility is concave or that it expresses a positive affect with diminishing returns. Now let us rewrite our utility function as a function of wage. Wage is an increasing function of utility and interest rates. Therefore, its first derivative is non-negative and its second is strictly positive. This makes sense because a tenant will always be better off when wages increase because it will increase his utility. Interlinkage will come between the factor productions through an informal credit market. The tenant will have some demand L, which is a function of i, the interest rate, such that L' is less than or equal to zero. This implies that at some sufficiently high interest rate, the tenant will stop accepting loans. For what economists and Basu (2003) call "partial equilibrium analysis", there is a reservation utility, such that for some utility that landlords offer that is below this reservation, tenants will stop coming to the landlord. The reservation frontier is then graphed in order to speculate on the interlinked equilibrium. According to Basu (2003), the reservation frontier will be similar to price in conventional market analysis. The reason this model is similar to a price market is that

the reservation utility is given exogenously to the landlord and then payoffs are maximized resulting in equilibrium of the three figures. See Figure 4 for more details regarding the

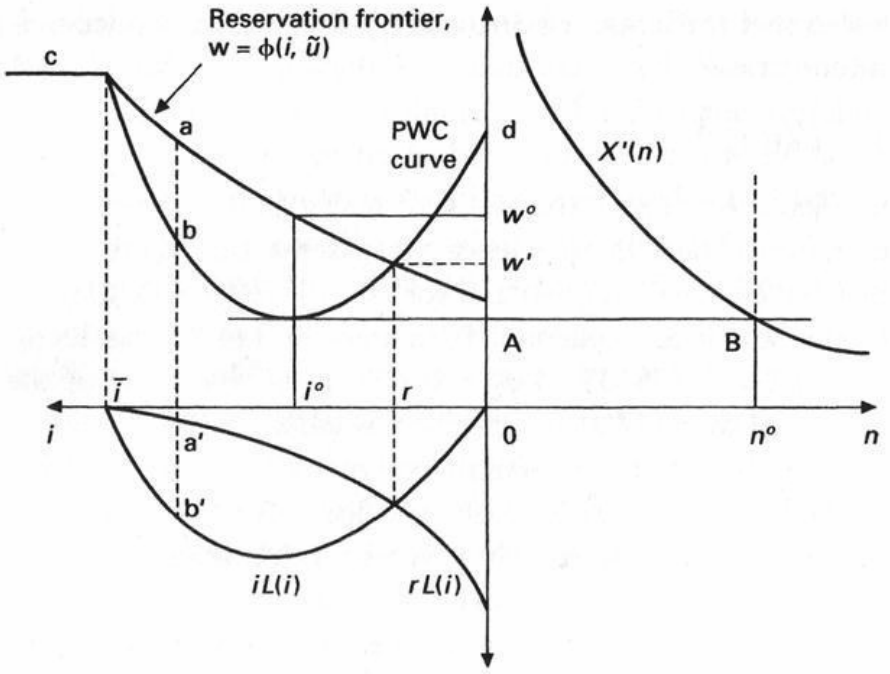

Figure 4

relationship of the tenant's reservation frontier, and the landlord's per worker cost curve in equilibrium. Now we must look at the landlord's decision problem. Assume that X output is produced, and is a function of n, the number of tenants. Assume that X' is positive, and that X'' is negative. These means that output is increasing in the factors of production, but eventually will show diminishing returns. The landlord must pay each tenant the same amount of wage, w and provide loans at the same interest rate i. His annual earnings is his entire production minus the wage for tenants times the number of tenants. The landlord chooses the lowest point on his per-

worker cost curve and sets the interest rate to i^0. The wage the landlord pays can be shown by following the interest rate choice to the previously given reservation frontier in Figure 4 as w^0. The equilibrium amount of tenants n, is labeled as n^0. Now the landlord has access to formal credit markets. The landlord can earn an exogenous interest rate r. This is the opportunity cost of lending to the tenants. Assuming that there is no interlandlord borrowing, it is reasonable to assume that there are different rates among landlords. So the landlord's net earnings is equal to the interest rate minus its opportunity cost times the loan, and multiplied by the amount of tenants. The landlord's objective is to maximize profit with respect to wage, the interest rate, and the number of tenants chosen. His profit maximization is subject to the wage as a function of reservation utility and interest rates. One can then substitute the wage directly into the profit function and reduce the choice variables to the amount of tenants selected and the interest rate. After solving for the optimal interest rate i, and the optimal number of tenants n, one can compute the optimal wage from the reservation frontier. We now have the rural sectors equilibrium for each landlord and the total employment can be calculated. Summing up the total amount of tenants given a reservation utility and the opportunity cost of lending them money, we can solve the block recursive equations. Therefore we can simplify the landlord's objective function to the amount produced as a function of n, minus the number of tenants times a cost function of the interest rate, reservation utility, and the opportunity cost of lending to a tenant. The cost function is the per worker cost to the landlord. It seems noteworthy to state that the only positive outcome is when the loan times the interest rate is equal to the loan times the opportunity cost. This implies that the interest rate is equal to the opportunity cost of lending money to the tenant. This is the only intersection of the curves rL(i) and iL(i), since L'(i) is decreasing. Now that our region has n identical tenants, we can sum up the tenants as a function

of reservation utility and the opportunity cost for lending them money to solve for market equilibrium. This model is in equilibrium if and only if the previous optimality conditions of interest, employment, wage, and utility values are satisfied.

CHAPTER 3

Upon researching the literature on sharecropping, many modeling methods came into question. Is it appropriate to model sharecropping as a simultaneous move game, or should there be a sequential game? It seems reasonable to assume that most, if not all of the surplus is being taken by the landlord. As I saw in some research monopolistic power and market fragmentation have been to be the cause of low interest rate returns instead of the lender's risk hypothesis. (Saleem 1987) However, in 2006 Maitra observed the share of productivity changed as the share of costs changed. Therefore it seems more appropriate to have a simultaneous move game because it reflects the nature of what happens in the real world. Not to mention most of the other authors comparative statistics are used with a simultaneous move game. The proposed extension of Basu's (2003) model is to add a share of productivity to the model. First it is important to distinguish if the share of productivity as some number that is between zero and one. This implies that either the tenant or landlord could receive zero share of the productivity, all of the share of productivity, or any combination in between. The hypothesis in question is the existence of some case where the change in the reservation utility, given a change in the share of productivity, is negative. Using a model similar to Basu, we can evaluate the share of productivity as a choice variable of the landlord, a choice variable of the tenant, or some value that is given exogenously. With what the literature says about landlords usually taking no more than half (Maitra 2006) the share of productivity, it seems reasonable to have the share of productivity as a parameter, given exogenously.

Assume a utility function, such that

$$Q = f(w, i), \qquad f_1 > 0, \qquad f_2 \leq 0$$

It may be rewritten as a function of w as follows:

$$w = \psi(i, Q), \qquad \psi_1 \geq 0, \qquad \psi_2 > 0$$

Also assume that the amount borrowed by the tenant depends on both i the interest rate, and θ the share of productivity

$$L = L(i, \theta), \qquad L'(i, \theta) \leq 0$$

Again it is reasonable to assume that at some sufficiently high interest rate, tenants will stop demanding loans. The objective function of the landlord is to maximize profit with respect to the choice variables n, the number of tenants, a wage w, and i the interest rate. X of n represents the production function, and r as the opportunity cost. L, the loan is a function of the interest rate i and θ, which is the share of productivity. Therefore the landlord:

$$max_{n,w,i}\pi = \chi(n) - wn + (i - r)L(i, \theta)n$$

Substituting w, the profit maximization function simplifies to

$$max_{n,i}\pi = \chi(n) - \psi(i, \bar{Q})n + (i - r)L(i, \theta)n$$

Proceed by taking the partial derivatives of the profit function with respect to n and i.

$$\frac{\partial \pi}{\partial n} = \chi'(n) - \psi(i, \bar{Q}) + (i - r)L(i, \theta) = 0$$

$$\frac{\partial \pi}{\partial i} = -\psi(i, \bar{Q}) + L(i, \theta) + (i - r)L'(i, \theta) = 0$$

With the optimal choices of n and i:

$$\chi'(n) = \psi(i, \tilde{Q}) - (i - r)L(i, \theta)$$

$$\psi(i, \tilde{Q}) = L(i, \theta) + (i - r)L'(i, \theta)$$

Now that we have the addition of the parameter θ, or share of productivity, we can evaluate the following recursive equations to get the equilibrium interest rate, and the equilibrium amount of tenants, n. After solving for these two, one can solve for the optimal wage rate w. The new reservation frontier will look similar to Figure 5.

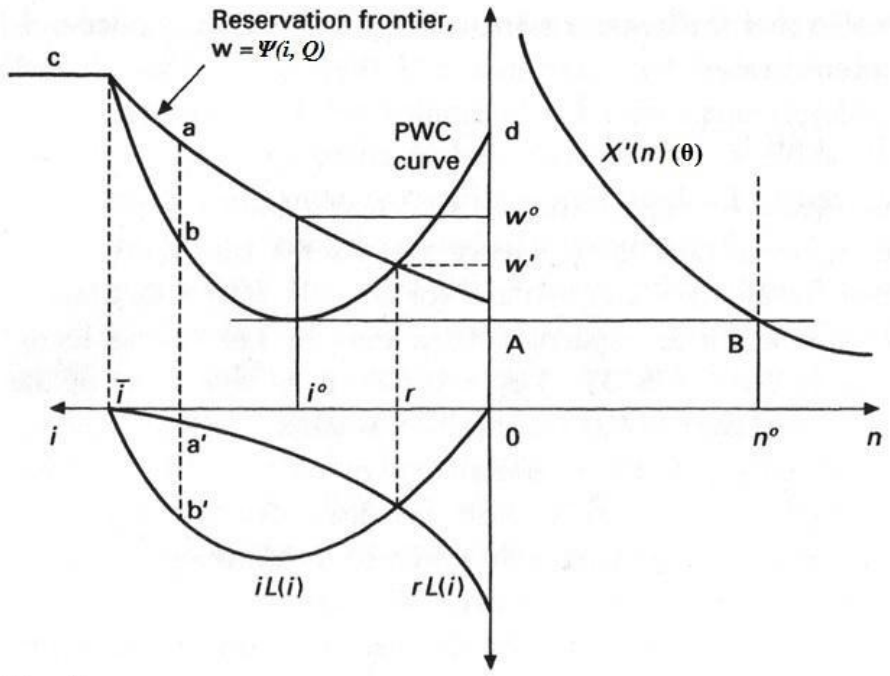

Figure 5

Again the landlord chooses the lowest point on his per-worker cost curve and sets the interest rate to i^0. The wage the landlord pays can be shown by following the interest rate choice to the reservation frontier in Figure 5 as w^0. The equilibrium amount of tenant's n, is labeled as n^0. However, now the market equilibrium is also affected by the share of output which can affect the

choice of $i^{\square}$ and consequentially everything else. The purpose of applying the implicit function theorem, the envelope theorem, and solving this simultaneous move game is ultimately to evaluate the comparative statics of the equilibriums. Applying Cramer's rule, one finds the following outcomes:

$$\pi_l^{nn} dn + \pi_l^{ni} di = -\pi_l^{n\theta} d\theta$$

$$\pi_l^{in} dn + \pi_l^{ii} di = -\pi_l^{i\theta} d\theta$$

$$\frac{di}{d\theta} = \frac{-\pi_l^{nn}\pi_l^{i\theta} + \pi_l^{in}\pi_l^{n\theta}}{\Delta}$$

$$\frac{dn}{d\theta} = \frac{-\pi_l^{ii}\pi_l^{n\theta} + \pi_l^{ni}\pi_l^{i\theta}}{\Delta}$$

Eventually we would like to evaluate how the tenant's reservation frontier is affected given a change in θ, a change of the share of productivity. I suspect that there exists a case where $\frac{dQ}{d\theta} < 0$. Solving this implicitly in order to sign was difficult. I resorted to a Cobb-Douglas case in order to simplify the problem to get an intuition of what is occurring. This also enables an explicit solution which also can aid in finding a clear signing of the change in reservation utility with the

change in share of productivity. Among what such circumstances would it seem reasonable for an increase in the share of productivity to negatively affect the tenant's reservation utility? Future research on sharecropping would do well to see if there is an economic story in which this negative outcome is possible. It would also be beneficial for one to continue investigating as to why economists are still observing sharecropping as an economic structure of societies? Additionally the literature suggests that asymmetric information plays a role in sharecropping and it would serve well to evaluate some of these market outcomes to see if it coincides with what is happening in the real world. Providing an economic case study where a tenant is engaged in sharecropping interlinked with factor markets, such as an informal credit market, can be worse off even though he/she has access to a greater share of the productivity of land can help researchers understand the nature of backward, low-income developing economies. A greater comprehension of how such markets operate can provide avenues to which policy makers can implement more effective strategies that improve the well-being for all the parties involved, and more generally, the aggregate economy.

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