A Theory of Two-Tier Labor Markets in Agrarian Economies

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Economic analysis of agricultural tenancy has yielded rich insights into the institutional mechanisms that evolve as rational responses to the state of market development and production technology. In many respects, the study of tenancy has been a forerunner of the modern literature that is attempting to create a theory of organization based on the analysis of incentive mechanisms underlying the contractual structure. It may be quite fruitful, therefore, to study premodern institutions, especially if they have recurred in diverse environments or at different time periods, and have proved to be historically tenacious. The more anomalous they seem, at first glance, the more rewarding may their analysis prove to us.

One such institution that has not been subjected to economic analysis until recently (Alan Richards, 1979; Pranab Bardhan, 1983) is the institution of permanent workers. Permanent workers (alternatively referred to as tied laborers, estate laborers, farm servants, or attached workers) have existed in agrarian economies as diverse as those of thirteenth-century England, Tokugawa Japan, East Elbian Germany (1750–1860), the Egyptian Delta (1850–1940), pre-1930 Central Chile, and present day India. This institution has exhibited certain common features across different time periods and regions. First, in sharp contrast to the so-called "casual workers" hired on a daily basis, permanent workers are engaged on long-term contracts that span entire crop periods, years, and, sometimes, lifetimes. Second, the employment relationship between the landlords and these laborers is highly personalized and involves patronage benefits such as homesteads, consumption credit, holiday gifts, and emergency aid in return for total loyalty. A permanent worker is expected to remain loyal to the landlord and further the landlord's interests even in periods of strife between the landlord and casual workers (Sheila Bhalla, 1976; Bardhan and Ashok Rudra, 1981; Richards, 1979). Third, the incidence of this seemingly backward institution appears to increase in response to what may be construed as modernizing stimuli. The opening up of new markets for Chilean agrarian products in the nineteenth century and the consequent increase in labor demand resulted in an increase in the number and proportion of permanent labor contracts (Richards, 1979). Those regions in North India (Haryana) with wider diffusion of new technology and consequently higher labor demand also exhibit greater proportion of permanent labor contracts (Bhalla). A theory of the institution of permanent labor should, therefore, simultaneously explain: (a) why the landlord places such a premium on loyalty, (b) the choice of the instruments he uses to elicit such loyalty, and (c) the increase in the incidences of permanent labor contracts in response to an increase in labor demand.

Bardhan (1983) has recently proposed an explanation for the institution of permanent labor, based on the following idea. Risk-averse workers faced with an uncertain spot wage can engage in long-term contracts with risk-neutral landlords for a prenegotiated wage, albeit at a rate lower than the expected spot rate. Workers, who are assumed to have heterogeneous opportunity incomes, self-select into the permanent and casual labor markets. The main comparative static result of this model explains the well-acknowledged empirical finding that the proportion of permanent workers is higher in tighter la-

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bor markets.[1] In an earlier paper (1979a), Bardhan proposed an alternative explanation for the existence of permanent contracts that was based on differential recruitment costs. Although he noted the importance of the patron-client aspects of the institution of permanent labor, the focus of his two models was to explain the longer duration of the contract. Patron-client aspects, such as loyalty, which are distinctive and inalienable features of the institution of permanent labor, are yet to be formally analyzed.

In this paper we follow the lead of Richards (1979), who has analyzed the institution of permanent labor in the widely different agrarian economies of East Elbian Germany, Egypt, and Chile. His investigation led him to the hypothesis that this institution emerged as a subtle means of supervising labor. A cursory examination of the differences in the tasks assigned to the two kinds of hired labor reveals that important tasks that require judgement, discretion, and care (and are difficult to monitor) are seldom, if ever, assigned to casual workers.[2] Permanent workers, on the other hand, are often entrusted with such responsibilities, almost as if they were family members. Our theory of the institution of permanent labor is based on the hypothesis that it is an attempt by the landlords to transform hired labor into workers whose behavior would approximate that of family labor, thus reducing the burden of on-the-job supervision. Do any of the stylized facts available on the terms of permanent contracts suggest a mechanism that could elicit such behavior from hired workers?

A significant and yet puzzling observation reported by Prafulla Sanghavi (1969) and Bardhan (1979a) is that permanent workers in Indian agriculture typically enjoy a significantly higher annual income (despite a lower daily wage) than casual workers.[3] In addition, permanent workers get consumption loans, homesteads, and other patronage benefits while casual workers face a great deal of uncertainty on the labor markets (Bardhan, 1983; Bhalla). It seems inconceivable that workers close to subsistence and without either employment opportunities or savings could be indifferent between a permanent contract that assures employment and consumption even in slack seasons and a precarious dependence on casual markets. To a worker at subsistence, neither the greater burden of responsibility and more work, nor the distaste for the serf-like existence under the close control of the landlord are reasons compelling enough to render the two types of contracts equivalent in utility.[4] On the other hand, it is equally puzzling that landlords would find it necessary to pay higher-than-opportunity incomes to their permanent workers. It might be natural to presume that the permanent workers are more able and, therefore, earn higher incomes than casual workers. The income differential between the two classes would be explained as ability-rent only if there is no excess supply of able people. In that case, the composition of the labor force would be insensitive to intensification of agriculture, contradicting the observations of Richards (1979).

An explanation of why employers are sometimes found to pay higher-than-oppor-

[1] In addition to Bardhan's own work on East India (1979), this finding has been found to be empirically valid in Chile (pre-1930), East Elbian Germany (1750–1860), and Egypt (1850–1940), as documented in Richards (1979).

[2] See Shigemochi Hirashima (1978, p. 109) for a description of the differential tasks assigned to the two kinds of workers in Pakistan. Also see Thomas Smith (1959) on the tasks performed by permanent workers in Tokugawa Japan and M. M. Postan (1954) for a description of the duties of estate workers in thirteenth-century England.

[3] In Sanghavi (Table 4.7, p. 100), the data on all states in North India, except for Uttar Pradesh, showed a higher annual income for male attached workers by a range of 15–100 percent. Bardhan (1979a) found that the average level of consumption for the family members of permanent workers in Bengal was Rs. 32/month/capita where as it was Rs. 24/month/capita for the family members of casual workers.

[4] For persuasive accounts suggesting that permanent workers are better off than casual workers, see Richards on Egypt (1982, p. 63); Arnold Bauer on Chile (1971, p. 1072).

tunity incomes to their employees has recently been proposed by B. Curtis Eaton and William White (1983). The idea, put simply, is that an income differential maintained over the opportunity income of the worker serves as a monitoring device; any shirking by the worker would invite the threat of getting fired and losing the stream of income differentials.[5] By replacing the income differential with a utility differential and assuming that the opportunity utility of a permanent worker is the expected utility of a casual worker (i.e., assuming an environment with no other employment opportunity), we can adapt the Eaton-White framework to answer the questions we posed earlier. The landlords transform some of the hired laborers into loyal laborers by keeping them at a higher utility level than what they could otherwise attain. The excess demand for permanent jobs thus created is sustained in equilibrium, since it enables the landlords to entrust responsible tasks to an artificially created cadre of loyal workers who would have been prohibitively expensive to supervise otherwise. The wage that minimizes the total labor costs (including wage and supervision costs) is higher than the wage that would minimize the wage costs alone. This framework explains the observation made by Bhalla and Richards (1979) that the permanent workers constitute a class within the class of agricultural workers—the upper tier in an artificially created "two-tiered" labor force. They receive superior benefits and tend to align themselves with their employers under most circumstances. It is important to note, however, that such contracts are viable only if they are long term and if reputation plays an important role so that the fired worker cannot secure another contract soon afterwards.

The above framework is an accurate representation of the institution of permanent labor as described by historians. For example, Arnold Bauer observes that in nineteenth-century rural Chile:

> Numerically few, the *inquilinos* [permanent workers] were the cream of the rural labour.... This selectivity was made possible by the limited need for estate labour and the lack of alternatives open to the numerous rural families. The good fortune of being accepted on the hacienda was repaid by the inquilinos with service and loyalty.
> [1975, p. 56]

Our assumption that permanent workers are kept at a higher utility level than casual workers is borne out by the accounts of Richards (1979) on the institution as it prevailed from 1850 to 1940 in Egypt, from 1750 to 1860 in East Elbian Germany, and in pre-1930 Central Chile. Richards also observes: "An Instmann [permanent worker] dismissed for insubordination would quickly find himself among the insecure ranks of Eigenkatner and Einlieger [casual workers]" (1979, p. 512).

A legitimate question that may be raised at this point is: why doesn't the landlord offer a tenancy contract to the worker? We have explained elsewhere our view that the choice among fixed rental, sharecropping, and fixed wage contracts are influenced by the distribution of certain unmarketed resources across landlords and workers (see our forthcoming article). It is demonstrated there that this, together with the technology and the type of crops, determines the contractual structure that would prevail; even with a linearly homogeneous technology, tenancy contracts will not necessarily obtain. A permanent contract is essentially a wage contract in which the landlord undertakes management and employs a subtle supervision technique that avoids resorting to continuous monitoring, and we model it as such.[6] Such a supervision technique is viable only with long-term contracts since the landlord

[5] A similar idea also appears in Steven Stoft (1980) and, more recently, in Carl Shapiro and Joseph Stiglitz (1984).

[6] Introducing the possibility of tenancy in this model would greatly complicate the formulation, and is a task to be accomplished in future research.

depends on imperfect indicators of the workers' efforts which are gathered almost costlessly as by-products of other management activities. Any meaningful judgment as to whether a worker has been supplying an acceptable level of effort can only be formed after reviewing the accumulated information on the worker's performance over the entire crop season. The landlord is then able to form a judgment on whether or not to fire the worker. For tractability, we shall assume that after the crop has been harvested and counted, the landlord has sufficient information accumulated to know with certainty if the worker has supplied an acceptable level of effort.

To sum up, we postulate that the institution of permanent labor exists in order to facilitate the assignment of important labor tasks to hired labor without having to devote inordinately large amounts of resources to supervision. It enables the landlord to utilize valuable information about the worker's performance that can be costlessly gathered while the landlord is engaged in performing other managerial activities. The permanent worker's income is maintained at a level that renders him a utility sufficiently greater than his opportunity utility that he would choose to supply the acceptable level of effort. Any change in the casual worker's wages, that are determined in a competitive market, results in a corresponding change in the permanent worker's wages.

In Section I, we present a general equilibrium model that incorporates the seasonal nature of agricultural production. The labor market consists of homogeneous workers allocated between permanent and casual workers according to the different tasks assigned. We work out the implications of the model assuming for the workers' utility function a specific form which gives rise to a labor supply function that is consistent with empirical observations. In Section II, we then carry out comparative static exercises and examine the link between the incidence of permanent labor and the different characteristics of the production technology. In the final section, we elaborate on the general applicability of the essential principle modeled in this paper to discourage morally hazardous behavior.

I. The Model

We assume that a single crop is produced each year; the crop takes two periods to produce, each period lasting for one-half year. The two periods posited for the production of a crop enable us to capture the variation in the demand for labor and capital over the year. For concreteness, the first period can be viewed as requiring such activities as soil preparation, tilling, sowing, etc., and the second as the period of harvesting, threshing, etc. Typically, the demand for labor and capital is considerably higher in the second period.

We envisage the production process as entailing the use of three inputs: land (h), capital (K), and labor. It is imperative for our purposes to disaggregate the labor input, and this we do according to the nature of the tasks performed. It is sufficient to consider two broad categories of tasks. Type 1 tasks are those that involve considerable care and judgment (such as water resource management, the application of fertilizers, maintenance of the draft animals and machines, etc.). Such tasks do not lend themselves to easy on-the-job supervision. Type 2 tasks are those that are routine and menial (such as weeding, harvesting, threshing, etc.). Since they involve little discretion, productivity on such tasks can be directly gauged from the extent of the workers' physical activity. In other words, Type 2 tasks are by their very nature easy to monitor. All workers are assumed to have identical abilities. However, even though all workers are drawn from a homogeneous labor force, the tasks to which they are assigned are not necessarily the same.

We draw a distinction between the length of a worker's employment over a period (l) and the "intensity" of effort (e) with which he applies himself. Efficient performance of a task (either Type 1 or Type 2) requires an effort level $\bar{e} > 0$. Since effort is deemed a bad, a worker on a fixed wage will set $e = 0$

unless he is monitored. We shall take an efficiency unit of labor to be one worker hired for a whole period ($l=1$) at an effort level $\bar{e}$. As will be explained below, Type 1 tasks are performed by workers with long-term contracts, while workers hired on the spot market (casual workers) are entrusted with only Type 2 tasks. Empirically, we observe that casual workers are hired mainly in the peak season (i.e., the second period). This is because the tasks to be performed in period 1 are mainly of Type 1 variety—soil preparation, plowing (which entails the use of draft animals or tractors), application of fertilizers, etc. For simplicity we assume that no casual workers are hired in period 1. We let L_p denote the number of efficiency units of permanent labor employed per period on a typical farm. A permanent worker's contract is over the infinite horizon unless he is found to shirk. We denote by L_c the number of efficiency units of casual labor employed on the farm in period 2. A casual worker's contract lasts for the whole or part of this period.

We posit that the output, q_1, of period 1 can be written

$$(1) \qquad q_1 = a \min\{ g_1(K_1, L_p), bh \},$$

where K_1 is the amount of capital used in period 1, h is the amount of land used, and $a, b > 0$, and $g_1(K_1, L_p)$ is a twice continuously differentiable, linearly homogeneous function that is increasing and strictly quasi concave in its arguments. The production function in (1) implies that there is no substitutability between land and the other two factors of production, and that the potential output of the farm is determined entirely by the amount of land. $g_1(K_1, L_p)$ can be interpreted as an aggregate of the capital and labor inputs in period 1. We assume that labor is an essential input in period 1, that is, that $g_1(K_1, 0) = 0$ for all K_1. The parameter b is introduced to capture land-augmenting technical change, while a is introduced to simulate Hicks-neutral technical change.

In period 2, the tasks performed by labor are mostly Type 2 variety. We shall assume that in period 2, casual and permanent labor are perfect substitutes and both will be employed to do Type 2 tasks. Now the output of the second period will depend nontrivially on the activities of the first period. More precisely, q_1 is an intermediate input and we write the second period's output (the final product), q_2, as

$$(2) \qquad q_2 = \min\{ g_2(K_2, L_p + L_c), q_1 \},$$

where K_2 is the amount of capital used in period 2, and g_2 is a twice continuously differentiable, linearly homogeneous function, increasing and strictly quasi concave in its arguments. The motivation for (2) lies in the interpretation of q_1 as the quantity of unharvested crop and q_2 as the quantity of the final product, that is, the harvested and threshed crop; q_1 is thus a natural upper bound on q_2.

The price of the output is assumed to be exogenously fixed—set in the world market, say—and is normalized to unity. All farmers are assumed to be price takers in the labor and capital markets. For convenience, we assume that all farms are identical. Then in view of the linear homogeneity of (1) and (2), we can aggregate all farmers into a single price-taking farmer. The quantity h now represents the total arable land in the economy and is assumed fixed; L_p, L_c, K_1, K_2, q_1, and q_2 can similarly be interpreted as aggregates. The wage rate of a permanent worker is w_p per period, while that of a casual worker is w_c. The rental rate on capital equipment per period, assumed exogenous, is r_i, $i=1,2$. Since the types of capital used in the two periods are not necessarily the same, we can have $r_1 \neq r_2$.

A. *Demand Side*

We now turn to the optimal choices of L_p, L_c, and K_i, q_i, $i=1,2$. Consider the production of a typical crop. First note that the optimal choice of factor inputs in period 2 depends on L_p and the decisions of the first period. The landlord's decision making must thus be foresighted and must be made with full awareness of how the choice of L_p and his period 1 decisions will impinge on period

2's choices. In what follows we shall adopt the convention that all expenses (wages and rentals) are incurred at the end of the period.

Given the nature of the production functions and the assumption of a constant and exogenously determined price for the final product, it follows that if production is at all viable, as we assume it is, it is profitable to cultivate all of the arable land. The profit-maximizing output levels in the two periods are

$$q_1 = q_2 = abh. \tag{3}$$

Without loss of generality we shall set $h = 1$. The factor inputs will thus be determined so as to minimize the total present value cost of producing the outputs in (3). Since the landlord's choices of capital and casual labor are dependent on the amount of permanent labor hired, we first determine his demands of K_1, K_2, and L_c conditional on his choice of L_p.

Define the cost functions

$$C_2(q_2, r_2, w_c) \equiv \min_{K_2, L_a} \{ r_2 K_2 + w_c L_a \mid g_2(K_2, L_a) \geq q_2 \}, \tag{4}$$

where $L_a \equiv L_p + L_c$ is the aggregate amount of labor used in period 2, and

$$C_1(L_p, q_1/a, r_1) \equiv \min_{K_1} \{ r_1 K_1 \mid g_1(K_1, L_p) \geq q_1/a \}. \tag{5}$$

At the profit-maximizing output levels given by (3), Shephard's Lemma yields the following factor demands:

$$K_1^d(L_p, b, r_1) = \frac{\partial C_1}{\partial r_1}(L_p, b, r_1), \tag{6a}$$

$$K_2^d(ab, r_2, w_c) = \frac{\partial C_2}{\partial r_2}(ab, r_2, w_c), \tag{6b}$$

$$L_a^d(ab, r_2, w_c) = \frac{\partial C_2}{\partial w_c}(ab, r_2, w_c). \tag{6c}$$

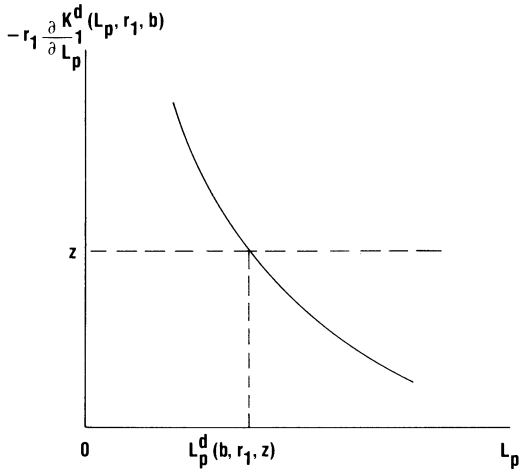

FIGURE 1. DETERMINATION OF THE DEMAND FOR PERMANENT LABOR

The casual labor demand is thus given by

$$L_c^d(ab, L_p, r_2, w_c) = \max\{ L_a^d(ab, r_2, w_c) - L_p, 0 \}. \tag{6d}$$

The optimal choice of L_p is now determined as the solution to

$$\min_{L_p} r_1 K_1^d(L_p, b, r_1) + \beta r_2 K_2^d(ab, r_2, w_c) + (1+\beta) w_p L_p + \beta w_c [L_a^d(ab, r_2, w_c) - L_p], \tag{7}$$

assuming that the amount of casual labor hired is strictly positive. In (7) $\beta (0 < \beta < 1)$ denotes the per period discount factor. The first-order condition associated with (7) is

$$-r_1 (\partial K_1^d / \partial L_p)(L_p, b, r_1) = (1+\beta) w_p - \beta w_c \equiv z. \tag{8}$$

The demand for permanent labor, $L_p^d(b, r_1, z)$, is implicitly determined as the solution to (8). Twice continuous differentiability and the strict quasi concavity of $g_1(K_1, L_1)$ implies that the left-hand side of (8) is declining in L_p. Thus L_p^d is decreasing in z (see Figure 1).

Together, $L_p^d(b, r, z)$ and the expressions (6a)–(6d) constitute the demand side of our model. We now turn to the supply side.

B. *Supply Side*

Consistent with Bardhan's (1979b) empirical evidence that the agricultural labor supply exhibits low elasticity in the peak period, though it may be fairly elastic in the slack period, we posit the utility function of an agricultural worker to be of the form

$$(9) \qquad U(y, e, l) = (y - el)^{\gamma}; \qquad 0 < \gamma < 1,$$

where y is the income received for the period and l is the fraction of the period for which he is employed ($l = 1$ if he is hired for the entire period). For an arbitrarily given e and wage rate w, the supply response $l^*(w, e)$, of a worker is obtained as the solution to

$$(10) \qquad \max_{l} U(wl, e, l) \qquad \text{such that } l \leq 1.$$

The maximization in (10) yields the labor supply response:

$$(11) \qquad l^*(w, e) \begin{cases} = 0 & \text{for } w < e \\ \in (0,1) & \text{for } w = e \\ = 1 & \text{for } w > e, \end{cases}$$

and an indirect utility function

$$(12) \qquad V(w, e) = \{(w - e)l^*(w, e)\}^{\gamma}.$$

Since V is a decreasing function of e, there is an obvious moral hazard problem under a fixed wage contract, which makes the monitoring of effort imperative. Since Type 2 tasks are easy to monitor, we shall assume that workers performing these tasks can be costlessly supervised. There is thus little reason to hire these workers on long-term contracts, and the conventional means of hiring them, namely, on the spot markets, serves adequately.

With workers performing Type 1 tasks the situation is, however, quite different. We have defined Type 1 tasks as those that involve some discretion and judgment, and are difficult to monitor. Our discussion in the introduction leads to the following view on the nature of contracts given to workers performing Type 1 tasks.

In order to provide a self-enforcing (incentive) contract, the landlord offers Type 1 workers a permanent contract (over the infinite horizon),[7] in which the worker receives a wage w_p per period in exchange for the worker's services for the fraction $l^*(w_p, \bar{e})$ of each period at an effort level $\bar{e}$. The worker's effort in period 1 is assumed to be accurately imputable at the end of the year. If the worker is found to have shirked, he is fired at the end of the crop.[8] He is, however, paid his wage, w_p, for each of the two periods. Once a Type 1 worker is fired, he cannot be rehired except as a casual worker.[9] If w_p is high enough that a worker's increase in utility from shirking in one period is more than offset by the discounted loss in his utility in having to join the casual labor force, he would never shirk.

It is important to spell out the terms required for the viability of such a contract to permanent workers. First, since a permanent worker's effort can be gauged only at the end of the second period, he can be fired only at the end of period 2. If the landlord concludes that the worker has shirked and decides to fire him, he must still be contractually committed to pay him the prenegotiated wage w_p in each of the two periods. Without such a contractual commitment, the landlord cannot be trusted to pay even honest workers

[7] While the assumption of infinite time horizon is analytically convenient, it is also empirically appropriate when a permanent worker's status can be inherited.

[8] It might be argued that the landlord would be indifferent between retaining the disloyal worker and replacing him with another who has exactly the same propensity to shirk. A permanent worker who realizes this cannot be deterred from shirking. Since the credibility of the system is at stake, however, the landlord would strictly prefer to replace the disloyal worker, establishing his reputation as a firm enforcer of contracts.

[9] This is assumed for simplicity. For our purposes it is enough if he can secure another such contract only with a probability that is strictly less than unity. This would lead to a discretely lower present value expected earning if he is fired.

and no worker would accept the contract. It may be argued that the fear of notoriety and the consequent difficulty in finding labor would keep the landlord honest. We feel, however, that in a labor surplus economy, reputation can hardly be as effective a check on the behavior of the owner of the scarce factor (land) as it is on the behavior of laborers competing for permanent jobs. Reputation is an effective weapon against moral hazard only for the suppliers of those factors that are in excess supply. The method of eliciting the desired level of effort from an employee by keeping him over his opportunity utility serves precisely to create such an excess supply so that reputation matters.

Another valid question is why a casual worker who failed to secure a permanent contract does not entice the landlord into offering him such a contract by posting a bond, the present value of which is marginally less than the difference in the present values of the lifetime income streams of the permanent and casual workers. Once again, such an arrangement is not viable due to the possibility of moral hazard on the part of the landlord; he always has the incentive to claim at the end of the period that the worker has shirked and thus expropriate the bond. Besides, as Eaton and White (1982) have pointed out, a worker faced with asset constraints may be unable to raise the amount necessary to post such a bond.

We can determine w_p in terms of w_c as follows. Assuming, for simplicity, that workers discount their utility at the same rate β as the landlord discounts profits, the present value utility of a permanent worker who is honest (i.e., who never shirks) is given by[10]

$$(13)\quad J_p^h(w_p,\beta)=V(w_p,\bar{e})/(1-\beta).$$

Now the opportunity utility of a permanent worker is the utility he would receive as a casual worker. Assume that the casual labor demand is spread uniformly across all the casual workers. Then the discounted lifetime utility of a casual worker is given by

$$(14)\quad J_c(w_c,\beta)=\big(\beta/(1-\beta^2)\big)V(w_c,\bar{e}).$$

We now turn to the possibility of shirking on the part of a permanent worker. Since any shirking is guaranteed to result in termination at the end of the second period of the same crop, a permanent worker who chooses to shirk will find it optimal to set $e=0$ in the first period. Since in period 2 he performs only menial tasks, which can be costlessly monitored, shirking is not possible. His discounted utility over this crop (relative to the beginning of the crop) is

$$V(w_p,0)+\beta V(w_p,\bar{e}).$$

Further, assuming demand and supply conditions to be identical across all years, a permanent worker who contemplates shirking will do so in the very first year. Thus the discounted lifetime utility of a permanent worker who shirks is

$$(15)\quad J_p^s(w_p,w_c,\beta)=V(w_p,0)+\beta V(w_p,\bar{e})+\beta^2 J_c(w_c,\beta).$$

To ensure that a permanent worker never shirks, we simply require

$$(16)\qquad J_p^h(w_p,\beta)\geq J_p^s(w_p,w_c,\beta).$$

For given w_c and β, inequality (16) puts a lower bound on the permanent worker's wage, w_p, which will elicit the required level of effort. At any w_p that satisfies (16) a worker obtains a strictly higher utility in a permanent contract than in a series of spot contracts:[11]

$$(17)\qquad J_p^h(w_p,\beta)>J_c(w_c,\beta).$$

[10] This assumes that there is no saving, so that consumption and income are identical.

[11] This can be seen by rewriting inequality (16) as

$$(1-\beta+\beta^2)V(w_p,\bar{e})\geq(1-\beta)V(w_p,0)+\frac{\beta^3}{1+\beta}V(w_c,\bar{e})>(1-\beta)V(w_p,\bar{e})+\frac{\beta^3}{1+\beta}V(w_c,\bar{e}),$$

by (12), so that $(1+\beta)V(w_p,\bar{e})>\beta V(w_c,\bar{e})$.

It follows that the number of permanent workers hired will be demand determined in general. Since a laborer strictly prefers being a permanent worker to being a casual worker, there will generally be an excess supply of workers seeking permanent contracts. This, however, will not result in a downward pressure on the permanent workers' wage, since any wage which is lower than the smallest w_p, say $\bar{w}_p(w_c, \beta)$, that satisfies (16) for given w_c and β is not credible: it leaves an incentive for the permanent worker to shirk. A casual worker who seeks to obtain a permanent contract by offering to work for a wage marginally less than $\bar{w}_p$ will find that the landlord will not entertain the offer.

In the next section, we shall find that the behavior of $\bar{w}_p(w_c, \beta)$ as a function of w_c is of crucial importance in determining the response of the agricultural economy to various exogenous changes. This behavior is recorded in the following proposition.

PROPOSITION 1: *For* $w_c \geq \bar{e}$, *an increase in* w_c *warrants a change in* w_p, *that is*, (a) *positive, and* (b) *if* $\bar{w}_p(w_c, \beta) < w_c$, *then*

$$(18) \qquad d\bar{w}_p/dw_c < \beta/(1+\beta).$$

(Proof: See the Appendix.)

Part (a) of Proposition 1 is eminently reasonable, since an increase in w_c amounts to an increase in the permanent worker's opportunity income (and utility). According to part (b), when the permanent worker's per period wage rate $\bar{w}_p(w_c, \beta)$ is less than that of a casual worker's, w_c, the increase (Δw_p) that is required to compensate a permanent worker for an exogenous increase (Δw_c) in a casual worker's wage rate satisfies the inequality

$$(19) \qquad (1+\beta)\Delta w_p - \beta \Delta w_c < 0.$$

This implies that the increase in present value cost of engaging a permanent worker is less than that of a casual worker.

We now turn to the determination of the equilibrium. The equilibrium levels of capital in the two periods are demand determined. Since permanent workers are held above their opportunity utilities, their number, L_p^*, is also demand determined:

$$(20a) \qquad L_p^*(b, r_1, z) = L_p^d(b, r_1, z).$$

The demand for casual workers, we have seen, is given by

$$(20b) \qquad L_c^d(L_p, ab, w_c, r_2) = L_a^d(ab, r_2, w_c) - L_p^*(b, r_1, z),$$

assuming the demand to be strictly positive. Next, we have the condition (16), which translates into

$$(20c) \qquad V(w_p, \bar{e})/(1-\beta) \geq V(w_p, 0) + \beta V(w_p, \bar{e}) + \left(\beta/(1-\beta^2)\right) V(w_c, \bar{e}).$$

For any w_c, (20c) determines the minimum w_p that will prevent a permanent worker from shirking.

Note that an equilibrium must have $w_c \geq \bar{e}$ and $w_p \geq \bar{e}$, in view of (11). Note also that $w_p = \bar{e}$ is never a solution to (20c) when $w_c \geq \bar{e}$. Thus we must have $w_p > \bar{e}$, and consequently, $l^*(w_p, \bar{e}) = 1$ for a permanent worker. In other words, each permanent worker provides one efficiency unit of labor per period. Let N be the (exogenously given) total number of workers in the agrarian economy. The aggregate supply of casual labor in the second period, L_c, is then given by

$$(20d) \qquad L_c^s \begin{cases} = 0, & \text{for } w_c < \bar{e} \\ \in (0, N - L_p^*) & \text{for } w_c = \bar{e} \\ = N - L_p^* & \text{for } w_c > \bar{e}. \end{cases}$$

This completes the specification of our model. Exogenous to the model are the production and utility functions, the discount factor, the rental rates on capital, and the total labor force. Endogenous to the model are the wage rate of the permanent and casual workers, the number of permanent workers, the number of efficiency units of

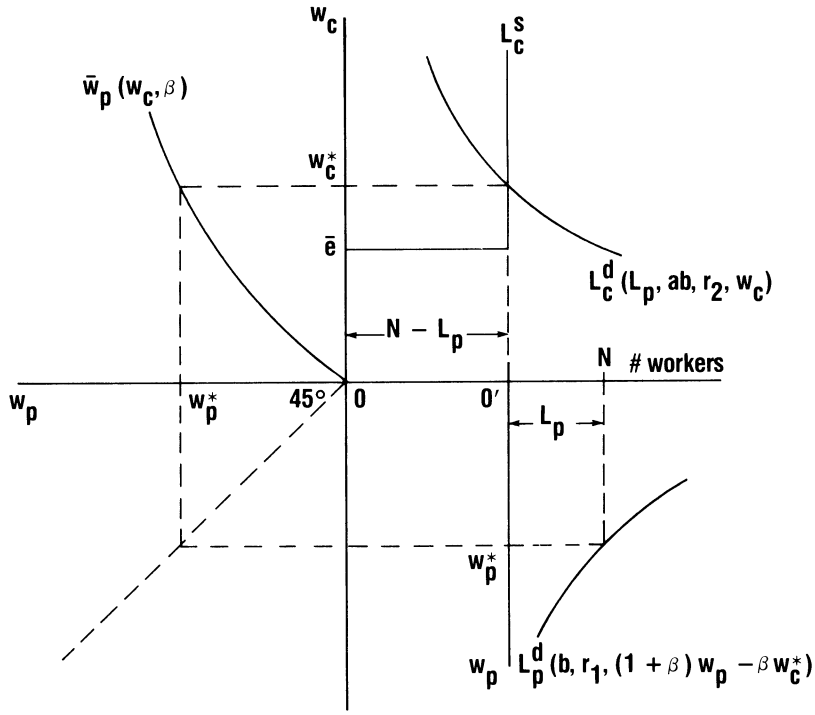

FIGURE 2. AN EQUILIBRIUM WITH UNEMPLOYMENT IN PERIOD 1 AND FULL EMPLOYMENT IN PERIOD 2

casual workers hired in the second period, and the amounts of capital hired in each of the two periods. These are obtained as the solution to the general equilibrium system defined by (20a)–(20d). The employment of capital is demand determined, that is, by (6a) and (6b).

Since a permanent worker's contract extends over the infinite horizon, the hiring of a permanent laborer represents a sunk cost for the landlord. The choice of the labor mix between permanent and casual workers can thus be viewed as a choice between sunk and variable costs.

For an arbitrarily chosen value of L_p, the casual labor supply is given by the kinked curve L_c^s in Figure 2. The demand for casual labor, contingent on the choice of L_p, is obtained from (20b) and is also shown in the first quadrant of Figure 2. The casual labor market clears at the wage rage w_c^*. (In what follows stars denote equilibrium values.) The second quadrant displays the solution for w_p in terms of w_c as obtained from (20c). Associated with a casual labor wage rate w_c^* is a permanent labor wage rate w_p^*. The fourth quadrant displays the demand for permanent labor as a function of w_p when the casual labor wage rate is w_c^*. For convenience this demand for permanent labor is measured from $0'$ (along the horizontal axis). If we have indeed located an equilibrium, the demand for permanent labor at w_p^* will be exactly equal to the L_p with which we began our construction. Thus the situation illustrated in Figure 2 represents an equilibrium of the system of equations (20a) through (20d).

Given our assumption that the number of casual workers hired is strictly positive, two distinct situations can emerge as equilibria, although both of these are not equally relevant:

$$\textit{Case } 1\text{: } 0 < L_p^* < N;\ 0 < L_c^* < N;\ L_p^* + L_c^* < N.$$

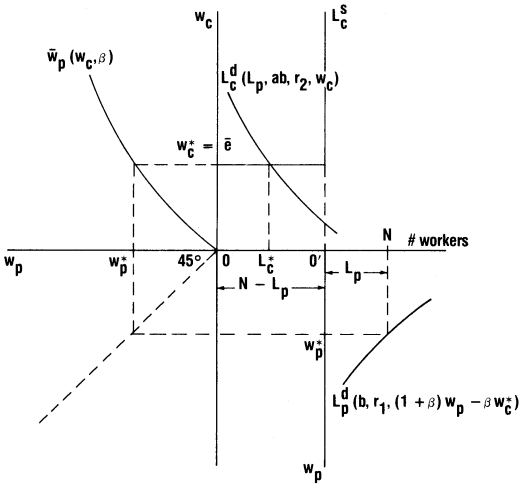

FIGURE 3. AN EQUILIBRIUM INVOLVING UNEMPLOYMENT IN PERIODS 1 AND 2

This situation is illustrated in Figure 3. The demand for casual labor in the peak season is not enough to warrant full employment: there is some unemployment at the equilibrium casual wage rate $w_c^* = \bar{e}$.

Case 2: $0 < L_p^* < N$; $0 < L_c^* < N$; $L_p^* + L_c^* = N$.

This is the situation we considered in Figure 2. Here the supply of labor is a binding constraint in the second period and $w^* > \bar{e}$.

Of these two cases, the empirically relevant one is Case 2—in which only part of the labor force is hired on a permanent basis, while in the peak season there is no unemployment. In what follows, therefore, we shall focus exclusively on this case.

II. Results

We now turn to the comparative static results of our model. These results depend crucially on whether the casual wage rate exceeds or falls short of the wage rate of the permanent workers. These are, of course, endogenously determined and our model allows for both possibilities. However, since our purpose here is to confront our predictions with what empirical evidence there is, we pursue the empirically relevant case. From Richards (1979), Sanghavi, Ashok Rudra (1982), and Rakesh Basant (1984), we gather this case to be one where

$$w_c^* > w_p^*. \tag{21}$$

In what follows we shall assume (21) to be true.[12] (The signs of the comparative static results below are reversed when (21) is violated.) Defining

$$z^* = (1+\beta)w_p^* - \beta w_c^*$$

we see from (18) that

$$\frac{dz^*}{dw_c^*} = (1+\beta)\left[\frac{dw_p^*}{dw_c^*} - \frac{\beta}{1+\beta}\right] < 0. \tag{22}$$

That is, the difference in the present value cost of hiring a permanent worker over that of hiring a casual worker declines with w_c^*. This fact is used in establishing the comparative static properties of our model, which are recorded in the following proposition.

PROPOSITION 2: *In an equilibrium corresponding to Case 2,*

(a) *an increase in N decreases the proportion of permanent contracts,*

(b) *an increase in a (or b or both) increases the number of permanent contracts,*

(c) *an increase in a, with ab held constant, decreases the number of permanent contracts,*

(d) *an increase in r_1 or r_2 increases the number of permanent contracts.*

(Proof: See the Appendix.)

Parts (a) and (b) of Proposition 2 provide explanations, alternative to Bardhan's (1983), for certain empirical observations on permanent labor. According to (a), the proportion of permanent workers is higher the tighter the labor market. A reduction in the supply of agricultural labor, N, increases the peak season casual wage rate, w_c^*. This results in

[12] Full employment in the peak period is a necessary condition for this to hold. It is also necessary that the permanent workers not discount the future too heavily.

an increase in the wage rate of the permanent workers, w_p^*. However, the increases satisfy inequality (19)—implying that the marginal permanent worker is becoming cheaper to hire relative to a casual worker in period 2—inducing a substitution of permanent for casual workers. Part (a) above explains the dramatic increase in the percentage of permanent contracts in East Prussian agriculture in the first half of the nineteenth century. During this period there was an increase in the cultivated area by almost 90 percent between 1815 and 1849, and a simultaneous agrarian reform resulted in peasants losing land to large landlords. The loss of land forced the peasants into the labor market. Richards (1979), however, estimates that the total net loss of land by the peasants to the landlords may have been as low as 3 percent, implying an overall decrease in the labor-to-land ratio, resulting in a higher proportion of permanent workers.

Part (b) of Proposition 2 implies that a yield-increasing improvement in the technology, either through a Hicks-neutral technical change (i.e., higher a) or through a land-augmenting technical change (i.e., higher b) would increase the proportion of permanent contracts. The intuition for this is the same as that for part (a), and hinges on the relative changes in the magnitudes of w_c^* and w_p^* triggered by the exogenous change. Bardhan (1983) provides empirical evidence based on the second Agricultural Labor Enquiry Data that the percentage of permanent labor in India is positively correlated with the index of land productivity.

The demand for permanent and casual labor is, of course, a derived demand. For simplicity we have assumed that the price of the output is exogenously given. It is clear, however, that any factor that affects the demand for output will have repercussions on the labor composition in equilibrium. In particular, an increase in the output price will induce an increase in the output for production functions more general than the ones we have adopted. The effects of an increase in the price of the output can, however, be simulated in our model by an increase in a. Part (b) of Proposition 2 then explains the impact of the opening up of export markets on the labor composition in nineteenth-century Chile. In the 1860's, Chile began to export grain to European markets and this lasted until 1890. Bauer (1971) estimated that the percentage of casual workers in the rural labor force of central Chile fell from 72 percent in 1865 to 39 percent in 1895—an observation that is consistent with the result in part (b) of the above proposition.

While part (b) is of empirical interest since it is easily verifiable, an exercise that is of theoretical interest is contained in part (c). Here the final output is held fixed and the burden of activity is shifted across the two periods. We see that an increase in a, implying a decrease in b, makes cultivation less intensive in the first period while increasing the activity in the peak season. Since in the second period casual and permanent labor are substitutable, we observe a shift from permanent to casual labor. Thus Jan Breman (1974) observes that a change in crops from rice (which has a relatively even distribution of tasks over the two periods) to mangoes (which has a very heavy labor demand in period 2) resulted in the replacement of permanent contracts by casual labor contracts in Gujarat, India. Kalpana Bardhan (1977) has also made similar empirical observations.[13]

Part (d) of Proposition 2 indicates that a decrease in the rental cost of the type of capital used in the first period would displace permanent workers and consequently increase the use of casual labor in the second period. It could be argued that in India, in view of the notoriously imperfect capital markets, farms with tractors are those for which the owners face lower capital costs. If tractors were employed on such farms only during period 1 (for operations such as ploughing and sowing), the result would be a displacement of permanent workers and an increase in the use of casual workers. While

[13] Part (c) of Proposition 2 is also consistent with empirical evidence that increases in the cropping intensity, which would result in a more even labor demand profile, are correlated with higher incidence of permanent contracts. See K. Bardhan on India, and Richards (1979) on East Prussia.

the existing empirical literature (Rudra; Bina Agarwal, 1981) bears out our prediction regarding permanent workers, there is conflicting evidence on the effect on the employment of casual workers. We conjecture that this conflict arises because tractors are used on some farms for period 1 operations only, while on others they are also used in period 2.

An interesting feature of the result in part (d) of Proposition 2 is the implied complementarity between the capital used in the two periods. Since there are no sunk costs involved in the use of capital (they are presumed to be rented separately in each period), one might expect the choice of the amount of capital used in period 1 to be independent of r_2. This, however, is not so. A decline in r_2 increases the demand for K_2 and reduces the demand for casual labor. Given full employment in the second period, this lowers the casual wage rate, which in turn lowers the wage rate of permanent workers. In view of (18), however, permanent workers are becoming relatively more expensive than casual workers and this induces a substitution away from permanent labor. The reduction in the amount of permanent labor hired warrants an increase in K_1 since, in the first period, these two inputs are substitutable. A policy implication of this result is that any governmental effort to alleviate labor-supply bottlenecks in the peak period by lowering r_2 (through subsidies, for example) would have an adverse effect on the employment of labor in the slack period.

III. Conclusions

In this paper we have presented the view that the institution of permanent workers exists to elicit loyalty and trustworthiness from hired workers, so that they can be entrusted with important tasks that are inherently difficult to monitor. This is accomplished by holding them at a higher-than-opportunity utility, and thus creating in the process two tiers within a homogeneous labor force. Evidence of disloyal behavior (i.e., shirking) results in the termination of the permanent contract and the possibility of the consequent discrete fall in the utility keeps the worker loyal.[14]

A well-known result in the agency literature states that a threshold contract with a discontinuous reward system can be devised to elicit the optimal amount of effort from a worker. The incentive mechanism implicit in permanent contracts within a two-tiered labor force is, however, not a special case of this. A contract which stipulates the agent's reward in terms of his effort when the verdict on the latter is pronounced *ex post* by the principal will not be accepted by the agent. The possibility of morally hazardous behavior on the part of both the principal and the agent has to be explicitly recognized. In the institution we have discussed, the relationship between the principal and the agent involves repeated transactions and this facilitates the design of a contract which gets around the above difficulty. The landlord is contractually committed to pay the permanent worker the full stipulated income for the year even if he is fired at the end of the year. In other words, the compensation goes with the position; as long as a worker is in the higher tier he receives a compensation appropriate to this position. The contract is thus incentive compatible for both parties despite the inherent problem that there is no objective criterion by which to gauge the worker's effort level.

Long-standing relationships that involve repeated transactions between two parties and put a premium on loyalty and trust are referred to as patron-client relationships.

[14] Note that the assumption of a homogeneous labor force is not essential to our theory. With heterogeneous alternative employment opportunities across workers, casual workers with high opportunity incomes may not prefer permanent contracts. Even so, our theory remains valid as long as there is an excess supply of some casual workers desiring permanent jobs. Bardhan and Rudra (1981) found, in a survey conducted in West Bengal (India), that the bulk of the casual workers preferred casual contracts and the bulk of the permanent workers preferred permanent contracts. However, a statistical test performed on their data leads us to reject the hypothesis that there is no excess supply of workers desiring permanent contracts in favor of the hypothesis of a strictly positive excess supply.

These relationships are often sustained and strengthened by means of implicit contracts. The patron (the principal) maintains the client (the agent) at a higher-than-opportunity utility through patronage to win the client's loyalty and trust. The instruments used to effect this patronage will vary according to the needs of the client and the ability of the patron to supply these needs. Ideally, the instruments will bestow a large benefit on the client at a relatively low cost to the patron. Provision of land plots in labor-scarce economies, consumption credit in an environment of imperfect capital markets or protection in the dubious legal environment of Sicily are examples of instruments of patronage. As discussed in this paper, the seasonal nature of agriculture renders it relatively easy for landlords to maintain a utility-differential between permanent and casual workers.

Even in industrialized economies we observe contracts that resemble those of permanent workers. In particular, in sectors subject to seasonal demand (such as construction, services catering to tourism, recreational vehicle services, etc.) firms retain year-round a core of permanent workers selected from the same pool as the seasonal workers. We further conjecture that the most familiar type of employment contract, namely, the salaried contract of a white-collar worker (in a position that is inherently difficult to monitor), embodies a supervision mechanism similar to the one discussed in this paper.

The institution of permanent workers is a graphic manifestation of the consequences of the supervision principle proposed by Eaton and White (1983). This principle, however, is quite general in scope. For example, it explains a fact that forms the premise of numerous models in the migration literature: the substantial wage differential that exists between newly recruited factory workers and those in the informal urban sector from which they are recruited.

Indeed, this incentive mechanism does not even require that the transaction between the principal and agent be voluntary. The mechanism could work equally well in a slave economy. What is essential is that the agent be convinced in a credible fashion that there is a state of existence that is discretely worse than his current one. Even the miserable existence of a slave can be made worse by selling him and separating him from his family. More subtle means employed to create a favored status among slaves in the antebellum South are discussed by Robert Fogel and Stanley Engerman (1974). Thus even when crude supervision devices such as physical punishment are permitted by society, subtle incentive mechanisms that reduce the cost of supervision have always played an important role. The study of historical institutions and their incentive structures could, therefore, be quite useful in the construction of a theory of economic organizations.

APPENDIX

PROOF of Proposition 1:

(a) Substituting (13), (14), and (15) in (16), which holds with equality at $\bar{w}_p$, we have

$$\text{(A1)}\quad V(\bar{w}_p,\bar{e})/(1-\beta)=V(\bar{w}_p,0)+\beta V(\bar{w}_p,\bar{e})+\left(\beta^3/(1-\beta^2)\right)V(w_c,\bar{e}).$$

Differentiating the above expression totally with respect to w_c and rearranging, we obtain

$$\text{(A2)}\quad \frac{d\bar{w}_p}{dw_c}=\left[\left[\beta^3/(1+\beta)\right]\frac{\partial V}{\partial w_c}(w_c,\bar{e})\right]\Bigg/\left[(1-\beta+\beta^2)\frac{\partial V}{\partial w_p}(\bar{w}_p,\bar{e})-(1-\beta)\frac{\partial V}{\partial w_p}(\bar{w}_p,0)\right].$$

The numerator of the right-hand side is clearly positive. Note that for (A1) to hold we must have $\bar{w}_p > \bar{e}$. Using (11), it follows from (12) that

$$\text{(A3)}\quad \frac{\partial V}{\partial w_p}(\bar{w}_p,\bar{e})>\frac{\partial V}{\partial w_p}(\bar{w}_p,0),$$

so that from (A2)

$$(A4) \qquad d\bar{w}_p/dw_c > 0.$$

(b) From (A3), we see that the denominator of the right-hand side of (A2) exceeds

$$(1-\beta+\beta^2)\frac{\partial V}{\partial w_p}(\bar{w}_p, \bar{e}) - (1-\beta)\frac{\partial V}{\partial w_p}(\bar{w}_p, \bar{e}) = \beta^2 \frac{\partial V}{\partial w_p}(\bar{w}_p, \bar{e}).$$

Thus from (A2) we have

$$\frac{d\bar{w}_p}{dw_c} < \frac{\beta}{1+\beta}\left[\frac{\partial V}{\partial w_c}(w_c, \bar{e}) \Big/ \frac{\partial V}{\partial w_p}(w_p, \bar{e})\right]$$

If $\bar{w}_p(w_c, \beta) < w_c$, it follows by differentiating (12) that the term in the square bracket is less than unity, so that $d\bar{w}_p/dw_c < \beta/1+\beta$.

PROOF of Proposition 2:

First, note that $K_1^d(L_p, b, r_1)$, which is obtained as the solution to the trivial optimization in (5) with $q_1 = ab$, has the following comparative static properties:

$$(A5) \qquad \frac{\partial K_1^d}{\partial L_p}(L_p, b, r_1) < 0,$$

$$\frac{\partial K_1^d}{\partial b}(L_p, b, r_1) > 0, \quad \frac{\partial K_1^d}{\partial r_1}(L_p, b, r_1) = 0.$$

The comparative static properties of $L_p^d(b, r_1, z)$, obtained by differentiating (8), using (A5) and the strict quasi concavity of $g_1(K_1, L_p)$, are easily seen to be given by

$$(A6) \qquad \frac{\partial L_p^d}{\partial b}(b, r_1, z) > 0,$$

$$\frac{\partial L_p^d}{\partial r_1}(b, r_1, z) > 0, \quad \frac{\partial L_p^d}{\partial z}(b, r_1, z) < 0.$$

If we let α denote an exogenous shift parameter whose comparative static effects we wish to determine, we may write

$$(A7) \qquad \frac{dL_p^*}{d\alpha} = \frac{\partial L_p^d}{\partial \alpha}(b, r_1, z^*) + \frac{\partial L_p^d}{\partial z^*}(b, r_1, z^*)\frac{dz^*}{dw_c^*}\frac{dw_c^*}{d\alpha},$$

recalling that the number of permanent workers is demand determined. From (20b) and (20d), we have

$$(A8) \qquad L_a^d(ab, r_2, w_c^*) = N.$$

Totally differentiating this with respect to α and rearranging, we have

$$(A9) \qquad \frac{dw_c^*}{d\alpha} = \left(\frac{dN}{d\alpha} - \frac{\partial L_a^d}{\partial \alpha}\right) \Big/ \left(\frac{\partial L_a^d}{\partial w_c}\right).$$

The comparative static properties of $L_a^d(ab, r_2, w_c)$, which is obtained as the solution to the optimization problem (4), are easily verified to be

$$(A10) \qquad \frac{\partial L_a^d}{\partial r_2}(ab, r_2, w_c) > 0,$$

$$\frac{\partial L_a^d}{\partial w_c}(ab, r_2, w_c) < 0, \quad \frac{\partial L_a^d}{\partial (ab)}(ab, r_2, w_c) > 0.$$

(a) Since $\partial L_a^d/\partial N = 0$ and $\partial L_a^d/\partial w_c < 0$, (A9) yields $dw_c^*/dN < 0$. Further, since $\partial L_p^d/\partial N = 0$, we have from (A7) and (22) that $dL_p^*/dN < 0$.

$$\therefore \frac{d}{dN}\left(L_p^*/N\right) = -\frac{1}{N^2}L_p^* + \frac{1}{N}\frac{dL_p^*}{dN} < 0.$$

(b) Since by (A10) $\partial L_a^d/\partial a > 0$, we have $dw_c^*/da > 0$ from (A9), so that from (A7) we have $dL_p^*/da > 0$. As above, $dw_c^*/db > 0$ since $\partial L_a^d/\partial b > 0$. Also, since $\partial L_p^d/\partial b > 0$, it follows from (A7) that $dL_p^*/db > 0$.

(c) When a changes but ab is held constant, we see from (A8) that $dw_c^*/da = 0$.

Thus from (A7),

$$\operatorname{sign}\left\{ \left.\frac{dL_p^*}{da}\right|_{ab=\text{constant}} \right\} = \operatorname{sign}\left\{ \frac{\partial L_p^d}{\partial a}(1/a, r_1, z) \right\} < 0.$$

(d) Since $\partial L_a^d/\partial r_1 = 0$, we have from (A9) that $dw_c^*/dr_1 = 0$.

$$\therefore dL_p^*/dr_1 = \partial L_p^d/\partial r_1 > 0.$$

Further, since $\partial L_a^d/\partial r_2 > 0$, it follows from (A9) that $dw_c^*/dr_2 > 0$. Since $\partial L_p^d/\partial r_2 = 0$, we have from (A7) that $dL_p^*/dr_2 > 0$.

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