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SPECIALIZATION AND COEVOLUTION OF AGRICULTURAL MARKETS

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**James Roumasset, Suntantar Setboonsarng,
Upali Wickramasinghe, Jonna Estudillo,
and Robert Evenson**

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Author: James Koumasset, Department of Economics, University of Hawaii at Manoa, Hawaii.

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by

James Roumasset
Sunantar Setboonsamg
Upali Wickramasinghe
Jonna Estudillo
Robert Evenson

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IRIS SUMMARY

The study focuses on the evolution of agrarian labor markets with a view toward building up a coherent theory explaining some pervasive patterns in developing countries. There are two primary sources of efficiency losses in rural labor institutions: (a) loss due to shirking, which rises with the breakdown of full information; and (b) loss due to lack of specialization. The summation of these two is defined as excess burden and the efficient contract is the one that minimizes it, The traditional village economy is characterized by low shirking cost due to full information and high cost of production due to lack of specialization. As a result, the personal mode of exchange is predominant starting from exchange between family members. With the development of transportation infrastructure, labor mobility rises leading to the emergence of the hired labor market. Due to the lack of information about hired laborers, the potential for shirking rises. At the same time, the potential for specialization rises and unspecialized wage workers are replaced by piece-rate workers specializing in particular tasks. The piece-rate contract emerges as a mechanism that minimizes excess burden. The evolution of agricultural labor contracts can therefore be understood as a continuum of the minimum excess burden points of successive institutions. As the investment in physical, legal, and relational infrastructures permits the further reduction in transaction costs, specialization and the extent of agricultural output and factor markets coevolve. In summary, the labor market evolves from autarky to communal production to the agricultural contracts and finally to the familiar neoclassical market economy.

The empirical evidence collected from the province of Laguna in the Philippines provides consistent support for the theory. Four kinds of contracts were observed, namely, pure family, time-rates, piece-rates, and mixed contracts. The piece-rate contract is observed to be predominant, especially in villages near the city center (Manila). The use of family labor has also declined over the survey years. The econometric tests also support the theory and suggest that transaction cost is one of the main driving forces in shaping labor institutions.

# Contents

1.   **Introduction**

Traditional neoclassical microeconomics assumes that markets have already evolved to the point where all firms and consumers face the same price vector of inputs and outputs. Organizational issues are suppressed. Decision making in the firm is determined by production functions and prices. Similarly, the functions of households are reduced to selling factors of production in exchange for outputs provided by competitive markets. Economic development in this paradigm is a function of factor augmentation and technological change. All other aspects of economic development are thus swept away. Evolution of markets, increasing X-efficiency of households and firms, increasing efficiency in the allocation of resources are some of the issues that are not considered.

This study focuses on the evolution of markets with a view toward building up a coherent theory explaining the observed phenomenon in developing countries. In particular, an efficiency theory will be developed to explain the evolution of a hypothetical agrarian economy from household autarky to communal production to the use of incomplete agricultural contracts and finally to the familiar neoclassical market economy. The central driving force in the economy is specialization. As part of the inquiry, actual patterns of organizational change in Philippine agriculture will be documented and explained. Two primary forces are assumed to account for organizational forms existing at a particular time in a given environment: the efficiency theory and specialization.   At the second level, an econometric model based on an axiomatic approach is utilized to test the model.

2.   Stylized Facts of Market Evolution in Agrarian Economies

The path of growth and development of a country is parallel to the path of specialization and division of labor in an environment of increased exchange. This paper examines the stylized facts of the evolution of markct in agrarian economies with a view toward developing inductively a theory relevant in explaining the stylized facts. It is possible to observe an emerging theory that explains the evolution of market from autarky to communal production to the use of incomplete agricultural contracts and finally to the familiar neoclassical market economy. The central driving force in the economy is specialization. As investment in the infrastructure, physical, legal and relational, permit the reduction in transaction costs, specialization and the extent of the agricultural output and factor markct cocvolvc. At any point in time, both specialization and the extent of the market are limited by transaction costs which are, in turn, a function of infrastructural investments and a set of exogenous determinants characterizing the physical and cultural environment.

The stylized facts of the evolution of market are shown in figure 1.

Figure 1: Evolution of Labor Market Institutions
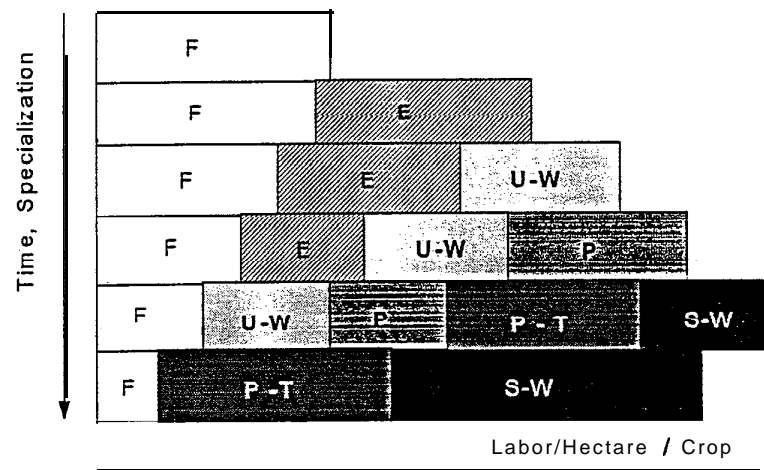
Notation:
F: Family Labor
E: Exchange labor
U-W: Undifferentiated Wage Labor
P: Piece rate
P-T: Piece rate with Teams
S-W Specialized Wages

The autarky can be understood as the family. In the agricultural setting, the family is recognized to be one of the most influential institutions that play a significant role in resource allocation and distribution. At this level, there exists a strong trust and bond as well as a sense of moral obligation toward one another among the family members. As a result, the transaction cost of organizing production at the household level is minimal. There are several factors that influence the extent of transaction cost. First, enforcement costs or supervision costs tend to be negligible as household members do not shirk due to the moral obligation toward the family, and the sense of collective-survival at difficult times'. Second, transaction costs tend to be minimal, because in the context of farm work, children will usually be trained on how to perform activities related to farming from childhood. **Third,** search costs, negotiation costs, or transportation costs involved **in using** family workers are also negligible (Hutaserani and Roumasset, 199 1). In the village economy, transportation costs between villages are high. The transaction costs within the family are low due to the factors discussed above. The most viable organization under these circumstances is the personal mode of exchange where other attributes that we discuss under modem industrial organization, such as cheating and shirking, are minimal. Thus one can conclude that the family serves as the major production organization under autarky due to low transaction cost and lack of specialization.

The emergence of the use of exchange labor arises from the nature of the production organization where production falls within a short span of time; every household is held to that specific time span to minimize conflicts relating to water usage,

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[1] This leads us to the literature on household insurance which is probably better left for a separate study. Interested readers can get a glimpse of social insurance by referring to Platteau (1991) and several papers in the volume by Ahmad, Dreze, Hills and Stem (1991).

pest control, etc. In the rural setting, agricultural activities are sometimes bounded by cultural repertoire (e.g., people believing that doing all the tasks simultaneously will bring them good luck). The exchange labor is a close substitute for family labor due to trust and bonds among members of the community. The bonds among the members may derive from kinship or repeated exchange with others or other knowledge about personal attributes and characteristics. If an exchange worker shirks on another person's farm, he can expect the same on his farm and, moreover, he loses the credibility as a good worker, which has far reaching consequences for his welfare due to closely-knit relationships among members of the rural community. These mechanisms mitigate against cheating and shirking and may render exchange labor and family labor transaction-cost minimizing modes of production.

As development progresses, there is a decline of the use of exchange labor. Though farmers claim that the exchange labor eases their financial burden of farming, fanners discontinue using exchange labor as social differentiation renders potential win-win contracts costly to design, negotiate and enforce.

The gradual erosion of the use of exchange labor gives rise to the use of daily wage labor. The hired labor is used in conjunction with family labor or sometimes with exchange labor. Family members work along with the hired workers and also supervise them. As a result, the cost of supervision can be kept to a minimum level.

The daily wage labor is the simplest form of hired labor. The laborers are paid based on a time rate, most commonly per day. The time-rate system is alleged to induce 'effort shirking' (Stiglitz, 1975; Lucas, 1979; Roumasset and Uy, 1980). Hutaserani and

Roumasset (199 1) has observed that in areas where labor markets have recently evolved, wage rates for all activities were paid on a time-rate basis. In the early stage of labor market development, uncertainties or transaction costs associated with market transactions tend to be high because of labor markets are poorly developed and standardization is low. This is also due to existence of some personal ties that prevailed before the beginning of the development process. However, as personal ties weaken, the transaction cost of time-rates will rise. It is observed that, for small unskilled activities which are difficult to monitor- e.g., chemical application[2]- time-rates are observed throughout all stages of development.

Household members continue to supervise hired labor until the cost of self-supervision is equal to the monetary benefit of substituting self-supervision with hired supervision. The marginal cost of supervision by household members increases as household members are demanded for other types of activities, while the monetary benefit of supervision declines because of difficulties in substituting family labor with hired labor. As supervision cost goes higher, the marginal benefit of supervising hired labor gets smaller. At this stage, pure hired labor arrangements disappear and a piece-rate system emerges.

In the piece-rate system, laborers are paid on the basis of the land area worked, as opposed to a daily wage rate which is based on time. Piece-rate payments have evolved to replace those of time-rate so as to mitigate against effort shirking, though "quality

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[2] These are the activities that need some judgment from the part of the worker. For example, in case of chemical application, the worker has to use his judgment as to how he should apply chemicals to different parts of the same plot depending on the need of each section. One could mechanically apply pesticides without regard to details yet pretending to be working hard.

shirking" remains to a greater extent. Piece-rates tend to be chosen over time rates for tasks where shirking is easily monitored by inspection. Piece-rates also exploits the factor of economy of scale in supervising. Bardhan and Rudra in their 1979 survey in North Bengal, India note that the piece-rate system is significantly more prevalent in agriculturally more advanced than in backward areas and is at the same time increasing over time. The incidence of piece-rates is also higher where the work force is more heterogeneous (Roumasset and Uy, 1980). Stiglitz (1975) also points out that the piece-rate system can minimize transaction costs in that it can be used to screen out less productive workers when the quality of work is variable and unknown. Roumasset and Uy (1980) in their observation on the Philippine sugar plantations note that piece-rate is chosen over time-rate in tasks that are easily monitored whereas the time-rate is maintained for tasks that are more difficult to monitor.

The next stage of the evolution of labor market is the substitution of wage based on piece-rate by piece-rates with teams. Piece-rates with teams are based on the same premise as piece-x-ales except for the fact that the tasks are performed by teams of workers that are skilled in specialized agricultural activities. The piece-rate with teams further evolves to reduce the excess burden associated with centralized management. Piece rates with teams motivate decentralization of three types: (a) decentralization of supervision, which economizes on supervision costs by making it worthwhile for workers to monitor themselves; (b) decentralization of selection, which makes efficient use of the team's own knowledge of a small part of the work force; and (c) decentralization of organization, which makes efficient use of a team's own information about the competitive advantages

of the team members (Roumasset and Uy, 1980). Workers belonging to a team are also faced with less uncertainty in the labor market than casual workers. It is clear that the piece-rate with teams is a sophisticated labor institution. Though learning-by-doing, specialization occurs and the labor market becomes differentiated and skill-specific. In terms of skill, family labor becomes a poorer substitute for hired labor.

Whither the Institution of Permanent laborers?

Hayami and Otsuka (1993) show that permanent labor may be an inferior substitute for share tenancy and will arise when share tenancy is banned. Since the institution of permanent labor exists even where share tenancy is not banned, however, one may conclude that there are other cases as well.

The institution of permanent laborers has been observed to exist in many parts of the world in different forms. Permanent laborers are workers who are engaged in long-term contracts which span the whole crop season, many seasons, or entire life times. The employment relationship between the worker and the landlord is highly personalized. The landlord provides the worker with benefits such as homesteads and credits in return for total loyalty from the workers (Bhalla, 1976; Bardhan and Rudra, 198 1; Richards, 1979; Eswaran and Kotwal, 1985). The incidence of occurrence of this particular institution has been observed to increase with modernization in Chile (Richards, 1979) and Northern India (Bhalla, 1979). This institution emerged as a subtle means of supervising labor. These workers are often entrusted with important tasks that require judgment, discretion, and care (which often are difficult to monitor) (Richard, 1979; Eswaran and Kotwal, 1985).

The use of permanent workers by landlords not only minimizes supervision costs but also recruiting and negotiating costs, as well as information costs. Workers in this institution enjoy guaranteed income, which serves as a shield against the uncertainty of the labor market, especially in the off-peak season, and they also enjoy other patronage benefits from the landlord. The relationship of landlord and worker in this institution is approximately that of the family institution and therefore minimizes transaction costs. At the same time the existence of permanent workers allows for alternative skill development and income avenues for family members, thus promoting specialization and division of labor.

3.   **Toward a Theory of Labor Market Evolution**

The last section was devoted to explaining the stylized facts of market evolution. This section attcmpt to link these stylized facts to a more rigorous theoretical foundation in the line of institutional economics.

As we have already discussed, in the traditional village setup, the transportation costs to other villages and to town are high. Exchange takes place in the personal mode where individuals engage in repeated exchange with others or otherwise have knowledge about attributes and characteristics of each other. Transaction costs are low due to this knowledge and moral obligation that controlled cheating, shirking, and other features that underlie the theory of modem industrial organization. However, in a such a setup, production cost is high due to incomplete specialization.

With the development of infrastructure, the cost of transportation becomes lower. As a result, it becomes possible to hire laborers from distant places, and worker

heterogeneity rises. At the same time, due to lack of information about all the hired laborers, the potential for shirking rises beyond what prevailed in the village economy. On the positive side, reduced transportation cost makes available more labor at competitive rates, and that enhances the potential for specialization.

Let us assume that, in any given employment, farmers face two sources of profit loss. The first source is the profit loss due to increase in shirking, a loss which increases with the breakdown of full information about workers. The second source is the profit loss due to failure to specialize, which decreases with the introduction of modem methods of production. The sum of the two sources of profit loss is the excess burden, which is given in figure 2. The parameter β represents the degree of specialization, which can be measured by the net to gross price ratio per unit of commodity and factor[3]. The parameter β varies between 0 and 1, i.e., $0 c \beta < 1$. When β is 0, transportation cost is very high and the wedge between buying and selling prices are very high. At this stage, there is no labor exchange between the village and the outside world. At the other end, when $\beta=1$, transportation cost is zero[4] and labor exchange occur between many different regions. Let LS represents the profit loss due to shirking, which increases with β. Let LF represents

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[3] $\beta = \dfrac{\text{Net Price}}{\text{Gross Price}} = \dfrac{P_b - t}{P_b}$ where P_b is the buying price, P_s is the selling price; and t is the exogenous transactions expenditures (especially monitoring and bonding) per unit of output., including transportation cost.

[4] The case of zero transportation cost cannot be achieved under existing technology. However, at very high levels of investment in transportation infrastructure, individual cost of transportation may decline.
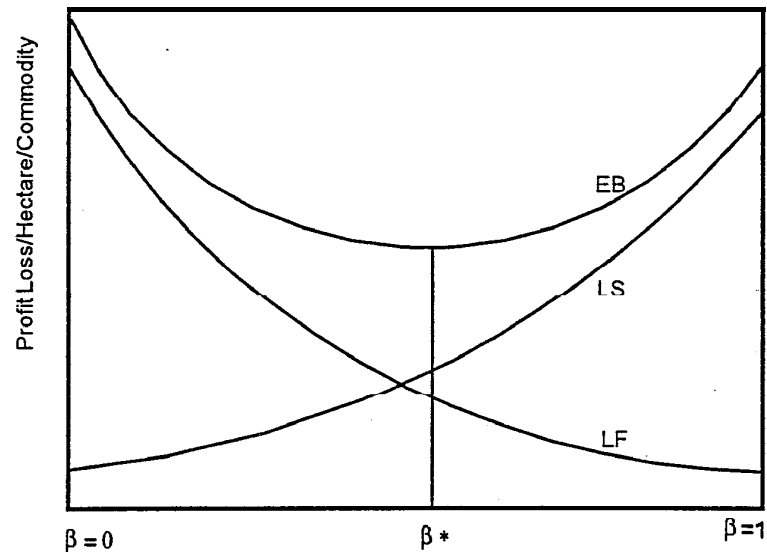
β = Index of market integration=$\dfrac{P_b - t}{P_b}$ where

P_b = Buying Price ot Commodity or Factor ot Production;

P_s = Selling Price of Commodity or Factor of Production;

t = Transaction cost wedge, including transportation costs;

LS = Agency Cost

LF = Profit Loss from Incomplete Specialization

EB = Excess Burden (LS+LF)

Figure 2: Excess Burden of Contract

the profit loss due to failure to specialize which decreases with β. The excess burden (EB) is the sum of LF and LS. Figure 2 illustrates the trade-off of the two types of transaction costs at different levels of transportation cost. Excess burden first decreases and then increases with **the reduction of** transportation cost, β. Note that excess burden is lowest at β^* at which one can observe the most efficient contract.

Figure 3 demonstrates the evolution of contracts from that of personal exchange at the beginning of the market evolution. As shirking rises due to breakdown of personal exchange, excess burden of time-rate rises rapidly. To mitigate the rising excess burden. new institutions emerge. The piece-rate contract can be thought of as one institution that emerges to lower the profit loss due to shirking and therefore lower the excess burden. Infrastructure development reduces the transportation costs; this in turn expands the market opportunities. The piece-rate contracts become more organized by way of specialization with teams performing special tasks, which we refer as piece-rate with teams. According to this arrangement, the team leader screens and supervises his workers. The shirking is reduced due to the specialized supervision of the team leader who attempts to maintain his reliability by screening those who want to join his team.

Another instance where one can use excess burden graph to illustrate the predominance of one contract over another is the choice between *gama* and *non-gama* contract?. It has been observed that *gama* contracts predominate in the latter stage of development. The *gama* is a contract that gives exclusive harvesting rights only to those

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[5] This practice is similar to the practice known as *ceblokan* in Indonesia although the same contract requires transplanting in addition to harvesting and weeding for the same 1/6 share (Roumasset, 1978; Roumasset and Uy, 1987; Hayami and Kikuchi. 1981).
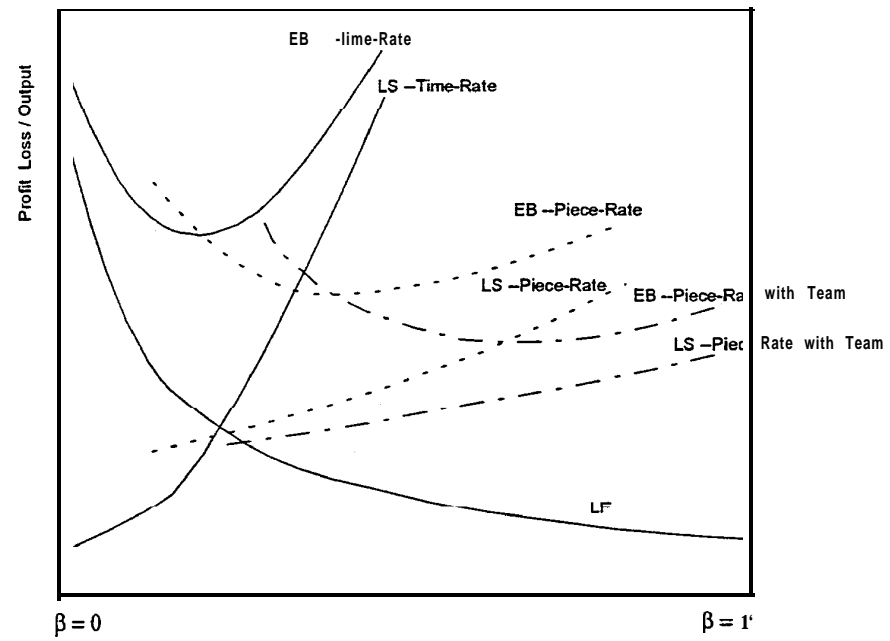
Figure 3a: Excess Burden Graphs for Each Type of Contract
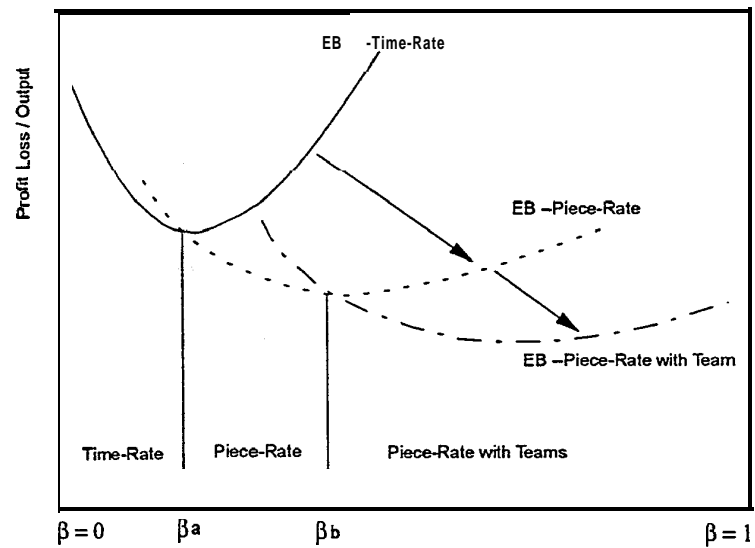
β = Index of market integration
LS = Agency Cost
LF = Profit Loss from Incomplete Specialization
EB = Excess Burden (LS+LF)

Figure 3b: Switching from One to Another Type of Contract

Figure 3: Evolution of Forms of Contracts

who participated in weeding, and workers receive a share of output as payment. Because of this payment system, one could think *gama* as a share contract. The difference between gama and other share contracts that we are familiar from literature is that gama is a ***share contract with*** teams. It has not been recognized in the literature that there are inherent differences between contracts that bind together land and management, i.e., share tenancy, and contracts that bind management and labor. The gama contract is a particular way of hiring labor with a share of output as a payment. This can also be characterized as a piece rate with payments in output instead of as a piece rate with payments in dollar terms. As in the case of output-based piece rates (Roumasset and Uy, 1980), which we can term as pure piece-rates, gama contracts have the advantage of providing their own supervision. Since the supervisor knows the characteristics of the workers, the incentives for shirking are minimum. Moreover, it encourages them to weed more conscientiously since they are entitled to a share of output. The system incorporates a mechanism to reduce labor shirking through the inherent incentive of output sharing (Stiglitz, 1974). Gama also reduces the search cost for both the landlord and the worker at time of harvesting, threshing, etc. in the peak period. There is also an element of risk sharing in this contract, as the risk of crop failure is shared by the workers and the landlord. In an environment where transportation cost is high and specialization is low, *gama* contracts prevail by taking advantage of low incentives to shirk. So *gama* is an institution that evolved partly as a selective process to limit workers to ones who are willing to do weeding without pay during the season. Therefore **gama** can be viewed as a special form of piece-rate which takes advantage of selection incentives. thereby further lowering the loss due to shirking.

The evolution of contracts from non-gama to *gama* contracts follows the same analogy of the evolution of labor contracts explained in figure 3.

Figures 3 also illustrates, in addition to evolution of contracts, that one type of contract will predominate in a particular stage of development. While specialization is enhanced through the expansion of the market, shirking is reduced by the improvement in the incentive structure through some institutional arrangements.

4.   Empirical Evidence

4.1   The Survey

The data were collected over six survey periods of approximately 56 farmers in 18 villages in six municipalities in the province of Laguna. These municipalities are Victoria, Pagsanjan, St. Maria, Calauan, Liliw, and Binan. All these municipalities are located in the second district of Laguna except Binan.

The villages were classified according to the proximity to the capital city, Manila, in terms of travel time. If the travel time is less than 30 minutes, they were treated as villages with sufficient infrastructure to develop labor markets. According to our estimates, Binan district is the most developed in terms of infrastructure (including irrigation) and labor markets. Roughly, the villages that are located within approximately 50 Kms south of Manila along the south super highway man be reached in less than 30 minutes. These villages are considered "near" while the villages that cannot be reached within 30 minutes from Manila are classified as "far".

Most rice farmers in these villages obtain irrigation water through communal systems operated by local farmers' groups. Rice is planted twice a year in most areas.

The major agricultural products are rice, coconut, and fruit crops, Non-agricultural enterprises are not prevalent except for some light manufacturing in Liliw, a place long famous for production of shoes and bags. Binan is the municipality closest to Mania. It is located within the South Superhighway stretch connecting Laguna Province to Manila. Irrigation water is provided by the National Irrigation Administration (NIA). Contrary to the general trend, rice is planted five times in two years in Binan. Being close to the main city, people in Binan earn their living through various means such as rice farming, livestock production and other non-farm Activities. Most non-farm activities take the form of office work, temporary work related to construction, and small scale cottage industries.

The farmers in the data set were selected from a bigger data set. The selection of a household was based on the number of times the farmers were included as part of the sample in the larger data set. A farm household is included in the data set if it had been interviewed at least four times out of five surveys conducted in 1977, 1982, 1985, 1988, and 1990.

The questionnaire was designed to obtain inforination pertaining to the following aspects: labor inputs of hired, family, and exchange workers; contract choice; supervision time; recruitment time; transportation time; negotiating time; hiring mechanism; and worker's relation to and years of work for the farmer.

4.2   Empirical Observations

This section explains our empirical findings on contractual arrangements in those villages surveyed. We observe four major kinds of contracts: pure family labor, time rates, piece-rates, and mixed contract. Appendix table 1 shows the evolution of contracts across time periods in major rice production activities. It is observed that piece rate is the most pervasive contract in almost all villages and all activities except weeding. This pervasive is more apparent in villages near the city compared to those located far away. The use of pure family labor has also evidently declined over the years in both villages and this decline is generally observed to be more substantial in villages near Manila. We explain contractual arrangements over time according to selected activities in villages with both developed and less-developed labor markets.

1.   Land Preparation

While the tractor is the major power source in villages near Manila, animal labor is still predominantly used (33% in 1992) in some villages far away from the main city. However, we cannot readily postulate that the reason for the slow adoption of modern technology in these villages as a result of backwardness of the region, because those villages are relatively near the International Rice Research Center and the College of Agriculture of the University of the Philippines. We observe that a substantial number of farmers using animal labor are adopting modern inputs in their production activities. Also, hand tractors have already been introduced in these villages in the early 1970s during the Green Revolution project of the government. These modern machines were,

however, not extensively used because some farmlands have elevated terrain which makes tractor use infeasible.

Piece rate contracts by far are the dominant form of contracts in land preparation in all villages in 1992 -70% in villages near Manila and 50% in far away villages. Most of the farmers adopting this type of contract are those who do not own tractors (or have non-functioning ones) and therefore need to rely on the tractor rental market for land preparation- The most pervasive piece rate practice is *pakyaw,* an arrangement where the rentee pays a fixed sum of money per hectare of land and all the necessary inputs for land preparation are provided for the renter, e.g. machine, fuel, and labor. Farmers who own a machine either use family Iabor or hire an operator who gets paid on time rate basis. Only two farmers in both groups of villages hired an operator in the dry season of 1992. The use of family labor in land preparation have declined substantially in villages close to Manila (from 3 1% in 1982 to 15% in 1992). The decline was smaller for away off villages (14% to 12%).

As we have explained in sections 1 through 3, the pervasiveness of piece rate contracts over many other possibilities can be explained by referring to asymmetric information and enforcement costs that exist between the farmer and his worker. The chosen contract will always be the one where the excess burden is minimized. Since piece rate contracts are pervasive in these villages, one can assert that this minimizes transaction costs. The transaction cost in this definition includes agency costs (i.e., transactions expenditures plus foregone gains from specialization where agency costs are monitoring and bonding costs plus residual shirking costs (including both land and lahnr shirking).

Contracts evolve to minimize transaction costs[6]. For example, *pakyaw* (piece rate) contracts are more common in the tractor rental market than time contracts. In time contracts, the farmer would have to stay almost full-time to check whether the work is being done the time that is paid for[7]. However, with the increasing value of time, especially for villages near Manila, the incidence of this contract is low.

2.   Transplanting

A contract in transplanting is commonly negotiated with a *cabisilya* or team leader on a piece rate contract, and in 1992 this was the contract chosen by 92% and 88% of the villagers in "near" and "far" respectively. Although supervision can be delegated to the team leader, the farmer chooses to stay at the farm full time because this activity is one of the most crucial in rice planting. The use of pure family labor and family time-rate combination is not common and is observed only in small-sized farms.

3   Weeding

Piece rates are not observed in weeding. Instead *gama* contracts are practiced. In this arrangement, a worker contracts to weed and harvest a specified parcel for typically 1/6 of the rice harvested for that parcel (Roumasset and Uy, 1987). This agreement has become popular in 1985 in villages near Manila, where 85% of the households are observed to have their farms contracted on *gama.* In 1988 and 1990, however, there has

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[6] We recognize that contract forms may emerge and persist because they serve the interests of those with greater bargaining power (Knight, 1992). That is, political equilibria, which are generated due in part to the differential ability of individuals to form coalitions for political influence may be departures from the efficient   solution.

[7] According to Otsuka and Hayami (1988), this incentive problem can be corrected by negotiating contracts with persons of known reputation to the farmer such as friends, relatives, and village people. This solution is observed in the villages although empirical evidence has yet to be presented. However, we abstract from these effects in the present paper. For an example nf how to model the comparative statics of political economy effects, see Balisakan and Roumasset (1987).

been a slow decline in the proportion of the households adopting this contract. By 1992

only 46% were reported to have hired workers on the gama contract. The same pattern is

observed in villages far away from Manila with a three year time lag. We observe that

54% of the farms in this group have used gama contract in 1988, which is comparable to

the proportion of this contract near Manila in 1985. A slow decline in the popularity of

gama is observed starting 1990.

Similarly, time rate is also observed to have declined in both type of villages. For

example, in villages close to Manila not a single household hired a daily wage worker in

1988 and 1990.

The declining trend of both gama and daily wage weeders may be due to a decline

in the number of workers in weeding. One major explanation for this trend is the

increasing availability on non-agricultural work in the village and easier access to Manila

which is facilitated by better infrastructure system in the whole province in general. This

leads the workers to abandon farm work and seek employment opportunities outside the

agriculture where they may find higher pay. It is observed that in some villages, family

labor and other contracts are used in mixed proportions. For example family labor

combined with time rate and *gama,* or both were observed. This must have been in

response to the declining number of time rate and *gama* workers.

4.   Fertilizer Application

This is an activity primarily done by family labor. The use of family labor,

however, is observed to have declined starting 1990 and the piece rate contract had

already come to existence in 1985 in villages near Manila. In the far off villages, piece rate

contracts have been observed only in 1992 and family labor is still the dominant form of contract. Roumasset and Uy (1987) classified fertilizer application as a task "hard to monitor" which explains why family labor is commonly observed.

5.   Harvesting

The piece rate contract dominates harvesting both in villages close to Manila and far off areas. The most common practice is for harvesters to get a proportion of output as a payment instead of a wage. This output-based piece rate economizes on the agency costs associated with labor shirking.

6.   Threshing

As with harvesting, the piece rate is the most pervasive practice for both manual **and** machine threshing. Again, one can see of the incentive compatible mechanism in the use of the piece rate for threshing. The threshing machine was introduced in early 1980s **and** by 1985 all farms near Manila were adopting this new technology. In villages far away from the city, however, 47% were still using manual threshing. The topography in the village may partly explain the non-adoption of threshing machine.

4.3   The Empirical Model and Findings

4.3.1   Introduction

This section deals with the empirical implementation of the ideas presented above. The first section presents the empirical model and variables. The second section deals with the estimation of the model and results.

The stylized facts were discussed in previous sections with partial empirical observations from the Philippines. We have chosen an axiomatic approach which utilizes

existing knowledge of economic principles to arrive at an empirical mathematical model This model allows us to conduct some simple thought experiments and to provide a sufficient description of the problem so that a testable hypothesis can be generated. The method is, in our view, superior to developing a sophisticated mathematical model as it provides us with answers and predictions regarding important matters of concern without compromising transparency. Even though the empirical model is simple, it abstracts from some of the complexity of agrarian contractual arrangements. To put it succinctly, the axiomatic approach was adopted as it is believed that truth emerges sooner from error than from confusion (Francis Bacon as cited by Debreu, 1959).

4.3.2 The Econometric Model

In the case of the Philippines, it is observed that the development of the labor market in the Laguna area coincided with changes in the labor use pattern and adoption of new technologies. The development of the labor market is such that there is an increase in the use of hired labor as well as replacement of family labor by hired labor. It is also observed that laborers are hired most commonly by either piece-rate or time-rate in any activity in the process of rice cultivation. The objective of the empirical model is to shed some light on the determinants of choice of terms of payments for different tasks of rice-farming activities, paying particular attention to the impact of transaction costs. The hypothesis is that among other economic and demographic variables, saving on supervision costs and recruiting costs associated with contracts plays a role in determining the choice of contracts chosen by farmers.

The process by which households choose contracts out of a given set makes it difficult to use a simple ordinary least squares (OLS) in the analysis. For each task in the process of cultivation, households are faced with choices among different contracts. For example households can hire labor on a piece-rate or time-rate basis. In certain other tasks such as transplanting, the choice is between piece-rate with a team or time-rate. The data collected is generated by individuals making choices, and therefore the distributions of supervision and recruiting costs associated with the contracts are truncated distributions. Because of the existence of selectivity bias, OLS estimations of transaction costs based on the observations will give an inconsistent estimate of the parameters. Therefore an alternative method of estimation is required.

Econometric discussion of the consequences of self-selectivity began with the studies by Gronau (1974), Lewis (1974), Amemiya (1974) and Heckman (1974, 1976). The problem has recently been analyzed in many different contexts by Lee (1976), Lee and Trost (1978), Willis and Rosen (1979) and others. The model used here is one of simultaneous equations with selectivity bias which is commonly known as the probit method. This deals specifically with data which are based on dichotomous observation of choice of contracts. An essential feature of the probit method is obtaining expected values of the truncated residuals. The estimated values are then introduced into the original equation and cstimntcd by OLS method (Lcc, 1976).

The model consists 'of a set of equations with the choice equation or the structural equation being the main equation. In the structural equation, the criterion that determines the choice between the piece-rate and the time-rate depends on, in addition to other

factors, the saving in the supervision costs and recruiting costs of using piece-rate over time-rate. Assuming complete interaction between the level of transaction costs and the type of contracts, one can estimate transaction costs equations separately for the piece-rate and the time-rate contract.

The structural equation can be represented as:

$$I_i^* = \delta_0 + \delta_1(S_{ti} - S_{Pi}) + \delta_2(R_{ti} - R_{Pi}) + \delta_3 X_i + \delta_4 D_i + \phi_i \qquad (1)$$

where I_i^* represent the choice of piece-rate or time-rate of each contract. The subscripts t and **P** represent time for time-rate and piece-rate respectively. For the ease of exposition, subscript i is left out from the discussion below. S_t and R_t represent the supervision and recruiting time for time-rate respectively; S_P and R_P represent the respective supervision and recruiting time for piece-rates. X is a vector of household characteristics (i.e. family size, age and years of education) and economic and institutional characteristics of the area (i.e., wage rate, piece rate, etc.). D is a vector of exogenous dummy variables representing different activities. ϕ captures the unobserved error and is assumed to be $N(0, \sigma^2)$. This equation determines whether or not the farmer chooses to hire labor at the piece-rate or the time-rate. Whether or not the expected savings that are measured by $S_t - S_P$ and $R_t - R_P$ in transaction costs are significant in the analysis is of central importance.

The determinants of transaction costs are formulated as:

$$S_{Pi} = \theta_{sP0} + \theta_{sP1}X_{sPi} + \theta_{sP2}D_{sPi} + \varepsilon_{sPi} \qquad (2)$$

$$S_{ti} = \theta_{St0} + \theta_{St1}X_{Sti} + \theta_{St2}D_{Sti} + \varepsilon_{Sti} \qquad (3)$$

$$R_{Pi} = \theta_{rPO} + \theta_{rP1}X_{rPi} + \theta_{rP2}D_{rPi} + \varepsilon_{rPi} \qquad (4)$$

$$R_{ti} = \theta_{rt0} + \theta_{rt1}X_{rti} + \theta_{rt2}D_{rti} + \varepsilon_{rti} \qquad (5)$$

where $\varepsilon_{SPI} \sim IN(0,\sigma^2_{SP})$, $\varepsilon_{Sti} \sim IN(0,\sigma^2_{St})$, $\varepsilon_{rPi} \sim IN(0,\sigma^2_{rP})$, $\varepsilon_{rti} \sim IN(0,\sigma^2_{rt})$.

Equations (2) and (4) are respectively the equations of supervision time and recruiting time when the farmer chooses the piece-rate. Equations (3) and (5) represent respectively the supervision time and recruiting time when the choice is the time-rate.

If I* >0, the farmer chooses the piece-rate contract, his supervision time is determined by equation (2) and his recruiting time is determined by equation (4). Otherwise he chooses to employ labor by the time-rate, and his supervision time and recruiting time are determined by equations (3) and (5) respectively. The farmer can choose either piece-rate or time-rate for any activity such that S_p and R_p will be used if I*>0. Otherwise equation S_t and R_t will be used.

By substituting (2) - (5) into (1) one can get the reduced equation which is given below:

$$I_i^* = \tau_0 + \tau_1 X_i' + \tau_2 D_i' + \varepsilon_i^* \qquad (6)$$

The parameters τ_0, τ_1 and τ_2 can be estimated by probit analysis to obtain consistent estimates. τ_0^*, τ_1^* and τ_2^* can be estimated after normalization, i.e., $\sigma^2_{\varepsilon^*} = 1$.

Conditional on the choice of the piece-rate, the supervision time equation is:

$$S_{SPi} = \theta_{SP0} + X_{SPi}\theta_{SP1} + D_{SPi}\theta_{SP2} + \sigma_{1\varepsilon*}\frac{f(\alpha_i)}{F(\alpha_i)} + \beta_{SPi} \tag{7}$$

where $E(\beta_{SP}|I_i = 1) = 0$, $\alpha_i = \tau_0 = \tau_1 X_i' + \tau_2 D_i'$. F is the cumulative distribution of a standard normal random variable and f is its density function.

The supervision time equation conditional on the choice of the time-rate is,

$$S_{Sti} = \theta_{St0} + X_{Sti}\theta_{St1} + D_{Sti}\theta_{St2} + \sigma_{2\varepsilon*}\frac{f(\alpha_i)}{1 - F(\alpha_i)} + \beta_{Sti} \tag{8}$$

where $E(\beta|I_i = 0) = 0$.

In this model, it is our hypothesis that farmers choose between the piece-rate and the time-rate depending on which one minimizes transaction cost. Transaction costs in this model are supervision cost (S_P, S_t in equation (2) and (3)) and recruiting cost R_P, R_t in equation (4) and (5)). Equations (2) to (5) cannot be consistently estimated by OLS using observed supervision cost and recruiting cost because the expected value of the error terms of these equations are not equal to zero. By substituting equations (2) to (5) into (1), we get a reduced form model, equation (6), which is a probit model. X' in equation (6) contains all the exogenous variables X_i and D_i, and ε_i^* has been normalized to have unit variance. Conditional on the choice of piece-rate or time-rate, the supervision equation can be rewritten as (7) and (8) where β_{SP}, β_{St} are the new residuals with their expected value equal to zero. The same is true for the recruiting time equations. These conditional equations can be estimated by OLS method, and the estimated values of S_P^*, S_t^*, R_P^*, and R_t^* can then be used to estimate the structural probit equation

The condition for identification of the model is that there should be at least one variable in the transaction costs equations not included in the structural equation to avoid complete multicollinearity. For selectivity bias adjustment when the probit model is used, it is possible for the reduced form equation to contain the same equation as in the transaction cost equations. It does not cause any identification problem as long as the variable in the transaction cost equations does not contain non-linear functions of the variable in the structural equation.

4.3.3 Empirical Implementation

The exogenous variables used in the model consist of socioeconomic variables from secondary sources and individual characteristics from the household survey. The exogenous variables used are:

WAGEPF	= Wage rate plus value of food served by farmers in pesos;
WAGESQ	= Square of WAGEPF;
EDUCM	= Years of education by household head;
EDUCF	= Years of education of wife;
AGEM	= Age of household head;
TRANSPC	= Cost of transportation to an from place of employment;
AERBAR	= Size of barrio measured in hectares:
TPROD	= Total production of rice in this cropping season (unit=cavan);
PRICE	= Expected price of rice per cavan for this cropping season;
PRICEWD	= Population density of the barrio (no./ha.);
INTEREST	= Interest paid on agricultural loans (Peso);
OFFWAGE	= Wage per day in off-farm employment (Peso);
SUPDIF	= The difference of supervision time between time- and piece-rates;
RECDIF	= The difference of recruiting time between time- and piece-rates;
REMIT	= Remittances
POPDEN	= Population Density of barrio.

Dummy variables used in the model are:

DYRO	= Laborers working for the farmers for the first YEAR;
DYR1	= Laborers working for the farmer for 2-5 years;
DYR2	= Laborers working for the farmer for over 5 years;
DLAND	= Land preparation using tractors;
DSEED	= seedbed preparation and care;
DTRAN	= Transplanting;
DWEED	= Weeding dummy;
DCHEM	= Fertilized and chemical application;
DHT	= Harvesting and threshing.

Table 1 provides the summary statistics for the exogenous variables:

Table 1: Descriptive Statistics of Variables

Variable	Mean	Std. Deviation
WAGEPF	43.62	20.05
TRANSPC	1.62	7.69
PRICE	156.15	29.29
DISPOB	26.13	18.68
AREABAR	209.26	84.45
TPROD	82.79	70.59
INTEREST	16.21	14.08
OFFWAGE	43.65	19.25
REMIT	1621.80	3080.70
EDUCF	5.05	3.78
EDUCM	4.95	3.85
AGEM	50.82	8.99
PRICEWD	2.43	1.06
POPDEN	26.67	12.98

Two models are used in explaining the choice of labor institutions. The first model investigates the determinants of the farmer's choice between time-rate and piece-rate or piece-rate with team in certain activities as well as identifying the factors affecting the level of transaction costs. The second model concentrates on the choice between *gama* and *non-gama* contracts. The model is necessitated because the highest number of labor employment in rice farming is in the activity of harvesting and threshing and as such either *gama* or *non-gama* contracts are prevalent.. Our hypothesis is that gama evolved to

reduce transaction costs associated with the use of hired labor which is brought about in the development of the market.

4.3.3.1 Choice Between Piece-Rate and Time-Rate

The dummy variables introduced to distinguish activity effects are normalized on seed-bed preparation and the dummy variable on length of time that the laborer had on the same farm is normalized on DYR1 for workers working 2-5 years. It is noted that for the activity of transplanting, all the piece-rate contracts are organized as piece-rate with team where the farmer contacts only with the team leader who recruits and supervises the team workers.

The results of the first model, the choice between piece-rate and time-rate contracts, are presented in table 2. As expected, the empirical results show that the savings in transaction costs between the two types of contracts (that is, supervision cost and recruiting cost) do play an important role in determining the farmer's choice of contracts. The results suggest that, everything else being equal, an increase in savings of supervision cost or recruiting cost leads to the higher possibility for farmers to choose piece-rate over time-rate. Between the saving in supervision cost and recruiting cost, the t-ratio of recruiting costs (3.039) is higher than that of supervision cost (1.425). This result reflects that while piece-rate and piece-rate with teams saves on both recruiting **cost** and supervision cost, the savings on supervision cost is less pronounced. This may also due underestimation of time spent on supervision. We noted during the survey that survey respondents had more difficulties of recalling the amount of time spent on supervision than on length of travel time or cost of riding the jeepney.

Table 2 Structural Equation Estimates (Probit) of the Choice Between Piece-Rate and Time-Rate

Dependent variable	Γ"		
(Piece-Rate =1,Time-Rate = 0			
Independent Variable	**Coefficient**	**t-ratio**	
Constant	-.9071	-1.457	
SUPDIF	.0354	1.425	
RECDIF	.0590	3.039	***
WAGEPF	-.0270	-1.849	
WAGESQ	.0002	2.260	***
EDUCM	.0150	.930	
EDUCF	-.0128	-.699	
AGEM	.0129	1.342	
TRANSPC	.0722	2.749	**
AREABAR	.0007	.911	
TPROD	-.0003	.335	
INTEREST	-.0004	.0103	
OFFWAGE	-.0103	-2.663	**
REMIT	-.00002	-.946	
PRICE	-.00001	-.005	
PRICEWD	-.0010	-2.984	**
POPDEN	.0126	.455	
DYRO	-.2638	-1.183	
DYR2	-.9957	-6.382	***
DLAND	**1.413**	5.339	***
DTRAN	2.2904	8.383	***
DWEED	2.040 1	7.676	***
DCHEM	-.1552	-.498	
DHT	2.849	10.343	***

Note: Figures in parentheses are values of t-statistics;
** and *** indicate that the estimates are significantly different from zero at 0.5 and 0.01 level of confidence respectively.

The number of years that a worker has worked with the farmer is also found to be an important determinant of choice of contracts. The first time workers are more likely to be hired at the time-rate than at the piece-rate whereas those who have worked for the farmer between two to five years are hired at the piece-rate. At the same time, those who have been working for more than five years are more likely to be hired at the time-rate. The result suggests that there are two aspects of worker's quality that are considered: skill in performing a particular task and shirking potential. First year workers whose both skill and shirking potential are unknown to the employers are found to be hired at time-rate. Workers with some experience are screened into working as piece-rate or piece-rate with team. However, once the confidence on a worker based on his specialization is developed, the worker is found to be hired independently at time-rate. This is particularly true in activities that need special care such as fertilizer application.

The dummies for different tasks were included to allow for the possibility that farmers perceive terms of payments differently for different tasks due to the nature of the task and the case of supervision. The dummies representing different tasks are highly significant except for the activity of chemicals and fertilizer application where piece-rate is often-used. The result suggests that the presence of the piece-rate and the piece-rate with team in one activity substantially raised the probability that farmers will choose to hire labor at the piece-rate in other activities. The nature of the task strongly determines the choice of contract. The piece-rate prevails in land preparation, transplanting, weeding, and harvesting/threshing while the time-rate prevails in the application of chemicals and fertilizer.

The age variable is found to be a significant variable which suggests that older farmers prefer piece-rate over time-rate. Although not highly significant, the possibility of preference for piece-rate increases among farmers with more schooling. The variable price wedge which is used to capture the degree of market orientation indicates that other things equal, the higher the degree of market orientation, the higher the possibility of the farmer choosing the piece-rate over the time-rate. At the same time, the choice of the piece-rate is higher in larger villages, and when the workers are from distant places. This indicates that as transportation cost is reduced workers from distant places are able to join a team and work as piece-rate workers in another village. In this way piece-rate promotes the expansion of the labor market.

Estimations further suggest that total production, interest rate, remittance from outside and price of rice are not significant in explaining the farmer's choice of term of payment. Nevertheless, the sign of the coefficients provides us with some insights. The negative sign associated with the size of the farm (proxy) suggests that the piece-rate is not necessarily chosen more by a larger farm than by a small farm This implies that the economies of scale associated with using the piece-rate is not observed in the case under consideration. The price of rice has a negative sign which suggests that, other things being equal, the increase of price of rice also leads toward a preference for the time-rate. The same is true for the variables including interest rate facing the household, off-farm employment, and remittances from abroad.

5   Discussions   and   Conclusion

This study confirms that the transaction cost is indeed an important determining factor in the choice of employment contracts. It is recognized that the level of significance is not strong; however, the results are consistent throughout the study. The savings in the amount of time spent in recruitment play a more important role in the choice of contract than the saving in supervision time. This may be partly due to the data measurement problems as in the case of supervision cost mentioned above.

From the empirical results, it is observed that the more specialized forms of organization such as the piece-rate tend to predominate among older farmers and farmers with more education. The piece-rate also predominates where the size of market is large, the transportation cost is low, and the price wedge is small.

The time-rate is observed more often in smaller villages where the size of the market may limit the extent of specialization. When the quality of worker is unknown, or when demand for labor is not consistent, time-rate is chosen. Time-rate is found to be the earliest form of labor contract. The time-rate with a high level of supervision is found among first-year workers, whereas the time rate with a low level of supervision is found among those who have worked with the farmer for over five years. The level of supervision in the time-rate differs significantly with the number of years worked but not so in the piece-rate. This suggests that the piece-rate workers are to a certain degree screened when joining the team, and workers watch each other in their work so that the burden of supervision does not fall solely on the farmer as it does in the time-rate.

The time-rate is chosen where the off-farm wage rate is high and where a remittance is available. It is noted that in these villages, a well-developed capital market does not exist, so availability of cash is limited, and exchange of locally produced goods is conducted through a barter system. Since the time-rate is paid in cash at the end of the day, the availability of cash allows for a higher incidence of time-rate contracts, which is the simplest form of contract. Thus, one can conclude that the availability of more cash permits the replacement of family labor with hired labor. This eventually leads to the development of the labor market.

The results from this analysis also suggest an inverse relationship between the degree of market orientation and the level of supervision and recruitment. As the price wedge decreases or the transportation costs decrease, both supervision costs and recruiting costs increase. One would expect that recruiting cost would fall with the decrease in transportation cost, but on the contrary, the lack of personal knowledge of workers who are from distant villages triggers a higher level of recruitment as well as supervision.

These results point out that in the path of development, transaction cost is one of the main driving forces in shaping the labor institution. Competitive supply of labor which is brought about by the reduction of transportation cost also reduces the information cost on workers. As a result, farmers tend to employ new labor institutions which can lower information cost. In this analysis, time-rate is shown to be less chosen with the reduction of transportation cost and is replaced by piece-rate and eventually piece-rate with a team.

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Table 1. Contractual Arrangements, 1977-92.

	Villages near Maradi						Villages far from Maradi					
	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
Tractor												
Piece	0 (0)	11 (69)	4 (21)	5 (31)	8 (57)	9 (70)	0 (0)	10 (28)	16 (50)	15 (40)	15 (40)	16 (50)
Time	0 (0)	0 (0)	6 (32)	4 (25)	1 (7)	2 (15)	8 (36)	5 (14)	5 (16)	4 (12)	4 (11)	2 (6)
Family	1 (100)	5 (31)	9 (47)	7 (44)	5 (36)	2 (15)	3 (14)	4 (11)	1 (3)	2 (5)	7 (19)	4 (12)
Mixed	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Animal												
Piece	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (9)	7 (19)	4 (12)	7 (19)	3 (8)	3 (10)
Time	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (14)	3 (8)	1 (3)	2 (5)	5 (14)	2 (6)
Family	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (27)	7 (20)	5 (16)	7 (19)	3 (8)	5 (17)
Mixed	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No of HH	1 (100)	16 (00)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 1. Contractual Arrangements, 1977-92.

	Villages near Manila						Villages ...					
	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
B. Transplant												
Piece	0 (0)	13 (81)	16 (85)	15 (94)	14 (100)	12 (92)	20 (92)	25 (70)	24 (75)	35 (95)	35 (95)	28 (88)
Time	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Family	1 (100)	0 (0)	1 (5)	1 (6)	0 (0)	0 (0)	1 (4)	7 (19)	2 (6)	2 (5)	0 (0)	1 (3)
Mixed	0 (0)	3 (19)	2 (10)	0 (0)	0 (0)	1 (8)	1 (4)	4 (11)	6 (19)	0 (0)	2 (5)	3 (9)
No of HH	1 (100)	16 (100)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 1. Contractual Arrangements, 1977-92.

	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
C. Weeding												
Piece	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Time	0 (0)	5 (31)	1 (5)	0 (0)	0 (0)	3 (24)	13 (59)	22 (61)	9 (28)	9 (24)	12 (32)	6 (19)
Gama	0 (0)	7 (44)	16 (85)	13 (81)	11 (78)	6 (46)	6 (27)	5 (14)	9 (28)	20 (54)	16 (43)	13 (41)
Family	1 (100)	3 (19)	1 (5)	2 (12)	3 (22)	2 (15)	3 (14)	8 (22)	8 (25)	4 (11)	3 (8)	4 (12)
Mixed	0 (0)	1 (6)	1 (5)	1 (7)	0 (0)	2 (15)	0 (0)	1 (3)	6 (19)	4 (11)	6 (16)	9 (28)
No. of H	1 (100)	16 (100)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 1. Contractual Arrangements, 1977-92.

D. Fertilizer	Villages Near Manila						Villages Far From Manila					
	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
Piece	0 (0)	0 (0)	1 (5)	1 (6)	3 (21)	4 (31)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (6)
Time	0 (0)	0 (0)	2 (10)	2 (12)	2 (14)	2 (15)	2 (9)	4 (11)	6 (19)	7 (19)	6 (16)	2 (6)
Family	0 (0)	16 (100)	15 (80)	13 (82)	9 (65)	6 (46)	20 (91)	32 (89)	25 (78)	30 (81)	29 (78)	26 (82)
Mixed	1 (100)	0 (0)	1 (5)	0 (0)	0 (0)	1 (8)	0 (0)	0 (0)	1 (3)	0 (0)	2 (6)	2 (6)
No. of N	1 (100)	16 (100)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 1. Contractual Arrangements, 1977-92.

E. Harvesting	Villages Near Manila						Villages Far From Manila					
	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
Piece	0 (0)	14 (88)	16 (85)	14 (88)	12 (86)	12 (92)	20 (92)	27 (75)	24 (75)	32 (86)	32 (86)	26 (82)
Time	0 (0)	0 (0)	0 (0)	0 (0)	1 (7)	0 (0)	1 (4)	3 (8)	1 (3)	1 (2)	1 (3)	0 (0)
Family	1 (100)	0 (0)	1 (5)	2 (12)	0 (0)	0 (0)	1 (4)	6 (17)	2 (6)	1 (2)	2 (6)	3 (9)
Mixed	0 (0)	2 (12)	2 (10)	0 (0)	1 (7)	1 (8)	0 (0)	0 (0)	5 (16)	3 (8)	2 (5)	3 (9)
No. of H	1 (100)	16 (100)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 1. Contractual Arrangements, 1977-92.

	Villages Near Manila						Villages Far From Manila					
	1977	1982	1985	1988	1990	1992	1977	1982	1985	1988	1990	1992
F. Threshing												
Machine												
Piece	0 (0)	0 (0)	19 (100)	16 (100)	14 (100)	13 (100)	0 (0)	0 (0)	3 (9)	20 (54)	23 (63)	15 (47)
Time	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Family	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mixed	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	1 (2)	0 (0)	2 (6)
Manual												
Piece	0	14 (88)	0	0	0	0	20 (92)	27 (75)	22 (70)	13 (35)	14 (37)	14 (44)
Time	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	3 (8)	0 (0)	1 (2)	0 (0)	0 (0)
Family	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	6 (16)	2 (6)	2 (6)	0 (0)	1 (3)
Mixed	0 (0)	2 (12)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (12)	2 (2)	0 (0)	0 (0)
No. of H	1 (100)	16 (100)	19 (100)	16 (100)	14 (100)	13 (100)	22 (100)	36 (100)	32 (100)	37 (100)	37 (100)	32 (100)

Table 2.   Supervision Time per Day of Farm Work, 1992.

	------ Villages Near Manila	Villages Far from Manila
A. Land Preparation		
Piece rate	2.50	5.70
Time rate	5.00	6.00
B. Plant/Transplant		
Piece rate	5.30	6.00
Time rate	n.a.	n.a.
C. Weeding		
Time rate	4.00	5.25
Gama	0.50	2.85
D. Fertilizer Application		
Piece rate	4.00	2.00
Time rate	4.00	2.00
E. Harvesting		
Piece rate	5.00	5.83
Time rate	n.a.	n.a.
F. Machine Threshing		
Piece rate	6.57	6.18
Time rate	n-a.	n.a.
G. Manual Threshing		
Piece rate	n.a.	5.15
Time rate	n.a.	n.a.

n.a.=means no farmer adapted the contract.