Farm-Land Scale and Agriculture Production Efficiency in China: Peasant's Select Restricted by Land-Ownership and Transaction Cost

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Abstract

The core of selections on the structure of production elements is cost constraint and the influence from economies of scale incentive these selections. Land-Ownership restraint reduces the scope of agricultural production elements, yet, it is that can get the economies of scale easily, which is the result of the equilibrium between production cost and management expenses. The paper established a dominate model on the structure of agricultural production in view of the theory of economies of scale, analyzed the Farm-Land scale and agricultural production efficiency, peasant's job selection and investment.

Key Words

Economies of scale; The combination of elements; Combined occupations

JEL Classification

Q190, R110

I. Introduction

Household contract responsibility system was established in 1982. The system, giving farmers the right to make independent decisions on using a small piece of contracted land, was created by Chinese farmers in the 1970s. Against the background of bringing order out of chaos and concentrating on the economic development after the end of the Cultural Revolution, the Chinese central authorities respected the willingness of the farmers and actively supported the tryouts and then introduced the experience to the whole country within a couple of years. As a result, about 800 million farmers have gained the decision-making power on farmland management. The household contract responsibility system helped China's agriculture step out of the long-term predicament. The agricultural economy grew fast toward specialization, commercialization and socialization. The thriving of township enterprises was another great achievement made by the Chinese farmers. The enterprises, making surplus rural labor shift from farming, blazed a new trail on enriching rural people and stimulating the industry and the whole economic restructuring as well.

However, the system leads to a negative result, which is the Farm-land scale limited to a certain level **(Cai, 2008)**. Generally speaking, the scale of agriculture must be suited to the level of development of productivity, but the scale of agriculture is a very broad concept. The centralization management of farmland is inevitable decided by the agriculture economies of scale. The agriculture economies of scale is an independent concept. This first lies in the particularity about its predominant factor. In the agriculture, economies of scale does not look like in the industry such was by the big inalienable basic goods decided, but is decided by Management unit's business capacity. That is, compares with the industry,

agriculture production's economies of scale relies on the management. This was why the agriculture management under the modern condition still might take the family as the unit. In addition, the special nature of the agriculture economies of scale also lies in its form of the realization. In industries, transportation, service, the form of realizing the economies of scale, nothing else but two fundamental types: One kind is the manager increases the investment, improves equipment to expand its management scale; another kind is the units merging among the managers to expand the single unit's scale. The latter form is the result of competition, when the better economic operators through their own growth reached a certain scale, they will merge others producer to obtain the scale benefit. Land has the special meaning to the agriculture, so that the inspection on agriculture production scale under the farmland property right restraint is the key of the paper.

The agriculture production took the family as the unit in china didn't mean that the unit production structure is highly effective. In fact, taking the family as the unit of agricultural production pattern popular in countryside in china nowadays is caused by the restriction of institution, which is not the result of competition between the peasant household. In the 1950s, the Chinese government had begun the movement of Agricultural production cooperatives, and then forbade the market transaction and others of land. At the end of 1978, the cultivation of agriculture in China had changed from the collection system to the household contract responsibility system, but until 1984, Chinese government has cancelled these limits the market transaction of land. For all this, until now, the land ownership of peasants' is still incomplete. After in the mid-1980s, some research indicated that agricultural production had already bogged down in most rural areas of China, for further flowing of land was limited by the household contract

responsibility system, the scale of agricultural production was limited as well. In fact, large-scale agricultural production is necessary, which is the only way to raise the economic level especially for agricultural production. But, agricultural production's formalization could not look like the production team as in 1950s. It is difficulty that to supervise peasants' labor under the production team system produces member's work enthusiasm to be extremely down **(Lin, 1988)**. The empirical studies demonstrated that the production team system compared to the household system low 20%-30% **(McMillan Wholly and Zhu, 1989; Lin, 1992; Wen, 1993; Tang, 1984)**.

Although some scholars believed that the technology is neutral of scale **(Rao, 1976; Grabowski, 1979; Griffin, 1974; Pears, 1980; Lipto and Longhoust, 1989)**, but is not means all the technologies are neutral. Regarding the agriculture, most of agriculture machineries are not the scale neutral. If except the scale neutral investment outside the agricultural production essential factors, the rest investments may regard as has economies of scale nature, then agricultural production's scale efficiency will does not have the essential difference with the industry. Therefore, agriculture is restricted by production scale equally in receiving the economies of scale. Because of this, the choice of the factor-mix for production under the cost restrain becomes the core problem of agriculture. Meanwhile, formalization of agriculture must be influenced the choice of peasants, for the economies of scale. If obtaining some kind of essential factor of agriculture was limited, agricultural production's scale would possibly be limited in certain level too. Lin thought that deepens the market reform is the key of the question current in China. This paper will elaborate the theory question of agricultural production in detail; analyze the Farm-Land scale and agricultural production efficiency, peasant's job selection and investment under

Land-Ownership; explain the phenomenon of economic in China's rural areas.

II. Model

The preamble pointed out that if except the scale neutral investment outside the agricultural production essential factors, the rest investments may regard as has economies of scale nature, then agricultural production's scale efficiency will does not have the essential difference with the industry. But, the theoreticians are not unified about the theory of enterprise size, and there is no one can determine the size of the firm is superior. Because we cannot decide enterprise's scale from the material upper boundary, the economies of scale becomes a very fuzzy question. Because of this, we can only carry on the theoretically to agricultural production's scale limits.

In the history of economic thought, from Adam Smith, the theory of economies of scale had elaborated by many economists[1], for instance, Stigler, Coase, Williamson[2] and so on. Stigler explained the upper limit of enterprise's size through the cost analysis, he thought each production process in the composition of total cost, some process return was increasing, and some process return was decreasing, this hindered the enterprise's further expansion. Coase thought that firm's scale was restricted by the transaction cost, but his theory about the firm was only based on the theoretical explanation. But, it is may determine that in the production process must exist some factor with the nature of increasing or decreasing returns along the scale change, and the management cost in different scale is different too. This management cost also has the scale effect, and the management's marginal cost curve and the production's marginal cost change are similar.

1. A general model of economies of scale

A. Scale of production under full competitive market

It must be explained, the management is necessary for the production activity. According to Stigler's thought that the cost is may separate. For a kind of factors combination, we can except the costs outside that caused by factors of neutral scale firstly. Secondly, the rest of costs would be classified as two kinds of standard; one is caused by material factors such as technology, energy, land and machinery, named physical production cost; the other is caused by management, named management cost. Management also has the scale benefit nature. In fact, the above classified standard has synthesized the theory of Stigler and Coase. Under the condition of fully competitive market, we established a dual theoretical model with cost control on the scale of production. As shown in Figure 1, *MDC* is the marginal cost curve of the physical production cost and *MMC* is the marginal cost curve of management cost. They are similar, only the change speed is different.

With the scale of production expanding, the marginal cost caused by material factors is increasing, and the marginal cost caused by management is increasing as well. Before the production reached in certain scale, the transaction costs by market were higher than the marginal cost caused by management, which is the thought of Coase. Therefore, when the C_2C_1AB was equal to *GFDE* area, the loss of benefit from physical production cost was equal to the saving of organization from transaction costs by market, and then the superior scale was achieved, namely H_0 point in Figure 1.

Therefore, in majority situations, when the equilibrium point of a group of production portfolio decided by management costs and market

transaction costs is different from the lowest point of the average cost decided by the material elements, they will decide the upper limit and the lower limit of the production scale. If the cost can be observed is vague, so the scale of production will pace back and forth between the upper limit and the lower limit[3]. This theoretical model shows that the scale of production is not only decided by the equilibrium of management costs and market transaction costs, but also is decided by the nature of the material elements needed in the production, the scale of production is the dual balanced results of physical production cost and the transaction cost saves[4].

Obviously, the cost of obtaining elements in the fully competitive market depends on the average level of the market, in other words, for the enterprise, if a combination of production factors is established, then choice of the production scale will be under the equilibrium of the management costs and transaction costs, that is the reason why Coase's theory about the determination of the firm size is completely tenable in logic. However, the market in reality is not always perfect, and sometimes, some necessary production elements obtained from the market are not competitive, such as the land in agricultural production. We know that the production elements through the imperfectly competitive market is high, so when the cost of obtaining certain necessary production elements is high enough, there will be another situation, that is, the choice of elements portfolio and the mode of administration will be under the limit of some kind element. At this time, Coase's theory about the determination of the enterprise seems to be powerless. The following discussion will focus on the agricultural production behavior under the constraint land rights and the farmers' choice of agricultural production elements.

B. The choice of agricultural production structure under the Land-Ownership restrained

Assuming there is a factor set for choice such as $F(1, 2, \cdots, i, \cdots n_0)$, which contains n_0 elements. Producers or manufacturers can select a set i included j elements, namely $F_i^j = F(a, b, \cdots, j)_i$, $F_i^j \subseteq F$, and this set is sufficient to guarantee the normal production. Once the set of production factors to be determined, MDC ($\frac{\partial Dc}{\partial H}$) and VDC ($\frac{Dc}{H}$) curve have also been identified. For the producers or manufacturers who select the set i included j elements, how to organize these j kinds of factors still has many kinds of way. The cost (management cost) of each kind of organization is different, and the change is different too. For f organization way, we express it as $O_f^j = \pi_f^j(a, b, \cdots, j)$. Similarly, once the organization way of production factors to be determined, MMC ($\frac{\partial Mc}{\partial H}$) curve has also been identified as well. In ordinary circumstances, the set of production factors and the organization way of Producers or manufacturers are not only identified. Producers or manufacturers' choice to the set of production factors and the organization way does not have specific the orders yet. So that, the cost accounting and inaccurate calculation for prospective return possibly causes the impropriety chooses to the production method. In any case, once the factors and organization way were determined, the optimal scale was determined too, as shown in Figure 1.

Namely: $S_{q\{F_i^j, \pi_f^j\}} = f(F_i^j \mid \pi_f^j)$.

As Figure 2 solid line shown, if acquiring land is limited in H_0' level, or the marginal cost of obtaining the land to surpass the H_0' level is very high, the marginal cost curve of management will rise suddenly at H_0'. As

MMC' shown, scale of agricultural production is balanced at H_0'. When the land scale is restricted, means that the investment of others factor muse be suit to this land scale, otherwise it will waste the resources. This conclusion has been proved by Su. Shui and Vernon W. Ruttan. At the same time, many scholars' empirical studies also indicated that destabilizing Land-Ownership affect peasant's investment to the agriculture (Yao, 1998). These are caused by the land restriction. Obtaining further farmland is difficult to peasants in China. The marginal cost curve of management rose suddenly at H_0', the materializing investment would be limited in the determination level too. Because are the land obtain are, the managed cost the boundary curve ' the result which place rises suddenly in H0, the materializing investment is limited, in H0 ' corresponds in the level, this does not favor technical the transformation. This is why agriculture develops slowly and the advanced agricultural technology can not be used in large rural area in China.

2. Peasant's choice under Land-Ownership

The preamble pointed out that once a group of essential factors combination was designated, the revenue function of agricultural production also to be determined. Under the Land-Ownership restrained, we may think that peasant obtains others' "contract land" (chengbao tian) through market transaction, renting, and so on is very difficult, because the cost of this process is extremely high, so the farmer will not do that diligently. Under this situation, here may establish a labor income model of agricultural production on contract land scale, namely the land scale is at the level H_0', as shown in Figure 3.

The marginal return in the agricultural production work is decreasing, as *MFP* shown. At the same time, agricultural production labor

investment is affected of scale as well; the marginal cost is increasing, as *MLC* shown. Curve *MFP* and *MLC* intersects at *C* spot, which means peasants' labor investment to the agricultural production will not surpass this point. In the full competitive market, *C* point means the labor price of peasant equals to the marginal return in agriculture, and this is an equilibrium state. But, when the labor price of peasant was higher than the price identified by *C* point, peasants will seek a part time job to maximize returns. From this we will obtain a constraint about peasants' choice to get employed, namely the labor price equals to the marginal return in agriculture[5]. As shown in Figure 3, without considering transaction costs, peasant will invest labor in agriculture at the level of *A* point; the rest of (*A* to *D*) will be invested in market of labor market. In particular, when the labor price higher than P_1, peasants will be completely out of the agriculture. This kind of situation has already appeared in China's eastern area, for instance, Tianjin, Zhejiang, Hainan, etc. The other hand, if the transaction costs is too high and the labor price of peasant is too low (lower than P_2), labor force will not move, and was fixed on the land.

According to two model's discussion above, we can draw two conclusions as follow.

Conclusion I: Economies of scale has the drive to choice of the essential factors by influencing the cost of production, and determines the production scale finally. Therefore, Land-Ownership restraint has the drive to choice of peasants; they favor the choice that can obtain the economies of scale easily at H_0'. If the scale at H_0' is small, it will hinder the agricultural technology with the economies of scale nature promotion, specially for those which only suit to the large scale.

Conclusion II: Peasants' employment choice is decided by the equilibrium between the marginal return in the agricultural production

work and the price of labor market. Both the reduction of transaction costs and the development labor market all can cause peasants turn to other industry in complement, and enhancing the efficiency of agricultural production will be opposite with it.

III. Analysis

Agricultural land use rights which are not fully market-oriented will have an impact on the agricultural technology promotion. As shown in Figure 1, if the peasants can not gain economies of scale from using large-scale machinery or new technology due to high administrative costs and not cost-effective access to obtain sufficient land, the promotion of agricultural new technologies would be blocked. More peasants are willing to choose the production pattern which the technical level is low but easy to obtain economies of scale. That is why peasants would rather to use Animal not to be willing to use the machine in the realistic countryside. Some studies have shown that some scale neutral essential factors in agricultural technologies, such as improved seed, high-quality pesticides are easier than the machinery to promote[6], which can explain the above question sufficiently.

The preamble conclusion 1 demonstrates that the farmers can only choose other essential factor combination in the very small space because of the limit of land ownership, which will affect the farmers to invest in agriculture. This point does not lack the evidence, the numerous economists have carried on the empirical analysis in view of the land property right's stability or secure and farmer's investment enthusiasm under the Chinese countryside's family joint production contract management system, the majority researches show that the instability of land property right has a negative impact on the investment incentives.

For example, **Yao (1995) and Wen (1995)** thought that the uncertainty in land tenure weakened the enthusiasm of farmers to invest; Yao's another research in view of two provinces of Zhejiang and the Jiangxi indicated that instability of the land ownership and the limit of land transaction rights had the negative influence to the land yield rate, its influence way is to low the efficiency of the essential factors allocation and reduce the land long-term investment of peasant household. Hebei Province's research indicated: the longer the peasant household's land contract, the more incentive for farmers to use the farm manure and the phosphate fertilizer **(Li and Loren, 1998)**. **Brandt et al (2002)** study also discovered that in those villages which the adjustment of land is more frequent, farmers use organic fertilizers with the lower density[7]. **Carter and Yao (1998)** examined the impact of land property rights on the investment incentives of peasants from three aspects using 214 peasant household's two-year panel data of Zhejiang Province, discovered that the tenure security of the land contracting right has the greatest impact on the investment incentives of peasants and the right to lease land has not remarkable influence, this also can explain this question.

Many scholars (**MacMilliam et al, 1989; Lin, 1992; Huang and Rozelle, 1996**) believed that the implementation of the household contract responsibility system has driven the Chinese peasants' production enthusiasm. And the enhancement of production enthusiasm was the primary reason for the early 1980s rapid and sustained agricultural growth. On the other hand, the conclusion 1 may explain the reason why the implementation of the household contract responsibility system has greatly inspired the Chinese peasants' produce positive similarly. This is because the agricultural production technology was quite backward under the conditions at that time, which made the agricultural production to achieve balanced very easily on the small scale.

However, with the development of agricultural technology and the universal enhancement of productivity, the set of agricultural production's essential factor that can be choose is in the unceasing expansion. The continuous reduction of the original small-scale agricultural productivity has highlighted the problem of agricultural production scale. Therefore, farmer's complete land transaction rights favor the disposition of the land.

In fact, we can obtain two deductions from the conclusion 1: (1) the development of production elements market and the enhancement of can also promote the expansion of the agricultural production scale similarly; (2) the promotion of the scale neutral technology is not restricted much by the land scale, but by the production elements market and the management level, and this kind of condition will result in incomplete specialization. For example, the head of household's educational level has the remarkable effect to the employment level of chemical fertilizer. This result is in accordance with the empirical evidence discovered in other developing country **(Jamison and Lau, 1982)**. But the transaction of countryside production elements market is active in traditional China **(Myers, 1970; Brandt, 1987)**, so the agricultural production in China has been leading the world before the end of Ming Dynasty. An important feature of developing countries' farmers is that the production is not complete specialization **(Hymer and Resnick, 1969)**; this can also explain this question.

The conclusion 2 demonstrates that the combined occupation is farmer's rational choice; the satisfied degree of constraints will affect the disposition of the labor force. The existing literature had also proven this conclusion; they discovered that the income obtained in other rural activity and the non-rural activity accounts for a large proportion in its total income in the Chinese countryside **(Shand, 1986; Anderson and Heiserson, 1980)**. At the same time, some phenomena that occur in

countryside now may also prove this question. For instance, in the past few years, Xihua Town, Henan Province, whose agricultural development level occupied medium level, had exported more than 90,000 workers one year. The proportion accounts for about 30% of total quantity of the county-wide labor force, but these workers mostly are not the full-time employment.

IV. Conclusion

When the elements market is full competitive, the scale of agricultural production is decided by the balance between physical production cost and management cost, in this kind of situation, the agricultural technology's promotion is not hindered. But, when the cost of obtaining the larger area farmland or other factors was very high, the agricultural production will be in the low state of balance. Under the household contract responsibility system, any peasant obtains others' "contract land" through market transaction, renting, and so on is very difficult, and the cost of peasant giving up the farmland is high too, so the agricultural technology's promotion will be hindered among the peasants. Of course, some agricultural technologies (for example, pesticides, fertilizers and fine varieties) without scale nature may be promoted normally, but their effect is weak, promoting agricultural technology in large-scale is impossible.

On the other hand, the population growth and birth control will cause the family's scale getting smaller, which has the contrary direction with the agricultural technology development is. If the conclusion above is tenable, the Land-Ownership restraints will become the most important factor to the agricultural development in China. The farmland institution must be innovated; otherwise it is impossible to establish a full

competition elements market. The goal of innovation is realizing the free trade of land, in order to reduce the transaction costs caused by Land-Ownership restraints. In other words, we must reduce the costs of obtaining more land for agriculture, to realize the large-scale production. It is the fundamental way for China's agriculture development.

NOTE

1. Refer to the Coase, R. H. 1937, "The Nature of the Firm", *Economica*, vol. 4, p.386. Williamson, O. E. 1979, "Transaction-Cost Economic: the Governance of Contractual Relations", *Journal of Law and Economic*, vol. 22, p. 233. Williamson, O. E. 1981, "The Modern Corporation: Origins, Evolution, Attributes", *Journal of Economic Literature*, vol. 19, p.1538. Williamson, O. E. 1983, "Organization Form, Residual Claimants, and Corporate Control", *Journal of Law and Economic*, vol. 22, p. 351.

2. But Williamson's theory was not suitable for the agricultural production, because the agricultural production does not have the complex organization as enterprises; the information transmission is not a problem among the peasants.

3. Here only discussed one kind of situation, sometimes, the lower limit may be decided by the equilibrium of management cost and the market transaction cost (but this kind of situation is rare, because if the management cost is too high, the production behavior will be blocked unless the nature of the goods is unique), but the upper limit of production scale is decided by the material elements, the article will not discuss this lonely.

4. The theory about the joint consideration of the cost expense to the production scale control can also refer to: Yinyin, Cai. 2006. "The

Balanced Analysis of Cost Expense Control and Organization Benefit. *Commercial times*. No.25. And the thought about the cost separation standard can also get from an article of Steven, NS Cheung (Steven, NS Cheung., "The Contractual Nature of the Firm", 1983) "Corporate nature of the contract" by abstracting.

5. This balance constrained by the return function, $R_{\max} = \int_0^{L_1} Q(L, H_0^{'}) + (L_c - L_1)P_0 - \int_0^{L_0} f(L)$. $Q(L, H_0^{'})$ is the function of labor in agriculture work at the level of $H_0{'}$ scale, $f(L)$ is the function of labor marginal cost, P_0 is the price of labor. The constraint of this balance is $P_0 = Q(L, H_0^{'})$.

6. Some scholars believe that agricultural technology system of family has the opening nature in China. Majority of agricultural technology can enter the realm of production through it. A little partial agricultural technology can not enter the realm of production because of scale temporarily, and may also through the technical revision suit the production system finally.

7. The organic fertilizer is suitable to improve the soil, so using it belongs to the long-term investment for peasant.

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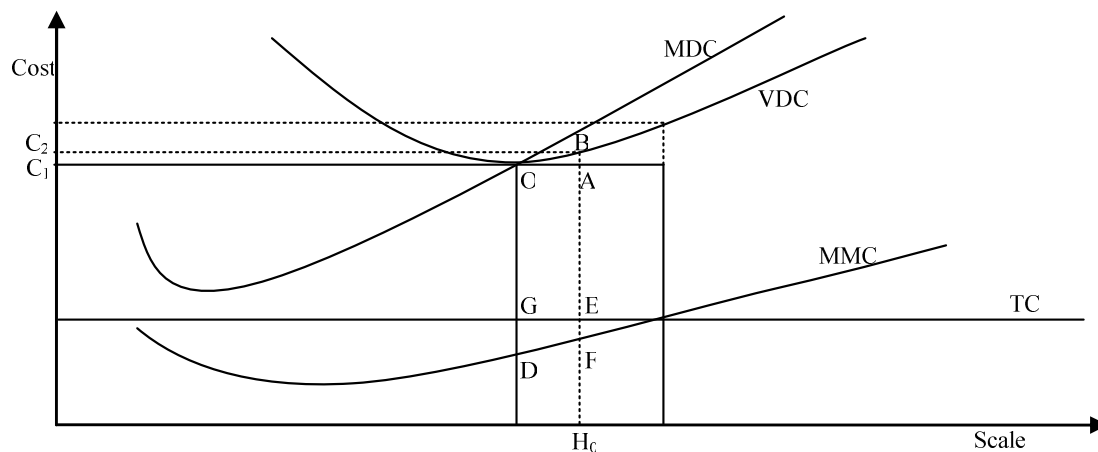
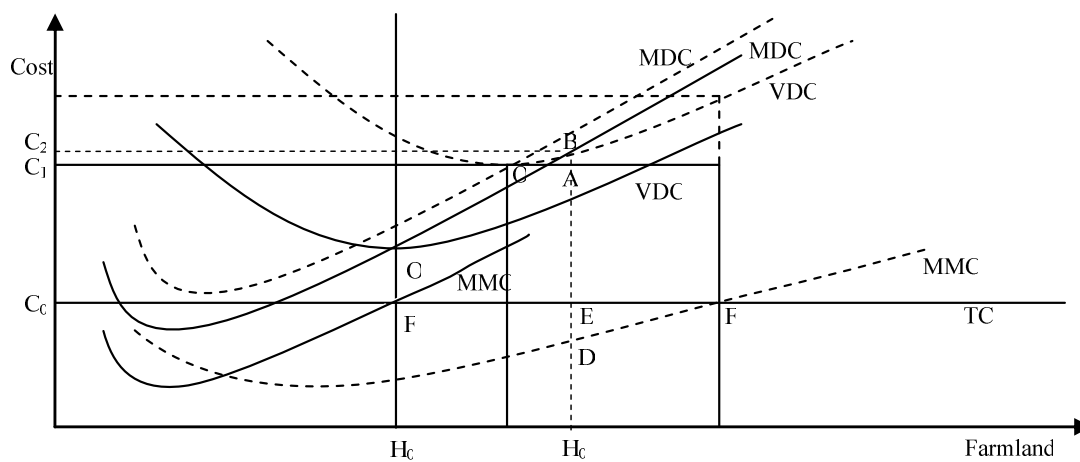**Figure 1 Superior Scale of production reached under fully competitive market**

Figure 2 Agricultural production factors combination under the Land-Ownership restraints
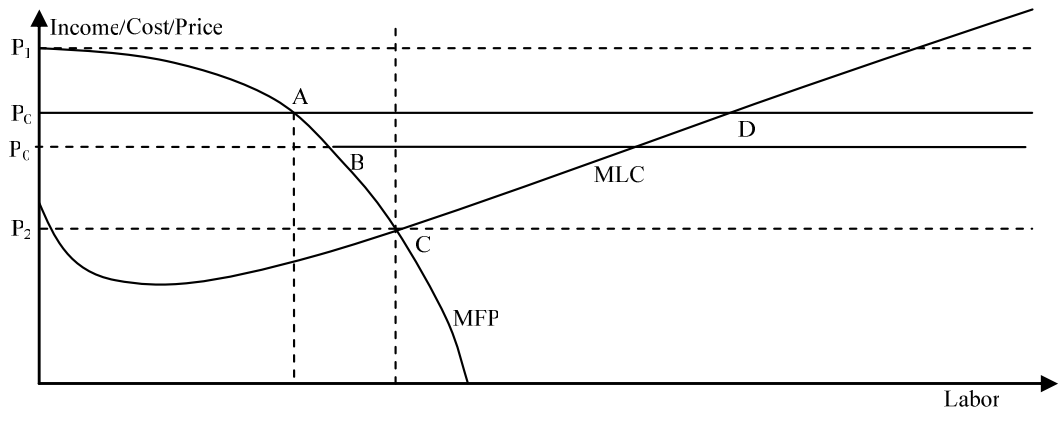
Figure 3 The equilibrium between the marginal return in the agricultural production work and the price of labor market