

Internal Mechanism and External Conditions of Scale Management of Land

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Abstract

Decisive factor of scale of land is the capacity of management and control of agricultural operation subject, which is strengthened with improvement of skills. Only if scale of land is enlarged accordingly, then economic profit can be gained. Under such external circumstances as reduction of agricultural comparative advantage and fluctuation of relative factor prices brought about by economic development, the capacity of management and control of operation subject can be improved, which, in turn, would promote scale management of land.

Keywords: Scale management of land, Capacity of management and control, Comparative advantage, Relative factor prices

Generally, agricultural land system of all nations in the world went through the two stages of “land to the tiller” and “scale management of land”. The so-called stage of “land to the tiller” referred to the stage of equalization of land ownership, which usually appeared at the interval of replacement of a new regime with an old regime, which accords with the State Theory of North about protecting security of the governor. In 1789, after the Jacobins came into power, they released three land decrees in succession which formed an extensive smallholder foundation. Eastern European countries also generally established the smallholder economic system of “land to the tiller” one after another after the Second World War. With intervention of American occupational forces, Japan finished the reform of private land ownership after the “Second World War”, and by the year 1950, more than 90% of its agricultural land had become self-cultivated land, forming the system in which land-holding peasants occupied the comparative advantage. Likewise, at the beginning of the founding of PRC, we also carried out the private land ownership system with the center of equalization of land. The stage of “scale management of land” appeared with reduction of agricultural comparative advantage and fluctuation of relative capital prices when the economy was developed to a certain extent. Although nations with different resource endowment presented different developmental characteristics at these two stages, the trends of their development were all manifested as diminished quantity of agricultural operation units and expansion of land scale. The phenomenon of scale management of land was, first of all, discovered in the coastal economically developed districts with more population and less land, and then was spread gradually to inland. This development feature was closely connected with conditions of economic development in all districts.

Some academics at home and abroad made an analysis in decisive factors of scale of agricultural land. According

to Schurz, (2007), scale of a farm depended on the control capacity of agricultural operation subjects in agricultural production. US agricultural economist R. T. Ely also had similar elaboration, (1982), “within the scope of one agricultural sort, there was also the trend that the scale of a farm adapted to capacity of fieldmasters and labor forces of their family or to the supply of labor forces in the case of maximum loading.” Institutional economists gave explanation to scale of an enterprise from the perspective of the central controlling person, (A.A. Alchian and H.Domsetz, 2009). That is to say, compared with the market, an enterprise was able to obtain comparative advantage which rested with the control capacity of a central controlling person with the central position of residual claims, and the control capacity of the central controlling person changed in the same direction with scale of the enterprise. If the “market” here could be understood as an enterprise with small scale and the “enterprise” could be explained as an enterprise with large scale, then, the control capacity of the central controlling person in institutional economics could be applicable to analysis of causes for scale management of land. The domestic scholar Han Xiping also had similar statement, (Han, Xiping), “how many means of production could be manipulated by a certain amount of labor capacity depends on several factors, such as quality of laborers, level of productivity development, condition of skills and quality of plowland, etc.” However, there has not had any literature review about systematical statement of the internal mechanism and external conditions of scale management of land from the perspective of control capacity. On the basis of existing theories, this article is going to analyze the internal mechanism of scale management of land and come to conclude that the capacity of management and control of operation subjects is the leading factor of scale management of land. Changes of external environment caused by economic development enabled the capacity of management and control of operation subjects, which may further promote expansion of scale of land.

The scale management of land here mentioned in this article refers to expansion of the scale of land operated by operation subjects of agriculture, mainly the plant industry. The optimum scale of land refers to the optimum condition of distribution of all factors of agriculture and the optimum returns to scale in terms of production, without any diminishing marginal returns of any production factor. Agricultural production in the major developed countries and China all take household operation as the main form, since the incentive and restraint mechanism of household operation adapts to the characteristics of agricultural production. This article is going to take household operation as the agricultural operation form and adopt the assumption of “rational man” in economics which differs this subject from other disciplines. Assuming that the agricultural operation subject is a rational economic man, that is, one who is able to make a decision that is most favorable for fulfillment of his target under a particular restrained condition. The target of an agricultural operation subject is maximization of profit which refers to the balance after deduction of cost from all sorts of incomes. Here, incomes include agricultural income and non-agricultural income and cost includes current assets of land, labor forces, fertilizer and seeds and input of machines, fuel and livestock. From the perspective of economics, the above cost means the opportunity cost, that is, the highest income of these agricultural production elements in other uses.

1. Internal mechanism of scale management of land

1.1 Analysis of the property of all agricultural production elements and their relations

According to the categorization method of Schurz, (2007), namely, relationship between production elements and scale of land, this article classifies productions elements into two sorts: one sort of detachable production elements and the other sort of inseparable production elements. The former sort includes elements of agricultural machines, seeds and fertilizer, etc, which is similar to the variable input in economics, that is to say, profit of this sort of elements has nothing to do with scale of land; the latter sort of production elements mainly refers to the management and control capacity of the operation subject, namely, human capital which can reflect levels of skills, similar to the fixed input in economics. According to authors of this article, when productivity is determined, quantity of other production elements effectively managed by the operation subject is limited. And if this limitation is surpassed, then the marginal returns of elements would present a declining trend, and this limitation is the capacity of management and control of operation subjects. That is to say, input of detachable production elements in agricultural production rests with the management and control capacity of inseparable production elements. When productivity is determined, and input of other production elements does not attain the limit of management and control, marginal output increases steadily with increase of variable elements; when input of other production elements attains the limit of management and control, the marginal output is the maximum; when input of other production elements surpasses limit of management and control, the marginal output declines steadily. Capacity of management and control of the operation subject is not only dependent on his/her own human capital, but also relies on quality of other production elements. When the capacity of management is improved, quantity of elements managed and controlled will be correspondingly expanded. When breeds of crops are improved, technical levels of agricultural mechanics are improved and irrigation levels are

improved, the capacity of management and control will also be correspondingly improved even if levels of human capital of the operation subjects per se are not improved, which is manifested as the case in which increase of input of variable elements will not be diminished as a result of the marginal returns.

Schurz especially pointed out that, (2007), the same to other detachable production elements, scale of agricultural land depended on the capacity of domination on elements of agricultural production by the operation subjects and the level and capacity of operation and management of farms. In allusion to the “principle of large scale of farms” which regards tractors as inseparable elements of modern agricultural production, he further pointed out, tractors have all sorts of specifications and models and they can be applied into production with several methods. Within areas where human power is relatively cheap, tractors of small scale tractors may be more effective; in places where human power is expensive, application of more tractors may be more effective. Furthermore, in order for large scale tractors to be more effective, extremely particular conditions are required which can not be satisfied in many areas. Cross-regional work of agricultural mechanics in China started in the middle of 80s in the Twentieth Century in Shangxi Province, and afterwards was spread to Inner Mongolia, Shandong, Henan and Hebei, which also indicated separability of agricultural mechanics, (Liu, Fengqin, 2003). Hence, according to authors of this article, just similar to other instruments of production, agricultural mechanics, improved varieties of seeds, fertilizer and farm chemicals also belong to separable production elements. In the process of development of land scale, when quality of producers themselves is enhanced, design of agricultural mechanics is easier to operate or drought resistance capacity of farm products is improved, it means that the capacity of control is improved. Under such a circumstance, only expansion of the scale of farms can make the average constant cost reduced. If expansion of the scale of farms exceeds the control capacity of the operation subjects, then the situation of diminishing marginal returns will appear, that is, land productivity is reduced. Only if the operation scale of farmland suits the control capacity of the operation subjects, can all sorts of production elements acquire optimum combination and the most economical application. Otherwise, application of all sorts of production elements will not be insufficient. Therefore, the operation scale of farmland is expanded with continuous improvement of the agricultural productivity and is the outcome of adapting to the improvement of capacity of management and control of the operation subjects.

1.2 Explanation to the internal mechanism of scale management of land based on the capacity of management and control

In view of the above analysis and from the perspective of management and control capacity, the internal mechanism of scale management of land can be stated as: scale management of land means in the process of development of productivity, increase of capital (human capital and material capital) in agricultural production with improvement of skills enables the management and control capacity of agricultural operation subjects to be gradually improved and the scope of their effective management and control of other production elements (including land) to be expanded. In this process, when the quantity of input and combination means of all sorts of agricultural elements accord with the management and control capacity of operation subjects, production potentials of all production means can be brought into full play and the scale of land is thus expanded.

2. Realistic explanatory power of the internal mechanism of scale management of land

2.1 Explanation of consistency between scale of land and productivity of land

As to the relationship between scale management of land and productivity of land, one viewpoint is held that scale management changes reversely with productivity. That is to say, the larger the scale of land is, the lower the productivity of land, and the smaller the scale of land is, the higher the productivity of land. RoyProsterman et al presented facts of agricultural production in developing countries, such as India, Kenya and Brazil, etc, (Roy Prosterman, Tim. Hanstad & Li, Ping, 1996). Although measurement standards for the scale of land in each country were different, a unanimous conclusion was got that scale of land changed reversely with productivity. Analysis of agricultural development practice in China by domestic academics indicates that economy of scale scarcely exists in grain production, (Liu, Fengqin, 2003; Wan, Guanghua & Cheng, Enjiang, 1996; Zhang, Zhonggen & Shi, Qinghua, 2001). According to authors of this article, scale of land does not go counter to increase in yield per unit. During the period of underdevelopment of productivity, management and control capacity of operators on agricultural production elements was weak, so they could only overcome the bottleneck of combination of elements input by means of increasing their own investment to increase production. Thus, they could only conducted intensive cultivation in small pieces of land for pursuit of economy; if expansion of land scale exceeded the capacity of management and control of the operation subjects, the only possibility was that land returns would decrease and yield per unit would also be reduced correspondingly. Generally speaking, in developing countries, human capital of operation subjects was relatively low, together with low level of

agricultural mechanics difficult to operate, low level of irrigation, bad quality of varieties of crops and weak capacity of management and control, large scale of operation exceeding the control capacity of operation subjects cause insufficient use of such production elements as land, which is manifested as yield per unit reduced with expansion of the scale. In countries where productivity is highly developed, improvement of quality of variety of crops, irrigation and soil makes the capacity of management and control strengthened, and only expansion of land scale can optimize combination of elements, which naturally will boost increase of land productivity. In the process when scale management of land is expanded with improvement of skills in developed countries, the fact that yield per unit gets correspondingly increased proves the above viewpoint. "The revolution of land productivity brought about by scientific progress in US started in the 30s in the Twentieth Century, symbolized by the birth of hybrid corn. In the following several decades, yield per unit of broomcorn, wheat, rice and cotton is also increased on a large scale.... The truth that yield per unit has increased twice in the past 60 years is attributed to application of modern biology and chemistry science," (D. Gale Johnson, 2009). T.A. Miller et al from US made a comprehensive analysis in a large number of typical survey data about all districts of US, which indicates that, (Yujiro Hayami & Yoshihisa Godo, 2003), in the past long period, the cash cost of one Dollar of gross income is 70 cents in small farms with an average annual sale amount (generally speaking, sale amount changes in the same direction with that of land scale) of \$18,000, whereas that of large farms with an average annual sale amount of \$133,000 is 61 cents, namely the latter being 14% lower than the former. This analysis indicates that, in agricultural production, only if land scale attains the limit of management and control capacity of operation subjects, can production be effective and achieve the optimum scale of land. If scale of land surpasses or is below the limit, production is inefficient.

2.2 Explanation of tenancy relationship of land which leads to improvement of the status of operators in the process of expansion of land scale

In developed countries (districts), the proportion of operators is increasing who both privately own and rent land for their agricultural operation and rental of land has become a primary approach to expand farms. The truth that they expand scale of farms by renting but not purchasing land is not only because that burden of renting land is not as heavy as purchasing land, but more because rental of land accommodates with the trend that increase of productivity leads to higher capacity of management and control. This is because the agricultural production means with unification of ownership and right of use can characteristics of agricultural production, which is often encountered with some issues of decision making that can not be resolved by the book, including spatial issue, seasonal issue, mechanical issue, biological issue and selection of seeds with high content of technique. In some cases when the party who is not present can not acquire adequate information, he is not able to effectively deal with these issues of decision making. Compared with the proprietor (lessor), when the operator (tenant) has more rights, the economic incentives of his effective decision making can play a more effective role and the capacity of management and control of the operator is higher, which can promote better the increase of agricultural productivity of economic profit.

It should be noticed that, protection of tenancy system by the nation in terms of policy is also an important factor. The specific content of protection includes, (Zhou, Cheng, 2007), protection of tenancy right, limitation to the amount of land rented, compensation to improvement of plowland and adjustment to dispute of tenancy, and France is the most typical country in this aspect. The tenancy policy of France mainly protects interests of tenants and at the same time interests of landowners so as to guarantee normal running of the tenancy system. The trend of tenancy relation in France is that, rights and freedom of tenant farmers are more and more. For instance, they can freely arrange labor service and operation projects, and their contribution to previous improvement of soil can be compensated when the tenancy relationship is cancelled. Furthermore, the tenancy law in 1946 guaranteed legally interests of tenant farmers and this law stipulated that rate of increase of rent should not exceed index of increase of agricultural products' price so as to protect interests of tenant farmers.

3. External conditions for scale management of land

At different stages of economic development, agricultural operation subjects are faced up with different environmental constraints. Under different environmental constraints, all operation subjects make a rational choice to maximize profits, which may promote scale management of land when productivity is developed to a certain degree.

3.1 Challenges to reduction of comparative advantages of agriculture

Comparative advantage means profits brought by input of some production elements in different fields. Driven by the motive of maximizing profits, subjects who have desposition on production elements may transfer these elements from fields with small profits to fields with large profits, and this sort of stimulus universally exists in

the situation when elements can flow freely and information is smooth. When economic development enters a certain stage, agriculture will be faced up with challenges of reduction of comparative advantage. That is, returns of elements in agricultural production are smaller than returns in non-agricultural fields. Reduction of comparative advantage in agriculture can be explained from the two aspects of demand and supply. From the perspective of supply, elements which affect agricultural production are influenced by economic factors of natural condition, element endowment and introduction of technology and social factors of national policies. Some developed countries in terms of agriculture, such as Japan, and a great variety of developing countries, are later developed countries, so their agriculture depends on introduction of technology to a great extent, which is greatly affected by natural conditions. "Both in terms of seeds of crops and means of cultivation, transfer of agricultural technique has to undergo test and research by transferees to adapt to local natural environment, which requires high human capital," (Yujiro Hayami & Yoshihisa Godo, 2003). Obviously, compared with industrial technology, introduction of agricultural technology is highly restricted, but the level of privately developed technology is laggard. Thus, if farmers go on operation in land with original scale, the potential to increase production is trivial, and speed of agricultural income increase is slow, which is especially obvious in developing countries. From the perspective of demand, agricultural products are inelastic compared with non-agricultural products. "Calculated according to the market price, the actual food income elasticity of demand in developing countries is estimated to be approximately 0.5 or a little bit higher. By contrast, in North America and countries in Western Europe where income per capital exceeds \$10,000, consumption of animal protein and fat comes to complete saturation, the actual food income elasticity of demand is estimated to be approximately zero even if the factor of quality of consumer goods is taken into consideration," (Yujiro Hayami & Yoshihisa Godo, 2003). When economic development boosts increase of income, demand of human beings on non-agricultural products enables income and wages of non-agricultural departments to be universally increased, and when there are large employment opportunities, it means to farmers that the cost of opportunities to undertake agricultural production is enhanced. At this time, farmers have two choices to make: either to stay in rural areas, then they can increase the level of labor force income and avoid the trend of reduction of income either through part-time operation or through expansion of scale management of land; or to leave rural areas and switch to non-agricultural departments, then they can obtain high wages and rent out or sell their original land, through which they can promote scale management of land by means of land flow.

3.2 Selection of scale management of land driven by changes of relative factor price

Natural resource endowment may determine the initial agricultural production means of a country. With economic development and increase of capital accumulation, capital is increased in relation to quantity of labor forces and land, and only if agricultural production means is transferred to capital intensive means, can economic profit be gained. Practices in all countries indicate that, one of approaches to realize scale management of land is to employ relatively rich resources as much as possible in the process of agricultural production so as to replace scarce resources, which is the case both in countries with more population and less land and in countries with less population and more land. According to data offered by Yujiro Hayami and Yoshihisa Godo, (Yujiro Hayami & Yoshihisa Godo, 2003), it can be calculated that during the period from the year 1955 to 1995, the relative price of labor forces increased annually in a speed of 4.3%, whereas agricultural implements and fertilizer reduced annually respectively in a speed of 5.4% and 1.3%. substitution of this sort of production elements was not only rational in economy, but could also promote improvement of technical level, because this was not a pure substitution under the same technical condition, but was a process of technical renovation which contained "production elements which were helpful for increasing reduction of the value of use, (Yujiro Hayami & Yoshihisa Godo, 2003). Besides, this also meant a development process of technology to alleviate strength of labor strength. In this process, the capacity of management and control of operators was improved and operation of large scale could not be formed without the distortion of the policy, (Yujiro Hayami & Yoshihisa Godo, 2003). In 1935, the total number of farms in US was 6,812,000, each with an average area of 155 acres, and the total number of farms in 1980 was 2,428,000, each with an average area of 429 acres. By the year 2006, the total number of farms in US had been further reduced to 2,090,000, merely amounting to 30.7% of that in 1935, and the average area of farms was increased to 446 acres, equaling to 287.7% of that in 1935, (Zhou, Cheng, 2007).

3.3 Process of marketization of agricultural production elements

Marketization of all sorts of production elements can rapidly and precisely reflect their scarcity and adjust the relation of supply and demand between them. Under direct effect of price, production elements may flow to sections with high marginal returns, which may motivate changes of production means of the industry. When the rate of interest fluctuates freely and capital belongs to rare production elements, the relative price of labor force is low and then farmers may tend to employ labor intensive production means. At this time, labor intensive production

means high supervision and management expense and low capacity of management and control. Hence, in the situation when relative labor price is high, production of small scale in household operation is the most economical. With development of economy, capital accumulation is increased and when capital becomes a relatively rich production element, the benign growth of credit market may enable households to acquire capital relatively cheaply. At this time, the subject of the economy is inclined to such production means of capital intensive as mechanization, etc, to replace production means of labor intensive. And expense of management and control in mechanical production is far lower than that in labor production. Therefore, under the condition of mechanical production, capacity of management and control of operators is improved, and accordingly, expansion of scale management of farmland becomes likely in terms of economy. The more developed the element market, the more economical the agricultural production means under guide of price. "Nothing can more effectively improve welfare of people than the free choice of opportunities and freely escaping from harsh areas," (Yair. Mundlak. (2004). This fully summarizes significance of marketization to improvement of people's welfare.

Deepening of integration of urban and rural labor market marked by the reform of household registration system in China has become an important factor to boost economic development and has driven non-agricultural employment of rural surplus labourers. Study by Cai Fang et al indicates, (Cai, Fang, 2008), migrant workers accounted for 46.7% of urban employed population in 2007 and the process of marketization of labor market drove economic growth; from 1978 to 1989, transfer of labor forces from agriculture with low productivity to non-agriculture with high productivity had a contribution rate of 21% to GDP and, at the same time, promoted flow of land, paving the way for scale management of land. Study by D. Gale Johnson on failure of Russian collectivization also indicates that, (D. Gale Johnson, 2009), as a result of restraint to flow of elements, unhealthy products and market of production elements has become a root of failure for agriculture in some countries.

3.4 Indispensable role of the government in scale management of land

The nature of scale management of land is the decision made by operation subjects to expand operation area of land for pursuit of maximization of profits, and all external environment including a series of policies by the government can not affect progress of scale of land without peasant households. Roles of the government in scale management of land can be classified as one that can act and one that can not act. The latter mainly means the government should guarantee free flow of elements in agricultural production and sensitivity of price mechanism. The former means that agricultural production has its externality, characteristics of such public products as agricultural technology and information, etc, and fragility of agriculture. The role of the government in providing public goods and protecting ecological environment is indispensable. Besides, the government should also take measures to reduce the transaction expenditure of land flow and stimulate roll-in and roll-out of land, including setting up special management institutions, encouraging constructing farms of large scale, and help small holders withdraw from agricultural production, etc.

4. Conclusion

Scale management of land refers to decision making of operation by the operation subjects in their pursuit of maximization of profits, which is subject to their management and control capacity. With progress of skills, only expansion of land scale can enable all elements of agriculture to tap their perspective potential and obtain the advantage of economy of scale. What the government can do should provide the operation subjects with adequate economic stimulus so as to make decisions.

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