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# **Industrial Upgrade, Adverse Employment Shock and Land Centralization**

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# ABSTRACT

Traditional Development Economics defines economic development in the view of transferring rural surplus labor force. It implies the industrialization is in a static state at a certain level while it is in a process of continuous industrial upgrade in reality. Under the circumstances, we analyze phenomenon followed by the upgrading of industrial structure such as return migration and mid-aged rural labors' difficulty in job-hunting and demonstrated the influence of land centralization based on the practice of industrial upgrade and rural change in Suzhou. Finally it come to the conclusion that because of the extensive competition on simple-labor market, the industrial upgrade will make a adverse employment shock upon mid-aged rural labor which will lead to the more uncertainty of peasants to get jobs in the industrial section . If government takes an improper policy of land centralization, peasants will lose guarantee in the future and resist the land centralization. After the comparison between one-off compensation and land cooperation, a further demonstration show that the method of one-off compensation will depress peasants' enthusiasm in land centralization while the form of land cooperation can guarantee and promote peasants' welfare under the given institution of land ownership. As a result, land cooperation allows the smooth operation of land centralization and supports the industrial upgrade to some extent.

**KEYWORD** Over-confidence, Regional Government Competition, Redundant Construction, Yangzte River Delta

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## 1. Motivation

For quite a long period, Traditional Developing Economics believes that the transfer of rural labor into the industrial section is the only way to balance the economic development in urban and rural areas. Zhang Peigang mentioned in *Agriculture and industrialization*, his creative works of Developing Economics, rural labor will not always stand in a static state on farms but part of it will transfer into factories to engage in industrial production (Chang, 1949). Later, Lewis established the Dual-Sector Model (Lewis, 1954) to elaborate that the transfer of rural labor is an imperative and pointed out the essence of economic development is structure transition from traditional department into modern industry, which mainly referring to the transfer of rural surplus labor into modern sections. Heading for the goal of transferring into industrial sections, Harris-Todaro Model (Harris, Todaro, 1970) converted the idea of industrial section to urban section (they assume the industrial section only exist in the cities). Thereafter the model has become classic in the research of labor transfer. So later it has become a topical subject of economic development research that rural surplus labor departing from agriculture to balance the agriculture and industry, the so-called Dual-Economic Structure in cities and countryside.

However, if we have a retrospect at the development of developed areas in China, the transfer of rural surplus labor is not so theoretical. The process of economic development should not be simply regarded as the transfer of simple labor from rural areas to stay immobile in the industrial or non-agricultural section. During our research on the current urbanization, industrial upgrade and new rural construction in Suzhou, we found that after the requisition of rural land in the process of urbanization and industrialization, the phenomenon of difficulty in job-hunting has arisen in the transfer of rural labor. Those who are mid-aged rural labor find themselves hard to get a job in the industrial section after rendering their land, since the section requires labor skill training. On the other hand, some township enterprises which established long ago are now facing the pressure of upgrading and competition, among which not a small amount of mid-aged rural labor have lost their jobs and are facing the pressure of re-employment. The two phenomena reveal that economic development is not simply counting on the transfer of rural labor into industrial section and urban section. We can tell that the transfer of rural labor from different age groups have their unique characteristics, especially at the current stage, the focus is put on the

realization of enhancing industrial level, which is also known as the industrial upgrades. It requires higher demand on labor skills, which cause the large amount of rural labor especially the mid-aged simple labor, can not adjust themselves to the labor with high-skill required by the industrial upgrades and face the threat of deadlock or unemployment. Meanwhile, the expansion of industrial and urban scale requires more and more rural land. Then a conflict appears that while mid-aged peasants have difficulty in job hunting and even face the crisis of losing their jobs, the dispersing lands are centralized and dedicated to industrial sections and urban sections. Even if these peasants have changed into citizens, their rights of development are critically restricted. We are glad to notice that new models are turning up in Suzhou in order to realize the peasants' rights of rural land, such as land cooperation, community cooperation and real estate cooperation. All of them entitle peasants to share part of the profits from assets return brought by industrialization and urbanization based on the land they own, which to some extent release the peasants' pressure of job-hunting. (Zheng Jianghuai etc. 2007)

Through analysis on the new phenomenon along with the economic development, we realized that the process of economic development described by modern development economics is far too abstract. It implies that industrialization relies on certain technology skills or it could be simply regarded as a sufficient condition in the employment expansion of rural labor (Yao Yang, 1999), which ignore the fact that adverse shock and difference in structure demand of transferred rural labor by continuous industrial upgrade. Since the mid-aged rural labor face the pressure of job-hunting and unemployment and return to the rural area, the centralization of land in the form of land cooperation has increased peasants' income and feasible ability, which has not gained enough attention by modern development economics. However, it is our main focus and will be elaborated in the following part.

Recent researches about the backflow of Chinese peasants are focusing on the concluding and testing. For example, Hare believed the key factors of labor transfer-out and backflow in China are different. The urban admittance system made ingoing peasants face certain kind of risk. Meanwhile the immature factor market at transfer-out location also restrict labors transfer into urban sections, which lead to the peasants' back and comutation in sections and districts (Hare,1999) . Zhao Yaohui analyzed the data of rural families in six provinces of China between August and September in 1999, and gave the conclusion that the factors influencing the peasant's

transfer plans include the unstable condition of land ownership, urban admittance system, spouse leaving for job-hunting in other big cities, the proportion of adult labor in a family and the development of none-agriculture section in rural areas(Zhao, 1999, 2002). Besides, the respective analysis on labor transfer of different types are prevalent in references (Vanderkamp,1971; Kau and Sirmans,1976), we distinguish young rural labor and mid-aged rural labor according to ages, as the classification made by Wu Zhongming(2003). According to Pang Lihua(2003)'s research on senior labor supply in rural area, the percentage of peasants aged from 50 to 59 who take part in agricultural production reaches 90%. The research also demonstrated the annual work hours of senior peasants in the none-agriculture section reaches 1400h, which strongly reveals that peasants aged from 40 to 60 can still join in various production activities. Considering land function and circulation, Hare (1999) regarded that under the situation that peasants can not enjoyed the registered permanent residence in cities, the land ownership is the only source which provide peasants with income and social welfare simultaneously. In the process of land circulation, government expropriated land by force and low compensation. However, the compensation can not be measured in the standard of market price but the standard to afford current basic living. Wang Xiaoying(2006) did research on distribution of expropriated land in rural areas, and the average compensation in Kunshang District of Suzhou is 28.9 yuan per square meter ,which accounts for 15.9% of market price.

Compared to these researches, our work is based on Zheng Jianghuai's research (2007) on the weakening or even losing of feasible ability of rural labor on the background of industrial upgrade in Suzhou, the developed districts in east china. Our work also elaborated how the adverse shock affects rural labor of different ages. And he pointed out that compared to young peasants, the main weakness of mid-aged peasants lies in the physical part and expected rate of return. That is to say, if the human resource and skills have not enhanced after transferring into industrial section and urban section, it will definitely shadow economic development by the successful transfer of rural surplus labor. Because of factors of land contract system and lack of land, return migration can not get high enough agricultural profit .Since they can not get enough compensation in the centralization and transfer of land, the development of rural labor will be in a dilemma. Once it is predicable, it will hinder the centralization of land and hinder the industrial upgrade as well as the urbanization afterwards. Based on the idea, our thesis further improved that land cooperation

operating in the developed district as Suzhou will release the dilemma of that part of rural labor and support the upgrading of industrial structure and urbanization to some extent.

The frame of this paper is as below. The 2<sup>nd</sup> section elaborates how industrial upgrade make the adverse shock on mid-aged rural labor .The 3<sup>rd</sup> section is divided into two parts. The first part discusses the influence of the adverse shock on mid-aged rural labor under one-off compensation condition, which hinders the land centralization. The other part mainly focuses on how the land cooperation release the impact of adverse shock and support land centralization. The last section is a conclusion.

## **2. The adverse employment shock**

The opening china is becoming the center of the international manufacturing industry. A flood of foreign companies has established manufacturing factories in china, which in fact has attracted large amount of rural labors' employment. However, what foreign companies value is the domestic cheap labor, raw material and energy supply, along with the main investment focus still set on the low-value-added processing and assembling sections. In this way, most of the profits are gain by foreign enterprises who own the core technology and international brand. Compared to the above, the profits gained by the domestic investors, labors and government are comparatively low, and the international competitive ability is still rather weak.

In order to solve the problem, lots of developed district have set their next goals to realize the upgrade of modern manufacturing, as a surpass strategy it will definitely have an impact on the employment of rural labor in the industrial section. The object of our study is the group of mid-aged peasants in the developed districts, who are generally not well educated and physically weaker than before. However, they can still provide certain kind of labor. We will use a company employment model to describe how the industrial upgrade has an employment impact on the mid-aged rural labor. Two hypotheses exist in the model: (1) the difference in age determines the difference in physical labor supplied (2) the industrial upgrade inside companies are driven by endogenous reason (company's pursuit to profits) and exogenous reason (government's pursuit to GDP and taxation )

First , assume three factors are demanded by the company production process, physical labor

as  $n_1l$ , mental input as  $n_2t$  and capital as  $K$ . The hired physical labor is all from rural workers. With generally low education and insufficient training of skills, rural workers can only provide simply physical labor.  $l$  represents the amount of labor provided per physical worker,  $b$  represents age of physical workers. Since the age of 40 is a threshold of turning into mid-aged, we set it as a dividing line. We can get:

$$l(b) = \begin{cases} l_1 & 20 \leq b < 40 \\ l_2 & 40 \leq b \leq 60 \end{cases} \quad \text{且 } l_1 \geq l_2 \quad (1)$$

It implies each young physical worker offers more labor than that each mid-aged physical worker offers. When  $b$  equals, all the labor offered by physical works are of same property,  $n_1$  represents the amount of physical worker hired by companies,  $n_2$  represents the amount of mental workers hired by the companies,  $t$  represents the amount of mental input per mental worker and  $\bar{K}$  represents the capital amount used by the enterprises, we assume it as a fixed value. The production function of the enterprise is  $f(n_1l(b), n_2t, \bar{K})$  which satisfies  $f_1, f_2 \geq 0, f_{11}, f_{22} \leq 0, f_{12} \geq 0$ .

The production price  $P$  depends on  $a$ , the value-added of production. The production price will be higher if the volume of  $a$  increases, with  $P'(*) \geq 0, P''(*) \leq 0$ . In this point of view, the goal of industrial upgrade is to produce high value-added products and gain more profits. Meanwhile, the add value of productions is influenced by the technology of enterprises and intellectual capital. The add value will be higher if the amount of mental work devoted into R&D increases. Here we assume the add value is only influenced by the total amount of mental works, as  $a = a(n_2t)$ . Meanwhile, the add value of production also represents the rank of the industry, and we assume  $a' \geq 0, a'' = 0$ , that is to say we assume the mental input by industrial rank is degree of one.

At present, the industrial upgrade in many areas is directed by the local government. On one hand, it is beneficial to increase the local government fiscal through enhancing the profits of local enterprises. On the other hand, it is also an important index for the upper government to assess the local official. According to the model, the local governments are propelling the industrial upgrade

through providing them with allowance of  $s$  per mental labor. The activities of enterprises are restricted by the budget. We assume the wage of mental workers is higher than that of physical workers,  $w_1 = \sigma w_2, 0 < \sigma < 1$  and we also set  $w_2 = w$ . Then the budget constraint of enterprises can be written as  $n_1 \sigma w + n_2 w \leq M$ .

Then the maximization problem of the enterprise is:

$$\begin{aligned} \underset{n_1, n_2}{\text{Max}} \pi &= f(n_1 l(b), n_2 t, \bar{K}) * P[a(n_2 t)] + s n_2 t \\ \text{s.t.} \quad &n_1 \sigma w + n_2 w \leq M ; \quad n_1, n_2 \geq 0 \end{aligned} \quad (2)$$

and the FOC is

$$f_1' l(b) P[a(n_2 t)] - \lambda \sigma w = 0 \quad (3)$$

$$f_2' t P[a(n_2 t)] + f'(\cdot) a'(\cdot) t + s t - \lambda w = 0 \quad (4)$$

combine (3) and (4) and simplify, we have

$$\sigma^{-1} f_1' l(b) - f_2' t - \frac{f(\cdot) P[a(n_2 t)] a'(\cdot) t + s t}{P[a(n_2 t)]} = 0 \quad (5)$$

What we concern is the impact of industrial upgrade on employment amount of mid-aged peasants. Derivate  $\Omega = n_1 l(b)$  with respect to  $a(\cdot)$  and we get:

$$\frac{\partial \Omega}{\partial a} \geq 0 \quad (6)$$

(see appendix 1), formula (6) manifested that the industrial upgrade is asking for more labor in the physical section. Combining the production function of enterprises and formula (1), we can find if  $n_1$  is fixed,<sup>①</sup> demand of  $l$  will increase as  $n_1 l$  increase, then inevitable part or even all of  $l_2$  will be replaced by  $l_1$ . According to the definition of the average labor amount of two different age groups defined by (1), if all the workers are at the age between 40 and 60, when the industrial upgrade occurs, the employer will definitely fire part of the employees and hire the

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<sup>①</sup> The invariability of  $n_1$  is due to the fact that if the employer pays no cost in firing workers, and wage is paid by worker number exogenously, it is cost-efficient for the employer to employ young workers rather mid-age workers. And it is also preferable to employ  $n_1$  young workers considering the future training expense.

young works at the age group[20, 40) , who can offer more labor. Then we can reach the proposition below:

**Proposition 1: when the enterprises are in the process of industrial upgrade, and if the amount of hired labor is fixed, part or all of the mid-aged workers will be replaced by young workers, namely the adverse shock of industrial upgrade on mid-aged peasants (simple physical workers).**

The model reveals that the industrial upgrade(the increase of add value  $a(\cdot)$ ) will increase the production price  $p$ . This incentive of profits will encourage companies to devote more mental labor  $n_2t$ , and the increase of mental labor will ask for more physical labor  $n_1l$  to coordinate. From formula (3), it can be seen that when the mental labor  $n_1l$  increases, with the wage  $w$  as a constant, the marginal production of physical works will exceed the marginal cost, which makes companies put into more physical labor. The reasons lead to industrial upgrade could be distinguished as market reason and government reason. If the creative competition is fierce in the market with new products coming out, it will lead to the fall of  $a$ , as industrial rank, of certain companies' mental labor input  $(n_2t)^*$ . If companies want to keep the current profit level, the feasible way is to enhance the input of mental labor. Besides, the model of government-leading will become more and more important. Based on what evaluated above, government has incentive to encourage enterprises to industrial upgrade and to give subsidy to R&D activities of enterprises.

According to formula (6), we can get the inequality based on the same reason:

$$\frac{\partial \Omega}{\partial s} \geq 0 \quad (7)$$

The formula (7) demonstrated that the increase of government subsidy into the process of industrial upgrade will lead the enterprise to devote more mental labor, and also physical labor. it will squeeze out the mid-aged workers from the market, that is  $\frac{\partial n_2}{\partial \Omega} \frac{\partial \Omega}{\partial s} \leq 0$ .

**Proposition 2: Under the circumstance that government enhances subsidy in the process of**

**industrial upgrade, if the amount of physical worker hired by the enterprises is fixed, it will lead to more input of physical labor and squeeze part or all of mid-aged peasants out of the market.**<sup>①</sup>

The mechanism of Proposition 2 is as same as Proposition 1, though the incentive of industrial upgrade do not again based on the market price but subsidy offered by the government. Besides, in this model, we treat peasant workers as pure physical workers in a static state. In fact, through skill trainings, peasants can offer certain amount of mental works or complex works. And obviously, it is more worthy for the enterprise to train the young peasant than the middle-age ones because of the longer period of return. That is why on the background of industrial upgrade, the development of industrialization might form an adverse employment shock on mid-aged rural labor. In our opinion, to realize the difference in the age structure will change the view held by traditional development economics that economic development will certainly propel the peasant employment.

### **3. Method to Release the Shock**

The developed districts as Suzhou are launching land centralization to meet the demand of industrialization and civilization. However, the inappropriate way to centralize land will easily cost the benefit conflicts between peasants and the government. Recently, the models of centralizing land are known as government expropriating land, land leasehold and land cooperation. Inspired by the model of Yao Yang (Yao, 1999), We are developing the model of a peasant household to analyze how peasant arrange the production factors when facing the adverse employment shock. In the model in 3.1, we assume government can buy land from peasants in the form of one-off compensation but still they can not force peasants to sell the land, therefore we can make clear the true attitude of peasants towards land centralization. We will add the factor of land cooperation in model 3.2

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<sup>①</sup> Some recent work prove our viewpoints indirectly. For example, Zhao (2002) showed once the age increase by 10 years based on 30.9, the return rate will raise by 9.8 percent. This conclusion proves one of our viewpoints empirically, namely that peasant begin to return to their hometown after 40.

### 3.1 One-Off Compensation

Assume there are two stages, at the first the peasants are around the age group [20, 40], they begin to arrange their initial resource. Between stage one and stage two, according to the local industrial upgrade, adverse shock on peasants is brought up by the industrial section, which lead to the dim prospect of the peasant in labor market. The shock is revealed by the amount of peasants hired by the enterprises. Known from the adverse shock model above, the target of the impact is mainly mid-aged peasants who are above 40 and whose energy is weaker than before. According to the fact that it is more supply than demand in the industrial section in developed areas in China, we can come to the conclusion that the labor supplied by peasants is as a quota,  $\bar{L}$ , which implies the activities of peasants can not influence the labor demand of enterprises. In the first stage, enterprise provide work positions as  $\bar{L}_1^w$ , the expected employment amount of peasant at the second stage is  $\bar{L}_2^w = \bar{L}_1^w - \theta$ , in which  $\theta$  is a random variable representing the adverse employment shock on peasants along with the industrial upgrade. That is why  $\theta$  is non-negative. On the range  $[0, \bar{L}_1^w]$ , the probability density is  $\phi(\theta | \varepsilon)$ , condition parameter  $\varepsilon$  represents the scale of industrial upgrade. Since we have known scale of industrial upgrading is forming an adverse employment shock on the peasants, namely  $\partial\Phi(\theta | \varepsilon) / \partial\varepsilon \leq 0$ ,  $\Phi$  is the cumulative distribution function of  $\theta$ . At the second stage, peasants' ages are around 40 to 60, the adverse employment shock has taken place, he can only arrange the rest of his resource.

Assume the initial endowment of peasant is the amount of labor  $\bar{L}$ , amount of undertaking land  $\bar{T}$ . In the form of one-off compensation, peasant families have three income resources. One is the agricultural income from own land, the production function is  $F(T, L)$ , among which  $T$  and  $L$  represent the input land and labor respectively. The second is the wage income from industrial section, the exogenous wage of industrial section is  $w$ ; the third is the one-off compensation by transferring land, with the price per unit of  $r^b$ . Because of the immature rural land market, the transaction cost existing in the transferring is  $c^b$ , the one-off compensation from

transferring amount  $T^b$  of land then is  $T^b(r^b - c^b)$ .

We use Cobb-Douglas Production Function  $F(T, L) = T^\alpha L^\beta$  to describe the agricultural production. To ensure the concave of function, we assume  $\alpha < 1, \beta < 1$ . Many papers regard the agricultural production as decreasing return to scale, so we assume  $\alpha + \beta < 1$ . Then the peasant's problem in the first stage is:

$$\begin{aligned} \underset{L_1^f, T_1^f, T_1^b, L_1^w}{Max} \quad & \pi = (T_1^f)^\alpha (L_1^f)^\beta + wL_1^w + T_1^b(r^b - c^b) + \mu E[\pi_2^*(T_1^b)] \\ \text{s.t} \quad & L_1^f + L_1^w = \bar{L}; \quad T_1^f + T_1^b = \bar{T}; \quad L_1^w \leq \bar{L}_1^w; \quad L_1^f, L_1^w, T_1^f, T_1^b \geq 0 \end{aligned} \quad (8)$$

Among the above,  $L_1^f, L_1^w, T_1^f, T_1^b$  represent respective, in the first stage, the labor amount used in the agriculture production, in the industrial production and the land amount used in the agricultural and the one-off compensation.  $\mu$  is the discount factor and  $\mu < 1$ .  $\pi_2^*$  is the optimal value function of peasant income in the second stage. Assume the optimum interior solution exists, we can get the FOD as below:

$$\beta(T_1^f)^\alpha (L_1^f)^{\beta-1} - w = 0 \quad (9)$$

$$-\alpha(\bar{T} - T_1^b)^{\alpha-1} (L_1^f)^\beta + (r^b - c^b) + \mu \frac{\partial E[\pi_2^*(T_1^b)]}{\partial T_1^b} = 0 \quad (10)$$

Formula (9) explains peasants will get marginal benefit from agricultural production equal to the wage from the enterprises. Formula (10) demonstrated that the current loss and expected loss in the agricultural production should be compensated by the one-off compensation. The second first order condition is crucial, which demonstrates peasants' attitude to land transfer do not only depend on present profit but also the future profit. Because of the low one-off compensation, the voluntarily transferred land is few or even none. This is the main reason why developed districts find it hard to expand agricultural production into large scale. We can regard the third item of formula (10) as the shadow price of land transfer  $P_2$ . Of course, the shadow price must be negative. According to formula (10), the land amount of the  $T_1^b$  is the Increasing Function of shadow price  $P_2$ , namely

$$\frac{\partial T_1^b}{\partial P_2} > 0 \quad (11)$$

In reality, the types of land transfer varies from transferring land into large-scale cultivation undertaken by rich families, transferring land seasonally to other peasants, to government expropriating land, land centralization for building factories led by government as well as land shares system. Among the above, some types are originated by the administrative order from government department and can not be solved by peasants themselves. To simply the analysis, we only use the land voluntarily transferred to represent all the situations. The reason why peasants would like to sell the land is to balance the marginal value of work income and agricultural income at the hypothesis that the chances of factory employment and compensation exist. It is different from the type of land leasehold. To illustrate the one-off compensation, at the second stage we assume peasants can not get follow-up income from the first stage.

The shadow price of land transfer at the first stage depends on peasants' income from the second stage. Assume when peasants entering the older age group [40, 60], they won't transfer land any more but distribute labor in different production use, which will not effect our conclusion. Before the second stage starts, adverse employment shock occurs. To all the peasants, the impact will deduce their hiring possibility in factories. Under the condition of adverse employment shock, the choice of peasants in the second stage is

$$\text{Max}_{L_2^f, L_2^w} \pi_2 = (\bar{T} - T_1^b)^\alpha (L_2^f)^\beta + wL_2^w \quad (12)$$

$$\text{s.t} \quad L_2^f + L_2^w = \bar{L} \quad ; \quad L_2^w \leq \bar{L}_2^w \quad ; \quad L_2^f, L_2^w \geq 0$$

then Kuhn-Tucker Condition is

$$-\beta(\bar{T} - T_1^b)^\alpha (\bar{L} - L_2^w)^{\beta-1} + w - \lambda = 0 \quad ; \quad \lambda(\bar{L}_2^w - L_2^w) \geq 0 \quad (13)$$

that is to say the optimal agricultural labor must make the marginal revenue from agriculture equal to the wage. Replace  $L_2^w$  in formula (13) by  $(L_2^w)^*$ . From formula (13) it can be concluded that when  $\lambda > 0$ ,  $\bar{L}_2^w - (L_2^w)^* = 0$ . The realistic explanation of this situation is that enterprises are providing wage much higher than the agricultural income. That's why peasants are so eager to enter the industrial section, and if they can get a fulltime job they can abort all the agricultural activities on land. It can be described in Mathematics way as  $-\beta(\bar{T} - T_1^b)^\alpha (\bar{L} - L_2^w)^{\beta-1} + w > 0$ .

We use  $\bar{L}_2^w$  to substitute  $(L_2^w)^*$ , signal the maximum of shock factor  $\theta$  as  $\bar{\theta}$ , so the shadow price can be rewrote as

$$P_2 = -\mu \int_0^{\bar{\theta}} \alpha (\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_2^w)^\beta \phi(\theta, \varepsilon) d\theta = -\mu \int_0^{\bar{\theta}} \alpha (\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_1^w + \theta) d\Phi(\theta, \varepsilon) \quad (14)$$

integrate by parts of (14) and we get

$$P_2 = -\mu [\alpha (\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_1^w + \theta) \Phi(\theta, \varepsilon) + \alpha \mu \int_0^{\bar{\theta}} \Phi(\theta, \varepsilon) d(\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_1^w + \theta)] \quad (15)$$

In this cross-stage strategy, the amount of land selling by peasants will grow at the first stage as long as the shadow price increases. To investigate the industrial upgrade scale  $\varepsilon$  we can research on the influence of adverse employment shock on shadow price of land transfer.

Derivate formula (15) with respect to  $\varepsilon$  and we get

$$\frac{\partial P_2}{\partial \varepsilon} = \int_0^{\bar{\theta}} \frac{\partial \Phi(\theta, \varepsilon)}{\partial \varepsilon} d(\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_1^w + \theta) < 0 \quad (16)$$

In this calculation, we use the inequation  $\frac{\partial \Phi(\theta, \varepsilon)}{\partial \varepsilon} \leq 0$  and  $d(\bar{T} - T_1^b)^{\alpha-1} (\bar{L} - \bar{L}_1^w + \theta) > 0$ . And

according to formula (11) and we get

$$\frac{\partial T_1^b}{\partial \varepsilon} = \frac{\partial T_1^b}{\partial P_2} \frac{\partial P_2}{\partial \varepsilon} < 0 \quad (17)$$

Formula (17) demonstrated that as the increase on scale of industrial upgrade (the increase of  $\varepsilon$ ) land voluntarily transferred will decrease, which lead to the recession of land to be centralized. In fact the logic of the result is quite simple: along with the industrial upgrade, the expected possibility of return to land is becoming higher, which leads to the growing labor devoted into land. The marginal return of agricultural labor decreases as long as the relative marginal return of transferred land decreases, which means the shadow price of transferred land at the first period is decreasing. To balance the marginal land return of the two stages, peasants will reduce the transfer of land.

One solution to release the difficulty of land centralization is to establish clear right of land transfer by which reduces the cost in the land transfer and incentive the peasants to transfer land. So under the same circumstance of adverse employment shock, if the right of land transfer becomes clear, maybe the motivation will be inspired. According to formula (10) and Implicit Function Theorem, we get

$$\frac{\partial T_1^b}{\partial c^b} = \frac{-1}{(1+\mu)(\alpha^2 - \alpha)(\bar{T} - T_1^b)^{\alpha-2} (L_1^f)^\beta} > 0 \quad (18)$$

The inequation comes from  $\alpha^2 - \alpha < 0$ . Above all, we can abstract the proposition to be test:

**Proposition 3: When the adverse employment shock on peasants during the industrial upgrade exists, there is a higher possibility that peasants are forced to return to the rural land. If this be predicted, their motivation of transferring land in the form of one-off compensation will be weaken, which makes the centralization of land become much harder. A more clear right of land transfer will release this pressure.**

### 3.2 Land Cooperation

As a new way to centralize the land, the form of land cooperation is developing fast to bloom in the areas such as Suzhou. It springs up in the process of peasants gathering and land centralization. Currently its purpose are mainly in two parts, first it centralizes land and rents them by batch to industrial and city sections. Even the peasants are collecting money to build standard factories, renting the dormitory and sharing the rent profits. Second purpose is to developing agriculture in larger scale. The former one plays a more obvious influence on adverse shock. But we base on the latter one to elaborate the mitigation of adverse shock by land cooperation

Assume the production function of cooperate cooperatives is the former agricultural production function, just newly put in the technology improvement factor as labor amplified  $A > 1$  to represent the advantage of production in large-scale in utilizing the production equipment. Assume  $N$  of peasants in a village organized a land cooperation, with the same production factor endowment. So for the peasant  $i \in N$ , the labor amount he owns is  $\bar{L}$ , land amount is  $\bar{T}$ , the agriculture production function is the same as set above, the wage of employees in the industrial section is  $w$ , the production function of land cooperation is  $G(T, L) = (\sum_{i=1}^N T_i)^\alpha (A \sum_{i=1}^N L_i)^\beta$ . For peasant  $i$ , the production function he faced is  $G(T^g, L^g) = [(N-1)T^{g*} + T^g]^\alpha [A(N-1)L^{g*} + AL^g]^\beta$ , among which  $T^g$  and  $L^g$  represent the land amount and labor amount peasant  $i$  put into the cooperation respectively,  $T^{g*}$  and  $L^{g*}$  represent the optimal land amount and optimal labor

amount devoted by peasants  $j$ ,  $j \in N$  and  $j \neq i$ . Peasants' income from the cooperation is endogenous, the wage  $w^g$  and stock share  $r^g$  depend on the marginal output of the land amount and labor amount, which are respectively as below

$$w^g = \frac{\partial G}{\partial L^g} = A\beta[(N-1)T^{g*} + T^g]^\alpha [A(N-1)L^{g*} + AL^g]^{\beta-1} \quad (19)$$

$$r^g = \frac{\partial G}{\partial T^g} = \alpha[(N-1)T^{g*} + T^g]^{\alpha-1} [A(N-1)L^{g*} + AL^g]^\beta \quad (20)$$

one of the advantages of land cooperation is it can smoothly avoid the difficulty in centralization of the land under the adverse shock. It can be proved that when  $N$  of peasants are in the equilibrium situation and  $A^\beta N^{\alpha+\beta-1} > 1$ , the marginal income curve of labor of the cooperation is always higher than that of self-cultivated land (except for when  $L = 0$ ). Beside, since  $A > 1$  and  $N \geq 1$ , the condition is surely satisfied. Given under the former optimal allocation, the marginal income is the same as that of self-cultivated land and cooperatives land. Thus, it will gain more income to keep putting labor into cooperation than into self-cultivated land. That is why peasants are now putting surplus labor into the cooperation continuously until marginal rent of the cooperatives equals to the marginal income of the land. In other words, if an adverse employment shock takes place, peasants will increase the land being centralized. This insight also makes us avoid to consider the cross-period adverse shock but only consider the influence by the exogenous variable.

According to the assumption above, the optimal problem is:

$$\begin{aligned} \text{Max}_{T^f, T^g, L^f, L^w, L^g} \pi &= (T^f)^\alpha (L^f)^\beta + wL^w + T^g r^g + L^g w^g \\ \text{s.t} \quad T^f + T^g &= \bar{T}; \quad L^f + L^w + L^g = \bar{L} \end{aligned} \quad (21)$$

At last we may find out whether necessary to discuss the corner solution because Lagrangian Solution is the overall optimal solution. When the Lagrangian Multiplier is strictly positive, we do not need to discuss the corner solution. Then we get 5 first—order conditions (27) to (31) (see appendix 2). Since all the peasants in the cooperation are the same, the allocations of their endowments are affirmatively symmetrical when it is in equilibrium. Use  $L^g, T^g$  to replace all the  $L^{g*}, T^{g*}$  in the optimal condition to simplify (28) and (31) in appendix. Combine (27) and (29) as well as (28) and (31), and we get the following equation respectively

$$\frac{\alpha L^f}{\beta T^f} = \frac{\lambda_1}{\lambda_2} \quad (22)$$

$$\frac{\alpha L^g}{\beta T^g} = \frac{\lambda_1}{\lambda_2} \quad (23)$$

From (22) and (23), we can get the conclusion that the land /labor proportion in the self-cultivated land and the cooperation should be the same, as :

$$\frac{L^f}{T^f} = \frac{L^g}{T^g} \quad (24)$$

What we concerned most is the scale of land to be centralized through the form of cooperation,

which is to say the voluntarily proportion of each peasant is  $\frac{T^g}{T^f}$ . According to formula (29) and

(31) in appendix 2, we can get the optimal land allocation proportion  $\Lambda$  as

$$\Lambda = \frac{T^g}{T^f} = \left[ \frac{1}{A^\beta N^{\alpha+\beta-2} (N + \alpha + \beta - 1)} \right]^{\frac{1}{\alpha+\beta-1}} \quad (25)$$

(see appendix 3). Since  $N$  at least equals 1, formula (25) is strictly positive, which means the land of cooperation from the peasants never equals zero, that is why this Lagrangy Solution is the overall optimal solution. The result also manifests that the cooperation have enhanced the welfare of peasants. From formula (25) we can see when  $\Lambda$  increases along with the growth of  $A$ . It means peasants are more willing to put land into the cooperation with the larger technology improvement with more positive impact on output. The reason why the cooperation can work is that it guarantees the land centralization and increases the living level of peasants simultaneously. One of the key factors to increase the productivity of cooperation is to make it adapt to the large-scale agriculture production. Besides we can prove that when  $N + \alpha + \beta - 2 > 0$ ,  $\Lambda$  will grow with the increase of  $N$ . When  $N + \alpha + \beta - 2 < 0$ ,  $\Lambda$  will decrease with the increase of  $N$ . However, since  $0 < \alpha + \beta < 1$ , only when  $N$  equals 1, the impact of the amount of cooperation members on individual land proportion is negative. But  $N$  equals 1 means the cooperatives does not exist, Ignore the condition when  $N$  equals 1, which means along with the increase of  $N$ ,  $\Lambda$  definitely rises. As same as the increasing amount of peasants joining in the land share cooperation, the amount of land devoted will increase too. In fact, we can proof that no matter  $\Lambda$  rises or falls, with the increase of the members, the total amount of land centralized is continuously growing (demonstrated in appendix 4). However,  $N$  is hard to cover all the

peasants in the whole village, since mass production through land cooperation requires for transaction cost, and the free-ride problem is common in a team. That's why an optimal level of  $N$  exists, and we can also expect that along with the development of cooperation, an entrepreneur who handle the right of residual control will come up inside the members to supervise. Except for the management cost during the production process, the operation of measurement of land, the rent of field, distribution of profits ask for a relatively higher coordinate cost in the process of establishment and expansion of the cooperation. Ordinary peasants are hard to afford the high cost. In reality, the village as a basic level of government organization (not a government in a strict sense) is operating as a Reputation Institution existing inside the cooperatives to some extent. It can cut down the coordinate cost in a reasonable operation. In the rural areas in south Jiangsu Province, various kinds of cooperatives are usually organized and lead by the village group. Thus, we finally come to the last proposition:

**Proposition 4: When the adverse employment shock on peasants exists during industrial upgrade, the land share cooperation can avoid the impact in the process of land centralization and enhance the welfare of members. The peasants will show higher enthusiasm to invest in lands with the more apparent technology improvement of the cooperation. Meanwhile, the increase of member amount can enhance the enthusiasm of single member, which bring up the total amount of land inside the cooperation. The member amount depends on the transaction cost of the organization.**

## **4. Conclusion**

Through theoretical demonstration on the latent relationship between the industrial upgrade and the mid-aged return to land phenomenon, we have come to the conclusion that, when peasants expect the relatively higher possibility of losing job, they will cut down the land transfer through one-off compensation by which prohibits the industrial upgrade relying on land acquisition and the coming urbanization. But the cultivated system of land share cooperation look after both sides of efficiency and fair, and is beneficial to realize the centralization of land.

The conclusion manifested the practice of economic developed districts such as Suzhou in the following aspects. First, it is well explained why the rural group economics has gained another big improvement after the establishment of land share cooperation. As the agent, the rural group positively defend and fight for rights of land for peasants who lose land and who return to the rural and distribute profit fairly. Secondly, to the development of agriculture production, under the condition that the current land ownership reform can not achieve soon, we explains the cooperatives is the compromise to rural land centralization and pattern of large-scale development and to provide mid-aged peasants with income guarantee as well as the development chance after their return to the rural areas. Thirdly, it explains the local governments especially those in the developed areas are increasing the input of training before and after the employment and the input of education. It is the ultimate method to prevent adverse employment shock on mid-aged peasants.

Theoretically, the analysis and conclusion of this paper has expanded the knowledge of how the traditional development economics regard the transfer of rural surplus labor as well as it meaning in the field of economic development. In other word, it is in the process of centralized development of dual economic, the transfer of rural labor is not smooth enough. It usually hinders by the impact of industrial upgrade. Meanwhile the industrial development and upgrade also require for the use of land, that's why the creative land ownership system is also influenced by the rural labor while it propel the process of industrialization .

Due to lack of data, we have not provided empirical test to the above proposition. Since it is not long ago to propel the industrial upgrade in the rural district in south Jiangsu Province, our proposition may be regarded as an assumption to the future possible phenomenon. In any case, the further empirical test to the proposition is the direction of our research. Besides, the public assets inside the cooperation and the redeem problem, the incentive and manager evolution inside the cooperation, none-agricultural development inside the cooperation are all good source material for us to explore.

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### Appendix 1:

Use  $\frac{\partial a'(n_2t)}{\partial a(n_2t)} = \frac{\partial a'(n_2t)}{\partial n_2t} * \frac{\partial n_2t}{\partial a(n_2t)} = \frac{a''(n_2t)}{a'(n_2t)}$  and Inverse Function's Derivative Theorem, we

get  $\frac{\partial n_2t}{\partial a(n_2t)} = \frac{1}{a'(n_2t)}$ , so

$$\frac{\partial \Omega}{\partial a} = \frac{\sigma^{-1} \left( \frac{f_{12}''(b)}{a(*)} - \frac{f_{22}''(t)}{a(*)} \right) - \frac{P(*)f(*)t \left\{ P'[a(*)]a'(*) + P[a(*)] \frac{a''(*)}{a'(*)} \right\} - f(*)t[P'(*)]^2 a'(*) - \sigma P'(*)}{[P(a(*))]^2}}{\sigma^{-1} (f_{11}''(b) - f_{21}''(t)) - \frac{tP'(*)a'(*)}{P(a)} f_1'} \quad (26)$$

According to the definition of  $f(*)$ , the denominator of Formula (32) is no greater than 0. Since  $a'' = 0$ , the second item in the brackets of numerator is 0. So we can rewrite the items in the brackets as  $\frac{f(*)ta'(*)\{P(*)P''(*) - [P'(*)]^2\}}{[P(a(*))]^2}$ . According to the assumption of the property of the

function  $P(*)$ , we get  $P(*)P''(*) - [P'(*)]^2 \leq 0$ . In a more apparent way, we may first equal the

problem as to judge whether  $\left[ \frac{P'(*)}{P(*)} \right]'$  is positive or negative. Since the increment of marginal

price is negative while the increment of price is positive, turn out to be the same result as

$\left[ \frac{P'(*)}{P(*)} \right]' \leq 0$ . Therefore, along with the property of function of  $f$  and we get  $\frac{\partial \Omega}{\partial a} \geq 0$ .  $\square$ .

### Appendix 2:

Use Lagrange's theorem to formula (21) and we get a first-order condition as below:

$$\alpha(T^f)^{\alpha-1}(L^f)^\beta - \lambda_1 = 0 \quad (27)$$

$$\begin{aligned} & \alpha[(N-1)T^{g^*} + T^g]^{\alpha-1}[A(N-1)L^{g^*} + AL^g]^\beta + (\alpha^2 - \alpha)T^g[(N-1)T^{g^*} + T^g]^{\alpha-2}[A(N-1)L^{g^*} \\ & + AL^g]^\beta + \alpha\beta AL^g[(N-1)T^{g^*} + T^g]^{\alpha-1}[A(N-1)L^{g^*} + AL^g]^{\beta-1} - \lambda_1 = 0 \end{aligned} \quad (28)$$

$$\beta(T^f)^\alpha (L^f)^{\beta-1} - \lambda_2 = 0 \quad (29)$$

$$w - \lambda_2 = 0 \quad (30)$$

$$\begin{aligned} & \alpha\beta AT^g[(N-1)T^{g^*} + T^g]^{\alpha-1}[A(N-1)L^{g^*} + AL^g]^{\beta-1} + (\beta^2 - \beta)AL^g[(N-1)T^{g^*} + T^g]^\alpha [A^* \\ & (N-1)L^{g^*} + AL^g]^{\beta-2} + A\beta[(N-1)T^{g^*} + T^g][A(N-1)L^{g^*} + AL^g]^{\beta-1} - \lambda_2 = 0 \end{aligned} \quad (31)$$

Among which,  $\lambda_1, \lambda_2$  are Lagrange factors.  $\square$ .

### Appendix 3:

Use the simplified formula (29) to divide formula (31) and we get:

$$\begin{aligned} 1 &= \frac{\beta(T^f)^\alpha (L^f)^{\beta-1}}{A\beta T^g \alpha (NT^g)^{\alpha-1} (ANL^g)^{\beta-1} + A^2(\beta^2 - \beta)L^g (NT^g)^\alpha (NAL^g)^{\beta-2} + A\beta (NT^g)^\alpha (ANL^g)^{\beta-1}} \\ &= \frac{1}{[\alpha A^\beta N^{\alpha+\beta-2} + A^\beta (\beta-1)N^{\alpha+\beta-2} + A^\beta N^{\alpha+\beta-1}]} \left(\frac{L^f}{L^g}\right)^{\beta-1} \left(\frac{T^f}{T^g}\right)^\alpha \end{aligned}$$

Since  $\frac{L^f}{T^f} = \frac{L^g}{T^g}$  and we can deduce the above equation equals to the form

$\frac{1}{A^\beta N^{\alpha+\beta-2} (N + \alpha + \beta - 1)} \left(\frac{T^f}{T^g}\right)^{\alpha+\beta-1}$ . Then, So the optimal proportion of allocation is

$$\Lambda = \frac{T^g}{T^f} = \left[ \frac{1}{A^\beta N^{\alpha+\beta-2} (N + \alpha + \beta - 1)} \right]^{\frac{1}{\alpha+\beta-1}}, \quad \square.$$

### Appendix 4:

We make an informal proof to standardize the amount of self-cultivated land of each member as 1, so the amount of invested land in the cooperation by each member is

$\left[ \frac{1}{A^\beta N^{\alpha+\beta-2} (N + \alpha + \beta - 1)} \right]^{\frac{1}{\alpha+\beta-1}}$ . Let  $\alpha + \beta - 1 = x$  and according to the condition, it is

demonstrated that  $0 < x < 1$ . So the total amount of land inside the cooperation is

$T^G = N \left[ \frac{1}{A^\beta N^{x-1} (N+x)} \right]^{\frac{1}{x}}$ . Then we have:

$$\begin{aligned} \frac{\partial T^G}{\partial N} &= [A^\beta N^{x-1} (N+x)]^{-\frac{1}{x}} - \frac{N}{x} [A^\beta N^{x-1} (N+x)]^{-\frac{1}{x}} \frac{A^\beta N^{x-2} (Nx + x^2 - x)}{A^\beta N^{x-1} (N+x)} \\ &= [A^\beta N^{x-1} (N+x)]^{-\frac{1}{x}} \left( 1 - \frac{N+x-1}{N+x} \right) > 0 \end{aligned}$$

it means that along with the increase of members inside the Land cooperation, the total amount of centralized land will grow too.  $\square$ .