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International Factor Mobility, Rural Development Policies and Wage Inequality in the Presence of Industrial Goods as Intermediate Input in Agriculture

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The paper develops a three-sector small open economy model with two final good sector and a non-trade good sector producing industrial intermediate goods in agriculture. It is shown that an increase in either type of labour endowment (capital endowment) raises (lowers) the unemployment rate of either type of labour if the scale elasticity of output is very low. On the other hand, if the industrial sector is more capital intensive than the agricultural sector and if efficiency functions of both types of labour are identical, then an increase in either type of labour endowment (capital endowment) lowers (raises) the skilled–unskilled wage ratio. However, the effect of a change in capital endowment on the Gini Coefficient of wage income distribution is ambiguous in sign.

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1. INTRODUCTION

The widening wage gap poses a significant concern for developing countries. Theoretical studies have endeavored to identify factors contributing to this gap, encompassing issues such as labor market imperfections [1], distortions in capital markets [2], public infrastructure provision [3], privatization [4], migrants' remittances [5], income taxation [6], trade, and market congestion [7], as well as the skill bias of technical change [8]. Scholars have particularly scrutinized international factor mobility when examining wage inequality from diverse perspectives. For instance, Beladi et al. [9] introduced a model considering unemployment, highlighting that the impact of international factor mobility on wage inequality significantly hinges on differences in intersectoral factor intensities. Chaudhuri [10] demonstrated that the effects of international factor mobility on wage inequality may not solely rely on factor intensity differences. The relevance of factor intensity conditions is contingent upon the positive correlation between unskilled wages in low-skill urban sectors and rural wages. Chaudhuria and Banerjee [11] delved into the "fair wage hypothesis" in skilled wages, concluding that the effects of international factor mobility depend crucially on the efficiency function properties of skilled labor. Pan and Zhou [12] constructed a model incorporating environmental pollution, emphasizing its role in determining wage inequality in the presence of international factor mobility. Investigating the impact of international factor movements on wage inequality, Li and Xu [13] found that unskilled labor outflow invariably decreases wage inequality. Meanwhile, the effects of skilled labor movement and capital inflow on wage inequality are contingent upon factor intensity differentials between urban and modern agricultural sectors.

However, much of the existing research neglects the pivotal role of industrial goods as intermediate inputs in agriculture. As the global population burgeons, arable lands struggle to meet escalating food demands, necessitating the implementation of crop enhancement techniques. Widespread practices in developing countries involve heightened usage of fertilizers and chemical materials to augment crop yield, consequently fostering the growth of a substantial agrichemical industry. Meanwhile, the development of industrial sector gradually lowers the price of industrial products relative to agricultural products, which makes the adoption of industrial intermediate goods reality in recent years. Moreover, numerous developing countries are grappling with extensive rural-urban migration, resulting in a substantial influx of rural labor into urban areas. This migration compels farmers to adopt more industrial equipment to substitute the relocated labor in agricultural production processes. Taking China as an illustrative case, the proportion of labor engaged primarily in agriculture plummeted from 68.7% in 1980 to 28.3% in 2015, according to the 2016 China Statistical Year Book. Concurrently, industrial intermediate goods input in agriculture has seen a notable surge. For instance, fertilizer input escalated from 12.69 million tons in 1980 to 60.22 million tons in 2015. Similarly, China's agricultural machinery power surged from 147.45 million kW in 1980 to 1117.28 million kW in 2015. This conspicuous rise in industrial intermediate goods input has played a pivotal role in sustaining high yields with significantly reduced labor. Given that industrial intermediate goods input holds substantial proportions, it is reasonable to envisage that fluctuations in the price of these intermediate goods could prompt shifts in the movement of production factors between sectors, thereby influencing wage inequality. Hence, it becomes imperative to investigate the effects of international factor mobility on wage inequality, particularly in the context of industrial goods serving as intermediate inputs in agriculture.

Rural development poses a significant impediment for numerous developing countries on the path to industrialization, prompting governments to enact policies aimed at promoting agriculture. One common strategy employed by governments in developing countries is the implementation of agricultural subsidies. Scholars have thoroughly examined the effects of such subsidies from various perspectives. Gupta [14] developed a model incorporating unemployment and the informal sector in urban areas, revealing that rural wage subsidies lead to an increase in unemployment.

Chaudhuri [15] found that a wage or price subsidy policy directed towards the rural sector decreases the level of urban unemployment. Yabuuchi and Beladi [16] considered a model encompassing both open unemployment and an informal sector producing final goods. Their findings indicated that wage subsidies to the agricultural sector enhance welfare and reduce urban unemployment. Li and Shen (2012) divided the agricultural sector into modern and traditional components, concluding that interest subsidies and wage subsidies have contrasting effects on urban unemployment. Li et al. [17] established a four-sector general equilibrium model, distinguishing between advanced and traditional rural sectors. They found that wage subsidizing policies exert a stronger influence than interest subsidies. Li and Fu [18] incorporated agricultural producer service sector into a three-sector general equilibrium model and studied the effects of government price subsidy, interest subsidy, and wage subsidy to agricultural producer service on agricultural pollution. Given that subsidy policies yield varied effects on rural development and the overall economy, it is pertinent to analyze their impacts on wage inequality and national income, especially in the context of industrial goods serving as intermediate inputs. However, the existing literature on rural subsidies has largely overlooked the issue of wage inequality, thus failing to scrutinize the effect of rural subsidies on wage inequality in the presence of industrial goods as intermediate inputs in agriculture.

This research contributes to the evolving body of literature focused on agricultural modernization and productivity in developing countries. Notably, recent scholarly attention has shifted towards small-scale agriculture, with an emphasis on integrating the agricultural producer service sector as an intermediate element in this context. In the work of Li and Fu [19], a comprehensive general equilibrium model is established to explore the ramifications of changes in remittance rates on the income of migrant workers and their impact on environmental pollution. In this model, the agricultural sector utilizes remittances to acquire agricultural producer services, which serve as complements to labor in agricultural production. Reflecting the dynamic interaction and substitution between intermediate services and rural labor, Wang and Li [20] extend this perspective. They assume that the acquisition of services contributes to rural labor migration and proceed to investigate the implications of capital market distortion and wage inequality, incorporating the agricultural producer service within the framework of a small open economy. Wang et al. [21] incorporated agricultural producer service sector and considered green technological progress on wage inequality in China. Results show that green technological progress increases both wage of skilled labor and unskilled labor. Nevertheless, green technological progress generates a greater impact on the wage of skilled labor than unskilled labor, leading to widening income disparity. Wang et al. [22] explore the relationship between labor market distortion and wage inequality by using general equilibrium model and concluded that mitigation of labor market distortion may widen wage gap. However, existing literature ignores to consider international factor mobility on wage inequality in the presence of industrial goods as intermediate input in agriculture.

In order to fill the current research gap, this paper constructs a three-sector model: one urban industrial sector and one urban sector that produces industrial intermediate input in agriculture and rural agricultural sector. We find that an outflow of skilled labor benefits the development of agricultural sector while an outflow of unskilled labor deteriorates it. The impact of an inflow of capital on agriculture depends on the elasticity of substitution between skilled labor and unskilled labor in the industrial sector. Their impacts on wage inequality depends on capital-labor relative distributive share in industrial and agricultural sector. The economic impacts of rural development policies, an increase in wage and purchase of intermediate goods subsidy narrows down the wage inequality. However, their impacts on national income are different: an increase in wage subsidy raises national income unambiguously; while the impact of an increase in subsidy of intermediate goods on national income is not clear.

The rest of the paper is organized as follows. We establish a model in Section 2. And investigate the effects of international factor mobility public in the first part of Section 3. In the second part of Section 3, we discuss the effects of rural development policies, wage and purchase of intermediate goods subsidy. Concluding remarksare made in Section 4.

2. THE MODEL

Consider a small open economy composed of three sectors, two urban industrial sectors and

one rural agricultural sector. One of industrial sector (sector 1, hereafter call it "industrial sector")produces import-competing goods X_1 by employing skilled labor L_{S1} ,unskilled labor L_{U1} and capital K_1, the other industrial sector(sector 2, hereafter call it "intermediate goods sector") uses unskilled labor L_{U2} and capital K_2 to produce non-trade intermediate goods X_2 for agricultural production. The rural agricultural sector utilizes unskilled labor and intermediate goods X_2 to produce exportable goods. Capital mobiles freely between the urban sectors. There exists segmentation in the labor market: skilled labor concentrates in the sector 1, while unskilled labor moves between three sectors. Unskilled labor allocation mechanism is Harris-Todaro type and there exists the unemployment of unskilled workers in the urban area due to rigid wage rate. The production functions of three sectors can be expressed as $X_1 = F^1(L_{S1}, K_1)$, $X_2 = F^2(L_{U2}, K_2)$ and $X_3 = F^3(L_{U3}, X_{23})$,respectively, where the three functions satisfy the neoclassical properties (i.e., strict quasi-concavity and linear homogeneity). It is worth noting that the agricultural production method, employing industrial goods as intermediate input for production, is different with the method of industrial agriculture which is a form of modern capital-intensive farming and widespread in developed nations. Though industrial equipment is used in agricultural production, agriculture in developing countries is still a labor-intensive sector.

Before the establishment of the model, we would like to point three points concerning the intermediate goods sector and agricultural sector. First, the intermediate goods sector produces chemical products (like fertilizer and pesticides. etc) and low-end agricultural equipment and makes it hard to attract skilled labor. Therefore, most of labor employed by this sector is unskilled labor and it is reasonable to assume that the intermediate goods sector only employs unskilled labor and capital. The setting of intermediate goods sector here is similar to that in Chaudhuri [23]. Second, the goods of intermediate goods sector is agriculture-oriented product and mainly used for agricultural production. Moreover, most of products in the intermediate goods sector are produced within the developing countries due to the high transportation cost and environment regulation in developed countries. Thus, we assume that the product of the intermediate goods sector is non-trade goods and only used into agricultural production, which is in accordance with Beladi and Marjit [24]. Third, the assumption that the agricultural sector does not employ capital as the factor of production is to emphasize that agricultural sector uses little capital to production apart from the intermediate goods in developing countries. Capital is used in the production of the intermediate goods sector and thus, indirectly employed by the agricultural sector.

In a competitive equilibrium with all goods being produced, unit cost of production in each sector reflects the market price. Taking the goods of agriculture as numeraire, we have:

$$p_1 = a_{S1}w_S + a_{U1}\bar{w}_U + a_{K1}r \quad (1)$$

$$p_2 = a_{U2}\bar{w}_U + a_{K2}r \quad (2)$$

$$1 = a_{X3}(\alpha p_2) + a_{U3}(\beta w_U) \quad (3)$$

where p_1 and p_2 are goods prices of industrial sector and intermediate goods sector relative to that of agriculture goods, respectively, and p_1 is assumed to be given and constant in a small open economy. $a_{ij}(i = S,U,K; j = 1,2,3)$ represents that the factor *i* used in producing one unit of goods in the *j* th sector. w_S is the wage rate of skilled labor in the sector 1. $\bar{w}_U$ is the wage rate of unskilled labor in the urban region, which is downward rigid due to protection of labor unions. w_U is the wage rate of unskilled labor in the agriculture, which is fully elastic. r is the interest rates of capital. α ($0 < \alpha \le 1$)and β ($0 < \beta \le 1$)are parameters, expressing the government implements policy to subsidize the purchase of industrial intermediate inputs and wage in the agriculture, respectively. $\alpha = 1$ ($\beta = 1$), means no subsidy. When the government starts the subsidy to promote rural development, the value of α or β decreases.

Use $\mu = L_{UU}/(a_{U1}X_1 + a_{U2}X_2)$ to denote the unemployment rate of unskilled labor in urban region. The Harris-Todaro

unskilled labor market equilibrium condition is given by

$$w_U = \frac{a_{U1}X_1 + a_{U2}X_2}{a_{U1}X_1 + a_{U2}X_2 + L_{UU}}\bar{w}_U = \frac{\bar{w}_U}{1+\mu} \tag{4}$$

Full employment conditions are:

$$a_{S1}X_1 = L_S \tag{5}$$

$$(1+\mu)(a_{U1}X_1 + a_{U2}X_2) + a_{U3}X_3 = L_U \tag{6}$$

$$a_{K1}X_1 + a_{K2}X_2 = K \tag{7}$$

$$a_{X3}X_3 = X_2 \tag{8}$$

The basic model has been established so far. Eight endogenous variables, w_S, w_U, r, μ, p_2, X_1, X_2 and X_3, are determined by Eqs. (1)–(8). Other variables are exogenous.

3.THE COMPARATIVE STATIC ANALYSIS

Differentiating the Eqs. (1)–(8) and writing in a matrix notation, we can obtain the following equation:

$$\begin{pmatrix} \theta_{S1} & 0 & \theta_{K1} & 0 & 0 & 0 \\ 0 & \theta_{U3} & \theta_{X3}\theta_{K2} & 0 & 0 & 0 \\ \sigma^1_{SS} & 0 & \sigma^1_{SK} & 0 & 1 & 0 \\ \lambda_{K1}\sigma^1_{KS} & 0 & \lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK} & \lambda_{K1} & \lambda_{K2} & 0 \\ \lambda^{\mu}_{U1}\sigma^1_{US} & \lambda_{U3}\sigma^3_{UU} - \lambda^{\mu}_U & \Omega_1 & \lambda^{\mu}_{U1} & \lambda^{\mu}_{U2} & \lambda_{U3} \\ 0 & \sigma^3_{XU} & \sigma^3_{XX}\theta_{K2} & 0 & -1 & 1 \end{pmatrix} \begin{pmatrix} \hat{w}_S \\ \hat{w}_U \\ \hat{r} \\ \hat{X}_1 \\ \hat{X}_2 \\ \hat{X}_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ \hat{L}_S \\ \hat{K} \\ \hat{L}_U \\ 0 \end{pmatrix} - \begin{pmatrix} 0 \\ \theta_{X3} \\ 0 \\ 0 \\ \lambda_{U3}\sigma^3_{UX} \\ \sigma^3_{XX} \end{pmatrix} \hat{\alpha} - \begin{pmatrix} 0 \\ \theta_{U3} \\ 0 \\ 0 \\ \lambda_{U3}\sigma^3_{UU} \\ \sigma^3_{XU} \end{pmatrix} \hat{\beta} \tag{9}$$

where " $\hat{}$ " represents the rate of change(e.g., $\hat{w}_S = dw_S / w_S$), $\theta_{ij}(i = S,U,K;\ j = 1,2,3)$ is the distributive share of factor i in the j th sector (e.g. $\theta_{S1} = a_{S1}w_S / p_1$), λ_{ij} is the allocated share of factor i in the j th sector (e.g. $\lambda_{U3} = a_{U3}X_3 / L_U$), $\sigma^h_{ij}(i, j = S,U,K;h = 1,2,3)$ is the partial elasticity of substitution between factors i and j in the h th sector (e.g. $\sigma^3_{UU} = \frac{\partial a_{U3}}{\partial w_U}\frac{w_U}{a_{U3}}$), $\sigma^h_{ij} > 0(i \neq j)$ and $\sigma^h_{ij} < 0(i = j)$ .We use λ^{μ}_U to denote labor(including unemployment) located in urban region, $\lambda^{\mu}_U = (1+\mu)(\lambda_{U1} + \lambda_{U2})$. In addition, $\Omega_1 = \lambda^{\mu}_{U1}\sigma^1_{UK} + \lambda^{\mu}_{U2}\sigma^2_{UK} + \theta_{K2}\lambda_{U3}\sigma^3_{UX} > 0$, $\lambda^{\mu}_{U1} = \lambda_{U1}(1+\mu)$ and $\lambda^{\mu}_{U2} = \lambda_{U2}(1+\mu)$. The detailed derivations of the distributive shares and the allocative shares of factors can be referred to Jones [25]. Moreover, in developing countries, assume the size of population living in rural is greater than that of urban, and $\lambda_{U3} > \lambda^{\mu}_{U1} + \lambda^{\mu}_{U2} = \lambda^{\mu}_U$ holds; capital allocated in the industrial sector is larger than that of intermediate goods sector, $\lambda_{K1} > \lambda_{K2}$ holds. In our expression, the Allen–Uzawa partial elasticity of substitution is define as $\sigma^h_{ij} / \theta_{jh}$. To the industrial sector, capital and skilled labor are more scarce resources than unskilled labor in developing countries. Since the skilled labor is sector-specific factor in the model, it is reasonable to assume that unskilled labor is more substitutable with capital than with skilled labor in the sector 1. Thus, we have $\sigma^1_{UK} / \theta_{K1} > \sigma^1_{US} / \theta_{S1}$. Such assumption is also used by Li. et al. [26] when the industrial sector employs same three factors. Consider the feature of agricultural production, the ratio of intermediate goods to agricultural output lies in a certain interval, which means the absolute value of σ^3_{XX} is relative small.

Δ is the determinant of the coefficient matrix of the equation (9) and we have

$$\Delta = \theta_{S1}\theta_{U3}\left\{\lambda_{K2}(\lambda^{\mu}_{U1}\sigma^1_{UK} + \lambda^{\mu}_{U2}\sigma^2_{UK}) - (\lambda^{\mu}_{U2} + \lambda_{U3})(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK}) - \sigma^1_{SK}[\lambda_{K2}\lambda^{\mu}_{U1} - \lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3})]\right\}$$
$$-\theta_{S1}\theta_{X3}\theta_{K2}\lambda_{K2}[\lambda_{U3}(\sigma^3_{UU} - \sigma^3_{XU}) - \lambda^{\mu}_U] + \theta_{U3}\theta_{K1}[\lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3})(\sigma^1_{KS} - \sigma^1_{SS}) - \lambda_{K2}\lambda^{\mu}_{U1}(\sigma^1_{US} - \sigma^1_{SS})] > 0$$

3.1 The Impacts of International Factor Mobility on Wage Inequality and Rural Development

International factor mobility is actually a trade in factors and another form of international integration. International factor movement, in our model, involves movements of skilled and unskilled labor and capital across national boundaries. To developing countries, an outflow of skilled and unskilled labor are common because of low wages in domestic market, while an inflow of capital is common at the present.

First, we consider the impacts of an outflow of skilled labor. Solving Eq. (9) by the Cramer's rule with the respect of the decrease of endowment of skilled labor, we get:

$$\hat{w}_S / \hat{L}_S = -\theta_{K1}\theta_{U3}[\lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3}) - \lambda_{K2}\lambda^{\mu}_{U1}] / \Delta < 0$$

$$\hat{w}_U / \hat{L}_S = -\theta_{X3}\theta_{K2}\theta_{S1}[\lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3}) - \lambda_{K2}\lambda^{\mu}_{U1}] / \Delta < 0$$

$$\hat{r} / \hat{L}_S = \theta_{S1}\theta_{U3}[\lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3}) - \lambda_{K2}\lambda^{\mu}_{U1}] / \Delta > 0$$

$$\hat{X}_1 / \hat{L}_S = \left\{ \begin{matrix} \theta_{K1}\theta_{U3}[\lambda_{K1}(\lambda^{\mu}_{U2} + \lambda_{U3})\sigma^1_{KS} - \lambda_{K2}\lambda^{\mu}_{U1}\sigma^1_{US}] - \theta_{S1}\theta_{X3}\theta_{K2}\lambda_{K2}[\lambda_{U3}(\sigma^3_{UU} - \sigma^3_{XU}) - \lambda^{\mu}_{U}] \\ -\theta_{S1}\theta_{U3}[(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK})(\lambda^{\mu}_{U2} + \lambda_{U3}) - \lambda_{K2}(\lambda^{\mu}_{U1}\sigma^1_{UK} + \lambda^{\mu}_{U2}\sigma^2_{UK})] \end{matrix} \right\} \Big/ \Delta > 0$$

$$\hat{X}_2 / \hat{L}_S = \left\{ \begin{matrix} \theta_{S1}\theta_{U3}[\lambda^{\mu}_{U1}(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK}) - \lambda_{K1}(\lambda^{\mu}_{U1}\sigma^1_{UK} + \lambda^{\mu}_{U2}\sigma^2_{UK})] \\ +\theta_{S1}\theta_{X3}\theta_{K2}\lambda_{K1}[\lambda_{U3}(\sigma^3_{UU} - \sigma^3_{XU}) - \lambda^{\mu}_{U}] - \lambda^{\mu}_{U1}\lambda_{K1}\theta_{K1}\theta_{U3}(\sigma^1_{KS} - \sigma^1_{US}) \end{matrix} \right\} \Big/ \Delta < 0$$

$$\hat{X}_3 / \hat{L}_S = \left\{ \begin{matrix} \theta_{S1}\theta_{U3}[\lambda^{\mu}_{U1}(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK}) - \lambda_{K1}\Omega_1] + \theta_{S1}\theta_{X3}\theta_{K2}\lambda_{K1}(\lambda_{U3}\sigma^3_{UU} - \lambda^{\mu}_{U}) \\ +\theta_{S1}\theta_{K2}\sigma^3_{XX}(\lambda_{K2}\lambda^{\mu}_{U1} - \lambda_{K1}\lambda^{\mu}_{U2}) - \theta_{K1}\theta_{U3}\lambda_{K1}\lambda^{\mu}_{U1}(\sigma^1_{KS} - \sigma^1_{US}) \end{matrix} \right\} \Big/ \Delta < 0$$

We use Lemma 1 to illustrate how an outflow of skilled labor affects the outputs and factor prices.

Lemma 1 *An outflow of skilled labor leads to an increase in the wage rate of skilled and unskilled labor and an decrease in the interest rate of the capital. As for outputs of three sectors, an outflow of skilled labor contracts the industrial sector and expands intermediate goods sector and agricultural sector.*

The economic mechanism behind Lemma 1 is as follows. An outflow of skilled labor decreases the skilled supply and lead to an increase of marginal product of skilled labor given constant industrial price and the wage rate of skilled labor increases. Meanwhile, the value of marginal product of unskilled labor and capital reduce because of an decrease of skilled labor. Since unskilled labor is protected by rigid wage rate, the industrial sector decreases the employment unskilled skilled, while capital in the industrial sector moves to the intermediate goods sector. Less amount of factors are used in the industrial sector and its output reduces.The marginal product of unskilled labor in the intermediate goods sector increases because of an inflow of capital. Since the sector can employ unskilled with constant wage rate, the intermediate goods sector employs more unskilled labor rather than capital, reducing the demand of capital and the interest rate. Thus, the cost as well as the price of the intermediate sector reduce, which encourage the agricultural sector use more industrial intermediate input. In the agricultural sector, an increase in the industrial intermediate input enhances the marginal productivity of unskilled labor and consequently raise the wage rate of unskilled labor.

Second, we consider the impacts of an outflow of unskilled labor. Solving Eq. (9) by the Cramer's rule with the respect of the decrease of endowment of unskilled labor, we get:

$$\hat{w}_S / \hat{L}_U = -\theta_{K1}\theta_{U3}\lambda_{K2}/\Delta < 0$$

$$\hat{w}_U / \hat{L}_U = -\theta_{X3}\theta_{K2}\theta_{S1}\lambda_{K2}/\Delta < 0$$

$$\hat{r} / \hat{L}_U = \theta_{S1}\theta_{U3}\lambda_{K2}/\Delta > 0$$

$$\hat{X}_1 / \hat{L}_U = -\lambda_{K2}\theta_{U3}(\theta_{S1}\sigma^1_{SK} - \theta_{K1}\sigma^1_{SS})/\Delta < 0$$

$$\hat{X}_2 / \hat{L}_U = -\theta_{U3}[\theta_{S1}(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK} - \lambda_{K1}\sigma^1_{SK}) - \theta_{K1}\lambda_{K1}(\sigma^1_{KS} - \sigma^1_{SS})]/\Delta > 0$$

$$\hat{X}_3 / \hat{L}_U = \left\{\theta_{K1}\theta_{U3}\lambda_{K1}(\sigma^1_{KS} - \sigma^1_{SS}) - \theta_{S1}[\theta_{U3}(\lambda_{K1}\sigma^1_{KK} + \lambda_{K2}\sigma^2_{KK} - \lambda_{K1}\sigma^1_{SK}) + \theta_{K2}\lambda_{K2}\sigma^3_{XX}]\right\}/\Delta > 0$$

We use Lemma 2 to illustrate how an outflow of unskilled labor affects the outputs and factor prices.

Lemma 2 *An outflow of unskilled labor leads to an increase in the wage rate of skilled and unskilled labor and an decrease in the interest rate of the capital. As for outputs of three sectors, an outflow of unskilled labor expands the industrial sector and contract intermediate goods sector and agricultural sector.*

The economic intuition behind Lemma 2 can be explained as follows. An outflow of unskilled labor decreases the unskilled supply and output in the agricultural sector due to Rybczynski effect. Since the intermediate goods provides intermediate goods in agriculture production, the demand of industrial intermediate goods as well as the demand of unskilled labor and capital in the intermediate goods sector reduce consequently. Unskilled labor and capital move to the industrial sector and expand this sector. As for prices of skilled labor, the demand and wage increase because of sector-specific factor. However, the demand of capital is mixed: on the one hand, expansion of industrial sector raises the demand of capital; on the other hand, the expansion of industrial sector can employ more unskilled labor with constant wage rate and reduce the demand of capital. In addition, capital moves from the intermediate goods sector into industrial sector. Thus, demand and interest rate of capital reduce eventually. The price of intermediate goods reduces due to the decreased interest rate, which encourages agricultural sector to raise the intermediate input in producing one unit of agricultural goods. Thus, marginal product of unskilled labor as well as the wage of unskilled labor increase.

Next, we consider the impacts of an inflow of capital.Solving Eq. (9) by the Cramer's rule with the respect of the increase of endowment of capital, we get:

$$\hat{w}_S / \hat{K} = \theta_{K1}\theta_{U3}(\lambda^{\mu}_{U2} + \lambda_{U3})/\Delta > 0$$

$$\hat{w}_U / \hat{K} = \theta_{X3}\theta_{K2}\theta_{S1}(\lambda^{\mu}_{U2} + \lambda_{U3})/\Delta > 0$$

$$\hat{r} / \hat{K} = -\theta_{S1}\theta_{U3}(\lambda^{\mu}_{U2} + \lambda_{U3})/\Delta < 0$$

$$\hat{X}_1 / \hat{K} = \theta_{U3}(\lambda^{\mu}_{U2} + \lambda_{U3})(\theta_{S1}\sigma^1_{SK} - \theta_{K1}\sigma^1_{SS})/\Delta > 0$$

$$\hat{X}_2 / \hat{K} = \begin{Bmatrix} \theta_{S1}[\theta_{U3}(\lambda^{\mu}_{U1}\sigma^1_{UK} + \lambda^{\mu}_{U2}\sigma^2_{UK}) - \theta_{X3}\theta_{K2}(\lambda_{U3}\sigma^3_{UU} - \lambda_{U3}\sigma^3_{XU} - \lambda^{\mu}_{U})] \\ -\lambda^{\mu}_{U1}\theta_{U3}(\theta_{S1}\sigma^1_{SK} + \theta_{K1}\sigma^1_{US} + \theta_{K1}\sigma^1_{SK} + \theta_{K1}\sigma^1_{SU}) \end{Bmatrix} \Bigg/ \Delta$$

$$\hat{X}_3 / \hat{K} = \begin{Bmatrix} \theta_{S1}[\theta_{U3}(\Omega_1 + \lambda_{U2}^{\mu}\theta_{K2}\sigma_{XX}^3) - \theta_{X3}\theta_{K2}(\lambda_{U3}\sigma_{UU}^3 - \lambda_U^{\mu} + \lambda_{U2}^{\mu}\sigma_{XU}^3)] \\ -\theta_{K1}\theta_{U3}\lambda_{U1}^{\mu}(\sigma_{US}^1 - \sigma_{SS}^1) - \lambda_{U1}^{\mu}\theta_{S1}\theta_{U3}\sigma_{SK}^1 \end{Bmatrix} \Big/ \Delta$$

Use Lemma 3 to illustrate how an inflow of capital affects the outputs and factor prices.

Lemma 3 *An inflow of capital leads to an increase in the wage rate of skilled and unskilled labor and an decrease in the interest rate of the capital. As for outputs of three sectors, an inflow of capital expands the industrial sector; however, the changes of output of the intermediate and agricultural sector are ambiguous, depending on the elasticity of substitution between skilled labor and unskilled labor in the industrial sector.*

An inflow of capital raises the supply of capital and the interest rate falls consequently. The price of intermediate goods reduces due to the decreased interest rate, which raises the intermediate input in producing one unit of agricultural goods. Meanwhile, the marginal product and wage of skilled labor rises in the industrial sector due to the increased capital. The inflow of capital expands the industrial sector, capital-intensive sector, and initially contracts the intermediate goods sector due to Rybczynski effect. However, reduced price of intermediate goods promotes the demand of intermediate goods, which has a positive effect on its output. The output of the intermediate goods sector is determined by the movement of unskilled labor. Urban sectors increase the demand of unskilled labor because of an inflow of capital and rural agricultural sector experiences a loss of unskilled labor. The amount of transferred labor depends on the increased demand in the industrial sector and its effect on agricultural output. The former aspect is decided by the elasticity of substitution among three factors. With decreased interest rate, substitution among three factors in the industrial sector occurs. Capital substitutes skilled labor first because its wage rate increases. Given the skilled labor is sector-specific, skilled labor substitutes unskilled labor which decreases the demand of unskilled labor. If the elasticity of substitution between skilled labor and capital(σ_{SK}^1) is small, the amount of increased unskilled labor in the industrial sector depends on the the elasticity of substitution between skilled labor and unskilled labor(σ_{US}^1). If σ_{US}^1 is relatively small, which implies that the substitution is relatively hard, then this sector employs less unskilled labor so as to make full employment of skilled labor. The effect of latter aspect is follow. With the decreased price of intermediate goods and raised wage of unskilled labor, agricultural sector substitutes unskilled labor with intermediate goods. If the elasticity of substitution between unskilled labor and intermediate goods(σ_{XU}^3)is relatively small, which implies that the substitution unskilled labor for intermediate goods is relatively hard, then demand of intermediate goods raises to make up the outflow of unskilled labor. If the less proportion of transferred unskilled labor employed in the industrial sector, the intermediate goods sector expands its output. Since the intermediate goods is input in agriculture, more proportion of transferred unskilled labor still work for agricultural production indirectly. In this way, more industrial equipment substitutes unskilled labor during agricultural production, which contributes to raising agricultural output. In reality, the substitution of skilled labor and capital generally not easy and considering the feature of industrial intermediate goods in agriculture, it is reasonable to assume that the elasticity of substitution between skilled labor and capital in the industrial sector and the elasticity of substitution between unskilled labor and intermediate goods in the agricultural sector are small. Therefore, the outputs of the intermediate goods sector and agricultural sector depends on the elasticity of substitution between skilled labor and unskilled labor in the industrial sector.

For developing countries, rural development and growth of national income are two central concerns,especially under the rural-urban migration. We use Proposition 1 to summarize international factor mobility on rural development and Proposition 2 to point their impacts on national income from the Lemma 1 to 3.

Proposition 1 *An outflow of skilled labor benefits agricultural sector while an outflow of unskilled labor deteriorates the development of agriculture. The impact of an inflow of capital on agriculture depends on the elasticity of substitution between skilled labor and unskilled labor in the industrial sector. If* σ_{US}^1 *is relatively small, an inflow of capital promotes agricultural development by*

employing more industrial intermediate inputs to substitute transferred labor.

As we show in the Lemma 1and 2, though an outflow of skilled and unskilled labor has same impacts on agricultural wage rate and interest rate, an outflow of skilled labor enlarges the production of intermediate goods sector and employment, increasing the agricultural output; while an outflow of unskilled labor falls the production of intermediate goods sector and promote rural labor to migrate which reduce the agricultural output. From the Lemma 3, an inflow of capital promote the development of industrial sector, its effect spills over to the agriculture if the elasticity of substitution between skilled labor and unskilled labor in the industrial sector is relatively small. If σ_{US}^{1} is relatively small, an expansion of industrial sector exerted by an inflow of capital employs relatively less proportion of transferred unskilled labor than the situation where σ_{US}^{1} is relatively large, and the industrial intermediate goods sector may enlarge the employment and benefit from an inflow of capital, which promotes agricultural output.

Next, we consider the national income. In our model, only two final goods, therefore the national income *I* can be described by: $I = p_1 X_1 + X_3$.Generally, less factor endowment causes an decrease in national income. However, under certain condition, less factor endowment causes factor moves from low price sector to high price sector and the national income may increase in this situation. Now we investigate the impacts of international factor mobility on the national income. According to the results, we can get:

$$p_1\frac{\hat{X}_1}{\hat{L}_S}+\frac{\hat{X}_3}{\hat{L}_S}=\left\{\begin{array}{l}[\theta_{S1}\theta_{U3}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2})-\theta_{K1}\theta_{U3}\lambda_{K1}\sigma_{KS}^{1}][\lambda_{U1}^{\mu}-p_1(\lambda_{U3}+\lambda_{U2}^{\mu})]\\ +\theta_{S1}\theta_{K2}[\sigma_{XX}^{3}(\lambda_{K2}\lambda_{U1}^{\mu}-\lambda_{K1}\lambda_{U2}^{\mu}-p_1\lambda_{K2}\lambda_{U3})]+\\ (\lambda_{K1}-p_1\lambda_{K2})[\theta_{X3}\theta_{S1}\theta_{K2}(\lambda_{U3}\sigma_{UU}^{3}-\lambda_{U}^{\mu})-\theta_{U3}(\theta_{S1}\Omega_1-\theta_{K1}\lambda_{U1}^{\mu}\sigma_{US}^{1})]\end{array}\right\}$$

$$p_1\frac{\hat{X}_1}{\hat{L}_U}+\frac{\hat{X}_3}{\hat{L}_U}=\left\{\begin{array}{l}\theta_{U3}(\lambda_{K1}-p_1\lambda_{K2})(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})+\theta_{K1}\theta_{U3}\lambda_{K1}\sigma_{KS}^{1}\\ -\theta_{S1}[\theta_{U3}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2})+\theta_{K2}\lambda_{K2}\sigma_{XX}^{3}]\end{array}\right\}$$

and if σ_{XX}^{3} is relative small, we have

$$p_1\frac{\hat{X}_1}{\hat{K}}+\frac{\hat{X}_3}{\hat{K}}=\left\{\begin{array}{l}\theta_{U3}(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})[p_1(\lambda_{U3}+\lambda_{U2}^{\mu})-\lambda_{U1}^{\mu}]-\lambda_{U1}^{\mu}\theta_{K1}\theta_{U3}\sigma_{US}^{1}\\ +\theta_{S1}[\theta_{U3}\Omega_1-\theta_{X3}\theta_{K2}(\lambda_{U3}\sigma_{UU}^{3}-\lambda_{U}^{\mu})+\theta_{K2}\lambda_{U2}^{\mu}\sigma_{XX}^{3}]\end{array}\right\}>0$$

We use Proposition 2 to express the impacts of international factor mobility on national income.

Proposition 2 *An inflow of capital raises the national income unambiguously. An outflow of skilled labor may raise the national income if* $p_1 < \lambda_{K1}/\lambda_{K2}$ *, while an outflow of unskilled labor may raise the national income if* $p_1 > \lambda_{K1}/\lambda_{K2}$.

From above results, an inflow of capital raises the national income unambiguously due to the expansion of industrial and agricultural sector. However, from the Lemma 1 and 2, an outflow of skilled labor decreases industrial output and increases agricultural output, national income reduces when $p_1 > \lambda_{K1}/\lambda_{K2}$. If $p_1 < \lambda_{K1}/\lambda_{K2}$, the gain from the expansion of the agricultural sector may offset the loss from the shrink of the industrial sector by the decrease in skilled labor. We can use similar economic intuition to explain the decreased in unskilled labor.

Last we consider the impacts of international factor mobility on wage inequality. From the allocation of unskilled labor, equation (4), we could get the average wage rate of unskilled labor is w_U .Hence, the paper treats the wage inequality between skilled and unskilled labor as the ratio of the wage rate of

skilled labor and that of unskilled labor in agriculture, that is, $\frac{w_S}{w_U}$ .Therefore, the change of wage inequality is expressed by $\hat{w}_S - \hat{w}_U$. When $\hat{w}_S - \hat{w}_U > 0(<0)$, the inequality between skilled labor and unskilled labor increases (decreases). Similar definition of the wage inequality is employed in the previous studies such as Beladi et al. [27], Pi and Zhou [2], Pan and Zhou [12] and Li and Xu [17]. Based on the results of Lemma 1 to 3, we can obtain that the impacts of international factor mobility on wage inequality ,

$$\frac{\hat{w}_S - \hat{w}_U}{\hat{L}_S} = \frac{(\theta_{X3}\theta_{K2}\theta_{S1} - \theta_{K1}\theta_{U3})[\lambda_{K1}(\lambda_{U2}^{\mu} + \lambda_{U3}) - \lambda_{K2}\lambda_{U1}^{\mu}]}{\Delta}$$

$$\frac{\hat{w}_S - \hat{w}_U}{\hat{L}_U} = \frac{\lambda_{K2}(\theta_{X3}\theta_{K2}\theta_{S1} - \theta_{K1}\theta_{U3})}{\Delta}$$

$$\frac{\hat{w}_S - \hat{w}_U}{\hat{K}} = \frac{(\theta_{K1}\theta_{U3} - \theta_{X3}\theta_{K2}\theta_{S1})(\lambda_{U2}^{\mu} + \lambda_{U3})}{\Delta}$$

Use Proposition 3 to discuss how an outflow of skilled and unskilled labor and an inflow of foreign capital generate an impact on wage inequality.

Proposition 3 (i) An outflow of skilled and unskilled labor decrease the wage inequality if $\theta_{X3}\theta_{K2}/\theta_{U3} > \theta_{K1}/\theta_{S1}$ holds; otherwise, an outflow of skilled and unskilled labor increase the wage inequality. (ii) An inflow of capital decreases the wage inequality if $\theta_{X3}\theta_{K2}/\theta_{U3} > \theta_{K1}/\theta_{S1}$ holds; otherwise, an inflow of capital widens the wage inequality.

The economic intuition of Proposition 1 is follow. From the Lemma 1 and 2, an outflow of skilled and unskilled labor increase the wage of skilled and unskilled labor and decrease the interest rate. An outflow of skilled and unskilled labor lead to the capital movement between two urban sectors. If the indirect capital-unskilled labor relative distributive share in the agricultural sector ($\theta_{X3}\theta_{K2}/\theta_{U3}$)is larger than the capital-skilled labor relative distributive share in the industrial sector(θ_{K1}/θ_{S1}),which means that compared with skilled labor in the industrial sector, the intermediate goods is more important for the production in the agricultural sector, the change of interest rate exerts a larger impact on the wage rate of unskilled labor than that of skilled labor, the wage inequality reduces. On the contrary, the wage inequality expands. For the second part, from the Lemma 3, an inflow of capital decreases the interest rate and increase the wage of skilled and unskilled labor. The change of wage inequality is determined by which labor benefits more from the decreased interest rate. If $\theta_{X3}\theta_{K2}/\theta_{U3}$ is larger than θ_{K1}/θ_{S1} , the unskilled labor benefits more from the change of interest rate and the wage inequality reduces. Otherwise, the wage inequality widens [28-32].

3.2 The Impacts of Rural Subsidy Policies on Wage Inequality and National Income

To promote the development of agriculture, wage subsidy is often used by government. Moreover, in order to obtain high yield of agriculture and make industrial intermediate goods available to farmers at affordable price, government in developing countries usually implements subsidy policy to promote the purchase the industrial intermediate goods. In this section, we examine the impacts of wage and purchase of intermediate goods subsidy.

First, we consider the impacts of an increase in wage subsidy in agricultural sector. Solving Eq. (9) by the Cramer's rule with the respect of $\hat{\beta}$, we get:

$$\hat{w}_S / \hat{\beta} = \lambda_U^{\mu}\theta_{K1}\lambda_{K2}\theta_{U3}/\Delta > 0$$

$$\hat{w}_U/\hat{\beta}=\left.\begin{Bmatrix}\theta_{S1}\theta_{U3}[(\lambda_{U2}^{\mu}+\lambda_{U3})(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2}-\lambda_{K1}\sigma_{SK}^{1})-\lambda_{K2}(\Omega_1-\theta_{K2}\lambda_{U3}\sigma_{XX}^{3}-\lambda_{U1}^{\mu}\sigma_{SK}^{1})]- \\ \theta_{S1}\lambda_{U3}\theta_{X3}\theta_{K2}\lambda_{K2}(\sigma_{UX}^{3}+\sigma_{XU}^{3})-\theta_{K1}\theta_{U3}[\lambda_{K1}(\lambda_{U2}^{\mu}+\lambda_{U3})(\sigma_{KS}^{1}-\sigma_{SS}^{1})-\lambda_{K2}\lambda_{U1}^{\mu}(\sigma_{US}^{1}-\sigma_{SS}^{1})]\end{Bmatrix}\right/\Delta<0$$

$$\hat{r}/\hat{\beta}=-\lambda_U^{\mu}\theta_{S1}\lambda_{K2}\theta_{U3}/\Delta<0$$

$$\hat{X}_1/\hat{\beta}=\lambda_U^{\mu}\lambda_{K2}\theta_{U3}(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})/\Delta>0$$

$$\hat{X}_2/\hat{\beta}=\lambda_U^{\mu}\theta_{U3}[\theta_{S1}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2}-\lambda_{K1}\sigma_{SK}^{1})-\theta_{K1}\lambda_{K1}(\sigma_{KS}^{1}-\sigma_{SS}^{1})]/\Delta<0$$

$$\hat{X}_3/\hat{\beta}=\lambda_U^{\mu}\left\{\theta_{S1}[\theta_{U3}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2}-\lambda_{K1}\sigma_{SK}^{1}+\lambda_{K2}\theta_{K2}\sigma_{XX}^{3})-\lambda_{K2}\theta_{X3}\theta_{K2}\sigma_{XU}^{3}]-\lambda_{K1}\theta_{U3}\theta_{K1}(\sigma_{KS}^{1}-\sigma_{SS}^{1})\right\}/\Delta<0$$

Use Lemma 4 to summarizes the impacts of an increase in wage subsidy in agricultural sector on the outputs and factor prices.

Lemma 4 *An increase in wage subsidy in agricultural sector has the following economic impact: (1)it falls skilled labor wage and raise unskilled labor wage and interest rate;(2) it falls industrial output and raise intermediate goods output and agricultural output.*

The economic intuition of Lemma 4 is given as follow. An increase in wage subsidy means that a decrease in β , and the agricultural sector enlarges the employment as well as the intermediate goods, which promote the demand of intermediate goods and unskilled labor. The expansion of intermediate goods sector attracts labor and capital from the industrial sector, reducing industrial output. The wage of skilled labor fall because its demand decreases. Since more unskilled labor employed in the agricultural sector, the expansion of intermediate goods sector mainly relies on capital which raises the interest rate. The increased interest rate pushes the cost and price of intermediate goods, discouraging the demand from agricultural sector. However

The increased demand of intermediate goods incurred by the expansion of agriculture is larger than the decreased demand leaded by the raised price, and the demand of intermediate goods increases at last.

Second, we consider the impacts of an increase in subsidy of intermediate goods in agricultural sector. Solving Eq. (9) by the Cramer's rule with the respect of $\hat{\alpha}$, we get:

$$\hat{w}_S/\hat{\alpha}=\theta_{K1}\lambda_{K2}\{\theta_{U3}\lambda_{U3}(\sigma_{UX}^{3}-\sigma_{XX}^{3})-\theta_{X3}[\lambda_{U3}(\sigma_{UU}^{3}-\sigma_{XU}^{3})-\lambda_U^{\mu}]\}/\Delta>0$$

$$\hat{w}_U/\hat{\alpha}=\theta_{X3}\left.\begin{Bmatrix}\theta_{S1}[(\lambda_{U2}^{\mu}+\lambda_{U3})(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2}-\lambda_{K1}\sigma_{SK}^{1})-\lambda_{K2}(\lambda_{U1}^{\mu}\sigma_{UK}^{1}+\lambda_{U2}^{\mu}\sigma_{UK}^{2}-\lambda_{U1}^{\mu}\sigma_{SK}^{1})] \\ -\theta_{K1}[\lambda_{K1}(\lambda_{U2}^{\mu}+\lambda_{U3})(\sigma_{KS}^{1}-\sigma_{SS}^{1})-\lambda_{K2}\lambda_{U1}^{\mu}(\sigma_{US}^{1}-\sigma_{SS}^{1})]\end{Bmatrix}\right/\Delta<0$$

$$\hat{r}/\hat{\alpha}=\theta_{S1}\lambda_{K2}[-\theta_{U3}\lambda_{U3}(\sigma_{UX}^{3}-\sigma_{XX}^{3})+\theta_{X3}\lambda_{U3}(\sigma_{UU}^{3}-\sigma_{XU}^{3})-\theta_{X3}\lambda_U^{\mu}]/\Delta<0$$

$$\hat{X}_1/\hat{\alpha}=\lambda_{K2}(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})[\lambda_{U3}\theta_{U3}(\sigma_{UX}^{3}-\sigma_{XX}^{3})-\theta_{X3}\lambda_{U3}(\sigma_{UU}^{3}-\sigma_{XU}^{3})+\lambda_U^{\mu}\theta_{X3}]/\Delta>0$$

$$\hat{X}_2/\hat{\alpha}=\left.\begin{matrix}[\theta_{S1}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2}-\lambda_{K1}\sigma_{SK}^{1})-\theta_{K1}\lambda_{K1}(\sigma_{KS}^{1}-\sigma_{SS}^{1})] \\ [\theta_{U3}\lambda_{U3}(\sigma_{UX}^{3}-\sigma_{XX}^{3})-\theta_{X3}\lambda_{U3}(\sigma_{UU}^{3}-\sigma_{XU}^{3})+\theta_{X3}\lambda_U^{\mu}]\end{matrix}\right/\Delta<0$$

$$\hat{X}_3/\hat{\alpha}=\left.\begin{Bmatrix}\lambda_{U1}^{\mu}\lambda_{K2}\sigma_{XX}^{3}(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})+\sigma_{XX}^{3}\lambda_{K2}[\theta_{K1}\lambda_{U1}^{\mu}\sigma_{US}^{1}-\theta_{S1}(\lambda_{K1}\sigma_{KK}^{1}+\sigma_{KK}^{2}\sigma_{KK}^{2})] \\ +[\theta_{S1}(\lambda_{K1}\sigma_{KK}^{1}+\lambda_{K2}\sigma_{KK}^{2})-\theta_{K1}\lambda_{K1}\sigma_{KS}^{1}-\lambda_{K1}(\theta_{S1}\sigma_{SK}^{1}-\theta_{K1}\sigma_{SS}^{1})] \\ [\theta_{U3}(\lambda_{U3}\sigma_{UX}^{3}+\lambda_{U2}^{\mu}\sigma_{XX}^{3})-\theta_{X3}(\lambda_{U3}\sigma_{UU}^{3}-\lambda_U^{\mu}+\lambda_{U2}^{\mu}\sigma_{XU}^{3})]\end{Bmatrix}\right/\Delta$$

Use Lemma 5 to summarizes the impacts of an increase in subsidy of intermediate goods in agricultural sector on the outputs and factor prices.

Lemma 5 *An increase in subsidy of intermediate goods in agricultural sector has the following economic impacts: (1)it falls skilled labor wage and raise unskilled labor wage and interest rate;(2) it reduces industrial output and raise intermediate goods output;(3) if own elasticity of intermediate goods in agriculture is small, it raises agricultural output.*

An increase in subsidy of intermediate goods means that a decrease in α, and the agricultural sector could purchase the intermediate goods at a lower price initially. And the substitution between the intermediate goods and unskilled labor occurs and the marginal product of unskilled labor and its wage raise. Part of rural labor moves to urban region. The intermediate goods sector expands its production because of increased demand from agriculture, and increases its demand of unskilled labor and capital consequently. Increased demand of capital pushes the interest rate and cost of intermediate goods. Increased price and subsidy of intermediate goods have opposite effect on the purchase price of intermediate goods in agriculture(αp_2). In the model, the change of subsidy dominates the change of price, and the purchase price of intermediate goods falls at last. The output of industrial sector falls since capital and unskilled labor moves to the intermediate goods sector, and the demand and wage of skilled labor reduce. Though the input of intermediate goods increases, the output of agricultural sector also depends on the amount of unskilled labor. In developing countries, the agricultural sector is still labor-intensive. If the own elasticity of intermediate goods in agriculture (σ_{XX}^3) is small, which implies that the substitution is relatively hard when facing the decreased price of intermediate goods, and the increased input of intermediate goods is limited. Consequently, the output and employment of the intermediate goods sector are limit. agricultural sector can raise its wage rate to retain needed labor and its output increases.

Next we investigate the impacts of subsidy on wage inequality and national income. From the Lemma 4 and 5, we get Proposition 3.

Proposition 3 *An increase in wage and purchase of intermediate goods subsidy narrows down the wage inequality.*

The economic intuition behind the Proposition 3 can be referred to the discussion of the Lemma 4 and 5.

Now we investigate the impacts of rural development policies on the national income. According to the results, we can get

$$p_1\frac{\hat{X}_1}{\hat{\alpha}}+\frac{\hat{X}_3}{\hat{\alpha}}=(\theta_{S1}\sigma_{SK}^1-\theta_{K1}\sigma_{SS}^1)[p_1\lambda_{K2}\lambda_{U3}\theta_{U3}(\sigma_{UX}^3-\sigma_{XX}^3)-p_1\lambda_{K2}\lambda_{U3}\theta_{X3}(\sigma_{UU}^3-\sigma_{XU}^3)$$

and

$$+p_1\lambda_{K2}\theta_{X3}\lambda_U^{\mu}+\lambda_{U1}^{\mu}\lambda_{K2}\sigma_{XX}^3-\theta_{U3}\lambda_{K1}(\lambda_{U3}\sigma_{UX}^3+\lambda_{U2}^{\mu}\sigma_{XX}^3)+\lambda_{K1}\theta_{X3}(\lambda_{U3}\sigma_{UU}^3-\lambda_U^{\mu}+\lambda_{U2}^{\mu}\sigma_{XU}^3)]/\Delta$$

$$p_1\frac{\hat{X}_1}{\hat{\beta}}+\frac{\hat{X}_3}{\hat{\beta}}=\lambda_U^{\mu}\{\theta_{S1}[\theta_{U3}(\lambda_{K1}\sigma_{KK}^1+\lambda_{K2}\sigma_{KK}^2-\lambda_{K1}\sigma_{SK}^1+\lambda_{K2}\theta_{K2}\sigma_{XX}^3)-\lambda_{K2}\theta_{X3}\theta_{K2}\sigma_{XU}^3]$$

$$-\lambda_{K1}\theta_{U3}\theta_{K1}\sigma_{KS}^1+(p_1\lambda_{K2}-\lambda_{K1})\theta_{U3}\lambda_U^{\mu}(\theta_{S1}\sigma_{SK}^1-\theta_{K1}\sigma_{SS}^1)\}/\Delta$$

The sign of $p_1\frac{\hat{X}_1}{\hat{\alpha}}+\frac{\hat{X}_3}{\hat{\alpha}}$ is ambiguous even though σ_{XX}^3 is small. If $p_1<\lambda_{K2}/\lambda_{K1}$ holds, we can get $p_1\frac{\hat{X}_1}{\hat{\beta}}+\frac{\hat{X}_3}{\hat{\beta}}<0$.

Proposition 4 *An increase in wage subsidy raises national income; while the impact of an increase in subsidy of intermediate goods on national income is ambiguous.*

From Lemma 4, if $p_1 < \lambda_{K2}/\lambda_{K1}$ holds, an increase in wage subsidy raise the national income. However, its impact on national income is ambiguous even with the condition that σ_{XX}^3 is small. The difference effect of two subsidy on national income lies on their impacts on price of intermediate goods. Subsidy of wage and intermediate goods raises the interest rate and pushes the cost, which discourages the demand of intermediate goods; however, subsidy of intermediate goods makes the purchase price of intermediate goods down, which encourages the demand of intermediate goods sector. The greater expansion of intermediate goods sector attracts capital and labor in the industrial sector, dropping the industrial output largely.wage subsidy also falls the industrial output, its impact on industrial output is limit because the increased price of intermediate goods reduces its demand which leads to limit expansion of intermediate goods sector.

4. CONCLUDING REMARKS

Economic growth, rural development and skilled-unskilled wage inequality are three main task for developing countries. Meanwhile, the developing countries also experiences massive factor mobility domestically and internationally. In this paper, we investigate the issue of the effects of international factor mobility and rural development policies on wage inequality in a three-sector general equilibrium model, where agricultural sector uses industrial goods as intermediate input in agriculture. We find that an outflow of skilled labor benefits the development of agricultural sector while an outflow of unskilled labor deteriorates it. The impact of an inflow of capital on agriculture depends on the elasticity of substitution between skilled labor and unskilled labor in the industrial sector. Their impacts on wage inequality depends on capital-labor relative distributive share in industrial and agricultural sector. The economic impacts of rural development policies, an increase in wage and purchase of intermediate goods subsidy narrows down the wage inequality. However, their impacts on national income are different: an increase in wage subsidy raises national income unambiguously; while the impact of an increase in subsidy of intermediate goods on national income is not clear.

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Author has declared that no competing interests exist.

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