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Rural-urban migrants' remittances and wage inequality: Evidence from China

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Supplementary Material S1 (ESM)

Based on the three strata of industry in the *China Statistical Yearbook* (2016) issued by the National Bureau of Statistics of China, let the primary industry be the rural sector *Z*, and the secondary and tertiary industries be the urban formal sector *X*.

(1) In the primary industry, the value added was 905 397.23 million USD, the number of employed persons was 214.96 million people, and the per capita disposable income of rural households was 1 861 USD. We can then calculate the output elasticity in the rural sector.

(2) In the secondary industry, the value added was 4 464 533.37 million USD, and the number of employed persons was 223.5 million people. In the tertiary industry, the value added was 5 771 704.08 million USD, and the number of employed persons was 337.57 million people. Let urban labour with junior college or above degree represent skilled labour, while urban labour with technical secondary school or less represents unskilled labour of the urban formal sector.[1] According to the 2013 Chinese Household Income Project Survey (CHIP2013), there were 19 887 individuals in the survey sample of urban households. Among them, there were 5 711 individuals with a college degree or above, whose average annual wage income was 8 862 USD. The average annual wage income of other individuals with a lower degree was 6 223 USD. According to the *China Statistical Yearbook*, in 2016, the number of urban employed persons was 414.28 million people, and the per capita disposable income of urban households

[1]Chinese workers' income is directly related to their education level, and a junior college diploma is the level above which one is considered to have higher education.

https://doi.org/10.17221/53/2019-AGRICECON

was 5 061 USD; in 2013, the number of urban employed persons was 382.4 million people, and the per capita disposable income of urban households was 3 985 USD. Thus, we can approximate that skilled labour in 2013 was 109.81 million people. Based on the growth rate of the number of urban employed persons, skilled labour in 2016 was 118.97 million people. With the growth rate of the per capita disposable income of urban households, the average annual wage income of skilled labour in 2016 was 11 255 USD, while that of unskilled urban labour was 7 903 USD. From the above, we can calculate the output elasticity in the urban formal sector.

(3) As for the urban informal sector, note that the wage rate of this sector is lower than that of the rural sector, and labour transfers to this sector in order to wait for employment opportunities in the urban formal sector, and goods and services produced by this sector can only be provided to urban residents. Therefore, we define labour employed in the urban informal as including both the economically active population excluding employed persons, which was calculated as being 30.91 million people,[2] as well as rural-urban migrants who provide hotel and catering services, services to households, repair services, and other services, which was calculated as being 47.89 million people.[3] According to the Statistical Report of the People's Republic of China on the Development of Social Services in 2016 issued by China's Ministry of Civil Affairs[4], the national average of urban minimum living guarantee of China was 893.5 USD (74.46 USD monthly), which provides an urban household with the minimum food requirements. Considering the minimum cost of housing for rural-urban migrants, the wage rate of the urban informal sector was estimated to be 1 200 USD. Since the output of the informal sector is missed in official statistics, we used Hu's (2015)[5] accounting method for China's informal economy as well as the definition of China's informal employment by Hu and Zhao (2006)[6], and calculated the ratio of the output for China's informal economy to the income of China's informal employment. In this way, we calculated the effective labour parameter in the urban informal sector.

Turning to rural-urban migrants' remittances, according to SRMCMW2016, the total number of rural-urban migrant workers in China was about 281.71 million, and their average monthly wage

[2] According to the *China Statistical Yearbook* (2016), in 2016, the number of economically active population in China was 806.94 million persons, and the number of employed persons was 776.03 million persons.

[3] From the Survey Report on the Monitoring of Chinese Migrant Workers (SRMCMW2016) issued by the National Bureau of Statistics of China, we obtained the industrial distribution of Chinese migrant workers. Available at http://www.stats.gov.cn/tjsj/zxfb/201704/t20170428_1489334.html (accessed Mar 1, 2019).

[4] Available at http://www.mca.gov.cn/article/sj/tjgb/201708/20170815005382.shtml (accessed Mar 1, 2019).

[5] Hu H. (2015): Study on the measurement of the informal economy in China. Statistics & Decision, 18: 22-25. (in Chinese)

[6] Hu A., Zhao L. (2006): Informal employment and informal economy in the economic transformation in the process of urbanization in China (1990-2004). Journal of Tsinghua University (Philosophy and Social Sciences), 3: 111-119. (in Chinese)

https://doi.org/10.17221/53/2019-AGRICECON

was about 493 USD; Li et al. (2008)[7] found that about 25% of rural-urban migrants did not send money back home. Meanwhile, a new generation of migrant workers born since 1980 has become an important part of rural-urban migrant, accounting for 49.7% of the national total in 2016 (according to SRMCMW2016); Liu and Sun (2014)[8] found that remittance-wage ratio of the new generation is about 80.14% of that of the older generation of migrant workers. Therefore, we can calculate that the internal remittance k was about 363 414 million USD.

As for the interest rate, it was calculated as being 6.9% according to the benchmark 1-to-5-year lending rate announced by China's central bank in 2016. Because capital cannot flow freely from urban areas to rural areas in developing countries—and China is not an exception—it's reasonable to consider that the interest rate in the rural sector is higher than that of other sectors, which is 10.35% (=1.5×6.9%).

We used the economic data described above to calibrate the parameters. The results are summarized in Table 3. Since the unskilled labour allocation mechanism in Equation (10) only has considered the relationship between wage rates, the effect of unconsidered factors on unskilled labour allocation is depicted by the migration parameter, 3.647, which is derived from the initial equilibrium of Equation (7).

[7] Li Q., Mao X., Zhang T. (2008): Analysis on the decision, quantity and use of migrant workers' remittance. China Rural Survey, 3: 2-12. (in Chinese)
[8] Liu J., Sun Y. (2014): The income level and consumption behavior of the new generation of migrant workers and their changing trend. Reform of Economic System, 4: 95-99. (in Chinese)

https://doi.org/10.17221/53/2019-AGRICECON

Supplementary Material S2 (ESM)

Total differential of Equations. (1) – (10) is the following:

Equation Chapter 1 Section 1 $\theta_{SX}\hat{w}_S + \theta_{KX}\hat{r}_X = 0$, (A-1)

$$\hat{p}_Y = \hat{w}_Y, \quad \text{(A-2)}$$

$$\theta_{LZ}\hat{w}_Z + \theta_{KZ}\hat{r}_Z - \varepsilon\hat{k} = 0, \quad \text{(A-3)}$$

$$\hat{p}_Y + \hat{Y} - (1+e)\hat{X} + e\hat{k} = 0, \quad \text{(A-4)}$$

$$\hat{X} + \varepsilon_{SS}^X\hat{w}_S + \varepsilon_{SK}^X\hat{r}_X = 0, \quad \text{(A-5)}$$

$$\lambda_{LX}\left(\hat{X} + \varepsilon_{LS}^X\hat{w}_S + \varepsilon_{LK}^X\hat{r}_X\right) + \lambda_{LY}\hat{Y} + \lambda_{LZ}\left(\hat{Z} + + \varepsilon_{LL}^Z\hat{w}_Z + \varepsilon_{LK}^Z\hat{r}_Z - \varepsilon\hat{k}\right) = 0, \quad \text{(A-6)}$$

$$\varepsilon_{LK}^X\hat{r}_X + \varepsilon_{LS}^X\hat{w}_S + \hat{X} - \hat{Y} + c\hat{w}_Y - (a+b)\hat{w}_Z = 0, \quad \text{(A-7)}$$

$$\hat{X} + \varepsilon_{LS}^X\hat{w}_S + \varepsilon_{LK}^X\hat{r}_X + \hat{\theta} = \hat{k}, \quad \text{(A-8)}$$

$$\hat{X} + \varepsilon_{KS}^X\hat{w}_S + \varepsilon_{KK}^X\hat{r}_X = 0, \quad \text{(A-9)}$$

$$\hat{Z} + \varepsilon_{KL}^Z\hat{w}_Z + \varepsilon_{KK}^Z\hat{r}_Z - \varepsilon\hat{k} = 0. \quad \text{(A-10)}$$

According to (A-1), we have $\hat{r}_X = -\theta_{SX}/\theta_{KX}\ \hat{w}_S$, then (A-5) and (A-9) become, respectively: $\hat{X} + \left(\varepsilon_{SS}^X - \varepsilon_{SK}^X\theta_{SX}/\theta_{KX}\right)\hat{w}_S = 0$ and $\hat{X} + \left(\varepsilon_{KS}^X - \varepsilon_{KK}^X\theta_{SX}/\theta_{KX}\right)\hat{w}_S = 0$. Thus, X, w_S, r_X will be unaffected by θ. Therefore, we have $\hat{\theta} = \hat{k}$ in (A-8), $c\hat{w}_Y - (a+b)\hat{w}_Z = \hat{Y}$ in(A-7), $\hat{r}_Z = -\theta_{LZ}/\theta_{KZ}\ \hat{w}_Z + \varepsilon/\theta_{KZ}\ \hat{\theta}$ in (A-3), and $\hat{Z} = -\varepsilon\left(\varepsilon_{KK}^Z/\theta_{KZ} - 1\right)\hat{\theta} - \left(\varepsilon_{KL}^Z - e_{KK}^Z\theta_{LZ}/\theta_{KZ}\right)\hat{w}_Z$ in(A-10). By (A-2) and $c\hat{w}_Y - (a+b)\hat{w}_Z = \hat{Y}$, and $\hat{Z} = -\varepsilon\left(\varepsilon_{KK}^Z/\theta_{KZ} - 1\right)\hat{\theta} - \left(\varepsilon_{KL}^Z - \varepsilon_{KK}^Z\theta_{LZ}/\theta_{KZ}\right)\hat{w}_Z$,

https://doi.org/10.17221/53/2019-AGRICECON

we have $a\hat{w}_Y - (a+b)\hat{w}_Z = -e\hat{\theta}$ in (A-4), and $c\lambda_{LY}\hat{w}_Y - \left[\lambda_{LY}(a+b) + \lambda_{LZ}d\right]\hat{w}_Z = -\lambda_{LZ}\varepsilon d\hat{\theta}$ in (A-6). Therefore, we obtain Equation (11).

Solving Equation (11) with Cramer's rule, we can obtain the following:

$$\begin{aligned}\frac{\hat{w}_Y}{\hat{\theta}} &= \frac{1}{\Delta_1}\begin{vmatrix} -e & -(a+b) \\ -\varepsilon\lambda_{LZ}d & -\lambda_{LY}(a+b) - \lambda_{LZ}d \end{vmatrix} \\ &= \frac{1}{\Delta_1}\left\{\left[\lambda_{LY}(a+b) + \lambda_{LZ}d\right]e - \varepsilon\lambda_{LZ}d(a+b)\right\}\end{aligned}, \tag{A-11}$$

$$\frac{\hat{w}_Z}{\hat{\theta}} = \frac{1}{\Delta_1}\begin{vmatrix} a & -e \\ \lambda_{LY}c & -\varepsilon\lambda_{LZ}d \end{vmatrix} = \frac{1}{\Delta_1}\left\{\lambda_{LY}ce - \varepsilon\lambda_{LZ}da\right\}. \tag{A-12}$$

As for the mobile capital case, total differential of Equations (1–8) and (14) is the following:

$$\theta_{SX}\hat{w}_S + \theta_{KX}\hat{r} = 0, \tag{A-13}$$

$$\hat{p}_Y = \hat{w}_Y, \tag{A-14}$$

$$\theta_{LZ}\hat{w}_Z + \theta_{KZ}\hat{r} - \varepsilon\hat{k} = 0, \tag{A-15}$$

$$\hat{p}_Y + \hat{Y} - (1+e)\hat{X} + e\hat{k} = 0, \tag{A-16}$$

$$\hat{X} + \varepsilon^X_{SS}\hat{w}_S + \varepsilon^X_{SK}\hat{r} = 0, \tag{A-17}$$

$$\lambda_{LX}\left(\hat{X} + \varepsilon^X_{LS}\hat{w}_S + \varepsilon^X_{LK}\hat{r}\right) + \lambda_{LY}\hat{Y} + \lambda_{LZ}\left(\hat{Z} + + \varepsilon^Z_{LL}\hat{w}_Z + \varepsilon^Z_{LK}\hat{r} - \varepsilon\hat{k}\right) = 0, \tag{A-18}$$

$$\varepsilon^X_{LK}\hat{r} + \varepsilon^X_{LS}\hat{w}_S + \hat{X} - \hat{Y} + c\hat{w}_Y - (a+b)\hat{w}_Z = 0, \tag{A-19}$$

$$\hat{X} + \varepsilon^X_{LS}\hat{w}_S + \varepsilon^X_{LK}\hat{r} + \hat{\theta} = \hat{k}, \tag{A-20}$$

$$\lambda_{KX}\left(\hat{X} + \varepsilon^X_{KS}\hat{w}_S + \varepsilon^X_{KK}\hat{r}\right) + \lambda_{KZ}\left(\hat{Z} + \varepsilon^Z_{KL}\hat{w}_Z + \varepsilon^Z_{KK}\hat{r} - \varepsilon\hat{k}\right) = 0. \tag{A-21}$$

https://doi.org/10.17221/53/2019-AGRICECON

According to (A-13) and (A-17), we have $\hat{w}_S = -\theta_{KX}/\theta_{SX}\hat{r}$, $\hat{X} = -h\hat{r}$. By Assumption 1, we have $\hat{k} = -h\hat{r} + \hat{\theta}$ in (A-20), $\hat{Y} = -\hat{w}_Y - h\hat{r} - e\hat{\theta}$ in (A-16), $\hat{Z} = -\left[\varepsilon_{KK}^{Z} + \varepsilon h + (j-h)\lambda_{KX}/\lambda_{KZ}\right]\hat{r} - \varepsilon_{KL}^{Z}\hat{w}_Z + \varepsilon\hat{\theta}$ in (A-21). Thus, we have $\theta_{LZ}\hat{w}_Z + (\theta_{KZ} + \varepsilon h)\hat{r} = \varepsilon\hat{\theta}$ in (A-15), $\lambda_{LY}\hat{w}_Y + \lambda_{LZ}\left(\varepsilon_{KL}^{Z} - \varepsilon_{LL}^{Z}\right)\hat{w}_Z + A\hat{r} = -\lambda_{LY}e\hat{\theta}$ in (A-18), $-a\hat{w}_Y + (a+b)\hat{w}_Z = e\hat{\theta}$ in (A-19). Therefore, we obtain Equation (15).

Solving Equation (15) using Cramer's rule yields the following:

$$\frac{\hat{w}_Y}{\hat{\theta}} = \frac{1}{\Delta_2}\begin{vmatrix} \varepsilon & \theta_{LZ} & \theta_{KZ} + \varepsilon h \\ e & a+b & 0 \\ -\lambda_{LY}e & \lambda_{LZ}\left(\varepsilon_{KL}^{Z} - \varepsilon_{LL}^{Z}\right) & A \end{vmatrix}, \tag{A-22}$$

$$= \frac{1}{\Delta_2}\left\{\varepsilon A(a+b) + e\begin{bmatrix}(\theta_{KZ} + \varepsilon h)\lambda_{LZ}\left(\varepsilon_{KL}^{Z} - \varepsilon_{LL}^{Z}\right) \\ +\lambda_{LY}(a+b)(\theta_{KZ} + \varepsilon h) - \theta_{LZ}A\end{bmatrix}\right\}$$

$$\frac{\hat{w}_Z}{\hat{\theta}} = \frac{1}{\Delta_2}\begin{vmatrix} 0 & \varepsilon & \theta_{KZ} + \varepsilon h \\ -a & e & 0 \\ \lambda_{LY} & -\lambda_{LY}e & A \end{vmatrix} = \frac{1}{\Delta_2}\left[c\lambda_{LY}e(\theta_{KZ} + \varepsilon h) + aA\varepsilon\right], \tag{A-23}$$

$$\frac{\hat{r}}{\hat{\theta}} = \frac{1}{\Delta_2}\begin{vmatrix} 0 & \theta_{LZ} & \varepsilon \\ -a & a+b & e \\ \lambda_{LY} & \lambda_{LZ}\left(\varepsilon_{KL}^{Z} - \varepsilon_{LL}^{Z}\right) & -\lambda_{LY}e \end{vmatrix}. \tag{A-24}$$

$$= -\frac{1}{\Delta_2}\left\{\varepsilon a\lambda_{LZ}\left(\varepsilon_{KL}^{Z} - \varepsilon_{LL}^{Z}\right) + \varepsilon(a+b)\lambda_{LY} + \lambda_{LY}ec\theta_{LZ}\right\} > 0$$