Urban-Rural Income Inequality in China:

new evidence from Input-Output Analysis

Guoming Shi

Advisor: Mònica Serrano

Abstract: Income inequality between urban and rural households is a severe problem in China. There are a variety of factors that can cause this urban-rural gap. This paper focuses on factor income inequality, more precisely in the labour compensation income received by urban and rural households at sectoral level (42 sectors) and considering the 31 Chinese provinces. The aim of this paper is to analyse to what extend China's economic structure can reduce this type of inequality. I develop an extension of the Miyazawa model within a multiregional and multisectoral framework. I find that urban households always benefit more than their rural counterparts when treated by consumption stimulation tools. In the cross-regional analysis, I evaluate the internal effect and spill-over effect, showing the regions that benefit most from others' consumption increase.

Key Words: Urban-rural gap, Income inequality, Miyazawa, Multiregional, Input-output

JEL: C67, R12, R20, R23

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1. Introduction

Income inequality is a challenge problem that strongly affects the economy and society. The impact is strong, significant, and wide (Dabla-Norris et al., 2015). Based on a long-time span analysis for OECD economies, Cingano (2014) shows that income inequality has a negatively and significant impact on economic growth, and retards the human capital accumulation of those countries in the bottom group affecting also education (Comfort et al., 2001) and health levels (Chetty et al., 2016).

Being the largest developing economy, China faces inequality problems more mixed and deeper than developed countries. The Chinese inequality magnitude has been dramatically increasing since the marketization reform in 1978. Piketty et al. (2019) find the top 10 percent income share increased up to 41%, while the bottom 50 percent decreased a 15% from 1978 to 2015. The analysis shows China's inequality level approaches that of US, even though its level was close to that of Nordic countries at the very beginning of the period. This trend implies that China's income inequality has been increasing with its economy grows for the last decades, reaching a GINI coefficient ranged between 0.53 and 0.55 in the period 2005-2012 (Yu & Xiang, 2014). Results by Yu & Xiang (2014) rank China's income inequality among the highest in the world, being significantly driven by structural factors such as regional disparities and the rural-urban gap. Evidence from Young (2013) shows that the urban-rural gap accounts for about 40% of country inequalities generally, and people migrating from rural hometowns to urban regions are likely to earn more wages. This conclusion is in line with Yang (1999), which decomposes inequalities in two Chinese provinces and finds the urban-rural income differences occupies a large share of total inequalities. The literature suggests the necessity to get deeper insights into China's urban-rural income gap, also considering regional differences.

Reasons behind the urban-rural income gap at regional level are multiple and complicated. This paper mainly focuses on those structural factors that might be attributable to the Chinese political system: urbanization, the dual structure, and the so-called "Hukou" system. First, urbanization process in China doesn't only stimulate economic growth, but also contribute to the enlarging income gap between urban and rural individuals simultaneously. Research done by Zhang & Song (2003) finds China's urbanization speeded up since 1978, the year of the marketization reform. The urbanization level increases from 17% to 30% in almost twenty years. Chen et al. (2020) examines the reverse causality between urban-rural income gap and urbanization process, showing that the former is a cause of the latter while the latter pushes to enlarge the former. Within China's urbanization process, people born in rural areas prefer to migrate to cities, whose higher wage compensations and richer amenities are attractive enough to pull workers in. On the contrary, rural areas are the one losing competitions with urban counterparts.

Second, the urban-rural dual structure is the result of unequal policy treatments. As analysed by Chan & Wei (2019), all Chinese citizens are divided by the institution into two systems: urban system and rural system. Since 1950s the Chinese government strategy gives more priorities to urban development, therefore people belonging to the rural system sacrifice a lot to support the development of urban areas. Rural workers are more specialised in agricultural production while urban workers are mainly engaged in the industrialization process (steel, automotive, chemical sectors etc.) first and then in the intensification of services sectors. During this process, the productivity in rural areas remained in a low level for many years (O'Leary & Watson, 1982). Within the dual structure, resource allocation is also unequal. Su & Heshmati (2013) finds that education resources and high-income vacancies are relatively scare in rural areas. It makes human capital accumulation and income increase in rural areas difficult, enlarging such urban-rural income gap. Since urban and rural areas have long been specialising in two different development modes, education resources, job vacancies, public welfare access, etc. are all strongly bounded with the dual structure itself, presenting an obvious advantage in urban side and intensifying the divergency in China's urban-rural development.

Finally, the "Hukou" system. "Hukou" system is the household registration system that documents the place of living, the birthdate, the gender of each citizen, and divides citizens into two groups: agriculture and non-agriculture. It also limits free domestic migration as discussed by Chan & Zhang (1999). Migrations from rural to urban areas, and from one province to another are strictly controlled or partly controlled by the government. According to Song (2014), workers with different "Hukou" may not be equally treated when they try to access public services. Discriminations in the job market are not gone since positions are only open to those registered in certain places, which may finally affect the wage one can gain. Since "Hukou" system is an institutional tool, reforms in that side will greatly influence market equilibrium in the market side. Pi & Zhang (2016) finds a positive relationship between the strength of "Hukou" system reform and the degree of wage equality.

Theoretically, individual income is affected by three components: remuneration of primary factors (labour and capital), through the effect of relative prices in consumption, and government interventions. The first one, the renumeration of primary factors, is key in China's distribution system today. After the abolishment of planned economy system labour supply, capital investment, intellectual properties, etc. are all legally permitted to get involved in production activities, although there still are some restrictions due to Chinese political system. The second factor, changes in relative prices, has a statistically significant impact on income inequality (Slottje, 1987). Third factor, goals of government interventions are achieved via taxation and subsidize or even other redistributive policies. By adjusting the tax rate and relocate tax revenues to those in need, the government can proactively intervene the distribution process.

As discussed, urban-rural income inequality in China has been long-existing, impose negative impact especially on the welfare of those living in rural areas with low income and impairs the long-run growth. Specially, this gap problem is closely related with regional disparities for levels of development of over the provinces in China that differ largely. In this context, this paper aims at analysing to what extent China's economic structure might downsize the existing urban-rural income gap in Chinese provinces. The paper seeks the interdependence between income, consumption, and production, to see if marginal increase of labour compensation stimulated by new production needed to satisfy additional consumption is large enough to eliminate the divergency trend. The geographical distribution of production (income generation) and consumption processes makes interrelationship occurs in different regions, linking the increase of one product consumption by one household-type in one region with the labour compensation (income generation through production) of another household-type that works in a different sector in another region.

This paper develops an income distribution model based in Miyazawa (1976) in a multiregional and multisectoral setting. The analysis combines income, consumption, and economic data for two-type of households (urban, rural), 31 Chinese provinces, and 42 economic sectors for China 2012. Results based on the country-level data suggest that extra consumption stimulated is not large enough to let the urban-rural income gap go down, while results based on the regional-level data lead to more detailed conclusion after taking regional disparities into consideration. Nonetheless, the current economic structure of China would amplify the urban-rural income gap if there is not any specific intervention from the government to redistribute income. It is advised to use a mix of tools including government interventions to help alleviate the urban-rural income gap in China today.

The structure of the paper is as follows: section 2 presents the literature review; Section 3 describes the input-output methodology focusing in the Miyazawa income distribution model and in the development of an income distribution model based on the Miyazawa model in a multiregional framework; section 4 describe the databases; section 5 is devoted to results; and section 6 concludes.

2. Literature Review

Plenty of studies targeting China's urban-rural gap are presented based on data in its marketization era. Xue (2005) analyses the urban-rural income distribution from 1978 to 1995, finding a "first improve but then worsen" dynamic characteristic of income distribution in China, and the rural productivity is shown to be in a low-level, which is in line with O'Leary & Watson (1982). Lu (2002) focuses on another dimension of gap analysis, the consumption. Results show that the urban-rural consumption disparity increases in 1990. By studying the urban-rural segmentation under a multisectoral framework, Yang & Zhou (1999) concludes that both income and consumption differentials between urban and rural areas have been going up since 1985. In a multisectoral analysis, Peng (1992) compares the wage determination process of rural public sector, rural private sector, and urban state sector, showing that the process of rural industries is different from that of urban ones. Though both started marketisation at almost the same time, ownerships and coordination mechanisms were not united, which can be considered as the institutional factor that effects. Solutions to this problem based on Yao & Jiang (2021) insist on increasing the productivity in agricultural sector and provide insurance support for it, which is mainly operated by rural households.

Meanwhile, regional disparities are shown to be mixed with the urban-rural disparity. Evidence from Lu (2002) say that provinces with higher Gross Domestic Product (GDP) per capita tend to have more equalities regarding urban-rural consumption. According to Knight & Song (1993), there are significant spatial inequalities of income in China, and the magnitude of divergency has been enlarging since the 1980s. Dividing China into the coast region and interior region, Hu (2002) shows the income inequality between these two regions increases with the industrial agglomeration process goes further.

The determinants of income have been widely discussed, including education and personal ability (Griliches & Mason, 1972), corruption (Gupta et al., 2002), foreign investment (Choi, 2006) and so on. Specifically in terms of the relationship with consumption, Jappelli & Pistaferri (2010) present models which serve to estimate the numerical relationship between income and consumption in the panel data; and Carroll (1994) shows future income uncertainty negatively effects the consumption scale. These studies clearly study such relationship from a variety of dimensions, while spatial elements or sectoral elements are not emphasized much.

However, previous literature in this topic rarely discusses two specific questions. First, whether it is possible for urban and rural households to eliminate the income gap on their own through adjusting the most basic behaviour that might connect both household-types: consumption. Second, to consider the sectoral interrelationship and regional interdependencies that characterizes the supply chain along the national and global production process today.

To investigate the numerical links among urban-income, rural-income, urban-consumption, and rural-consumption changes in a multisectoral and multiregional setting, this paper applies the income distribution model based on Miyazawa (1976). This model is open to absorb both household consumption and their wage compensation into the intermediate production flow, which is similar to Batey (1985).

Results gained are to show the interdependence of income and consumption. For example, Hewings et al. (2001) studies such interdependence relationship of income formation and output generation in Chicago metropolitan area. Following ideas in Steenge et al. (2019), the income distribution model allows analysis with multiple groups (i.e. with different characteristics, having different skills, locating in different places, working in different sectors etc.).

In the multiregional analysis, the region aggregation strategy helps for generating more diverse results. Based on Miller & Blair (2009) which presents one way of aggregation, together with the new interpretations of technical coefficient matrices. The income model and aggregation strategy are jointly used in this paper, so that the urban-rural income inequality problem is able to get deeper discussed.

In a nutshell, what make this paper different are the following:

(i) Empirically evaluate the efforts to alleviate the urban-rural income gap by adjusting consumption choices on households' own.

(ii) Strengthen elements including sectoral differences and spatial disparities in the urban-rural income gap topic.

3. Methodology

3.1 Basic Framework of Input-Output Analysis

Let a column vector $\mathbf{x}$ with $\boldsymbol{n}$ rows be the total output by sectors of one economy, such that:

$$\boldsymbol{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ \vdots \\ x_n \end{bmatrix} \tag{1}$$

where $\boldsymbol{x_i}$ corresponds to the total output in sector $\boldsymbol{i}$ in monetary terms.

Let a $\boldsymbol{n} \times \boldsymbol{n}$ matrix $\mathbf{Z}$ denote the intermediate production flow:

$$\boldsymbol{Z} = \begin{bmatrix} z_{11} & z_{12} & \cdots & \cdots & z_{1(n-1)} & z_{1n} \\ z_{21} & z_{22} & \cdots & \cdots & z_{2(n-1)} & z_{2n} \\ \vdots & \vdots & & & \vdots & \vdots \\ \vdots & \vdots & & \ddots & \vdots & \vdots \\ z_{(n-1)1} & z_{(n-1)2} & \cdots & \cdots & z_{(n-1)(n-1)} & z_{(n-1)n} \\ z_{n1} & z_{n2} & \cdots & \cdots & z_{n(n-1)} & z_{nn} \end{bmatrix} \tag{2}$$

where $\boldsymbol{z_{ij}}$ is the interindustry flow from sector $\boldsymbol{i}$ to sector $\boldsymbol{j}$, which measures the quantity of intermediate products consumed in the whole production process.

Let another column vector $\boldsymbol{f}$ with $\boldsymbol{n}$ rows be the final demand of this economy:

$$\boldsymbol{f} = \begin{bmatrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ \vdots \\ f_n \end{bmatrix} \tag{3}$$

where $\boldsymbol{f_i}$ is the direct consumption of products produced in sector $\boldsymbol{i}$.

For any sector the total output is the sum of its intermediate input and final consumption. The following relationship hence holds for any sector $\boldsymbol{i}$:

$$x_i = z_{i1} + z_{i2} + z_{i3} + \cdots + z_{in} + f_i \tag{4}$$

The technical coefficient, $\boldsymbol{a_{ij}}$, measures the correlation between intermediate input and total output, which is defined by:

$$a_{ij} = {}^{z_{ij}}/_{x_i} \tag{5}$$

Gathering all $\boldsymbol{a_{ij}}$ for each sector's interaction with others, the technical coefficient matrix $\boldsymbol{A}$ can be given by:

$$\boldsymbol{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & \cdots & a_{1(n-1)} & a_{1n} \\ a_{21} & a_{22} & \cdots & \cdots & a_{2(n-1)} & a_{2n} \\ \vdots & \vdots & & & \vdots & \vdots \\ \vdots & \vdots & & \ddots & \vdots & \vdots \\ a_{(n-1)1} & a_{(n-1)2} & \cdots & \cdots & a_{(n-1)(n-1)} & a_{(n-1)n} \\ a_{n1} & a_{n2} & \cdots & \cdots & a_{n(n-1)} & a_{nn} \end{bmatrix} \tag{6}$$

It can be shown that:

$$\boldsymbol{x} = \boldsymbol{Ax} + \boldsymbol{f} \tag{7}$$

$$\boldsymbol{x} = (\boldsymbol{1} - \boldsymbol{A})^{-1}\boldsymbol{f} \tag{8}$$

Term $(\boldsymbol{1} - \boldsymbol{A})^{-1}$ in equation (8) is called the Leontief Inverse. Shortly, the Leontief Inverse links the gross output with the final demand, making dependence analysis, playing a significant role in Miyazawa's method.

Moving further, vectors including final demand $\boldsymbol{f}$ and value added $\boldsymbol{v}$ could be matrices with more than one column or one row respectively. The final demand, $\boldsymbol{f}$, is usually composed of household consumption, government purchase, capital formation, inventory increase, net export etc. (The definition of each component may differ since countries implement different statistical regulations, which also applies to value-added matrix after). Equation (3) can be rewritten as:

$$\boldsymbol{f} = \begin{bmatrix} f_{1c} & f_{1g} & f_{1k} & f_{1x} & \cdots \\ f_{2c} & f_{2g} & f_{2k} & f_{2x} & \cdots \\ \vdots & \vdots & \vdots & \vdots & \cdots \\ f_{nc} & f_{ng} & f_{nk} & f_{nx} & \cdots \end{bmatrix} \tag{9}$$

Subject to:

$$f_i = f_{ic} + f_{ig} + f_{ik} + f_{ix} + \cdots \tag{10}$$

where f_{ic} is the household consumption of products made in sector i, f_{ig} is the government purchase, f_{ik} is the capital stock increase, and f_{ix} is the net export or the difference of imports and outputs in sector i.

Similarly, the value-added term $\boldsymbol{v}$ can be expanded to:

$$\boldsymbol{v} = \begin{bmatrix} v_{1w} & v_{2w} & v_{3w} & \cdots & v_{nw} \\ v_{1t} & v_{2t} & v_{3t} & \cdots & v_{nt} \\ v_{1p} & v_{2p} & v_{3p} & \cdots & v_{np} \\ v_{1d} & v_{2d} & v_{3d} & \cdots & v_{nd} \\ \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix} \tag{11}$$

Subject to:

$$v_i = v_{iw} + v_{it} + v_{ip} + v_{id} + \cdots \tag{12}$$

where v_{iw} is the wage compensation for labours working in sector i, v_{it} is the tax paid by firms, $\boldsymbol{v_{ip}}$ is the business profit or surplus, $\boldsymbol{v_{id}}$ is all of the capital depreciation.

3.2 Miyazawa's Income Distribution Model

In the framework presented in section 3.1, it is assumed that both $\boldsymbol{f}$ and $\boldsymbol{v}$ are exogenous. Consequently, the numerical interdependence between income and consumption on household hand is set to be predetermined and hence ignored. It is called by Miyazawa (1976) to endogenize these household behaviours, and make them correlate with the interindustry productions. Regarding households as an independent production sector makes sense for they directly sell labours (the total amount of labour supply is measured by their wage compensation) to other sectors and consume final products produced in other sectors.

Let's first start with the model with only one type of household in Miller et al. (2009). Define the new technical coefficient matrix $\overline{\boldsymbol{A}}$ as:

$$\overline{\boldsymbol{A}} = \begin{pmatrix} \boldsymbol{A} & \boldsymbol{h_c} \\ \boldsymbol{h_w} & \boldsymbol{h} \end{pmatrix} \tag{13}$$

With:

$$\boldsymbol{h_c} = \begin{bmatrix} a_{1(n+1)} \\ a_{2(n+1)} \\ a_{3(n+1)} \\ a_{4(n+1)} \\ \vdots \\ a_{n(n+1)} \end{bmatrix} = \begin{bmatrix} f_{1c}/x_1 \\ f_{2c}/x_2 \\ f_{3c}/x_3 \\ f_{4c}/x_4 \\ \vdots \\ f_{nc}/x_n \end{bmatrix} \tag{14}$$

$$\begin{aligned} \boldsymbol{h_w} &= \begin{bmatrix} a_{(n+1)1} & a_{(n+1)2} & a_{(n+1)3} & a_{(n+1)4} & \cdots & a_{(n+1)n} \end{bmatrix} \\ &= \begin{bmatrix} v_{1w}/x_1 & v_{2w}/x_2 & v_{3w}/x_3 & v_{4w}/x_4 & \cdots & v_{nw}/x_n \end{bmatrix} \end{aligned} \tag{15}$$

$$\boldsymbol{h} = \frac{f_{(n+1)c}}{x_{n+1}} = \frac{v_{(n+1)w}}{x_{n+1}} \tag{16}$$

where the submatrix $\boldsymbol{A}$ is the technical coefficient matrix identical with that in equation (6), covering all industrial sectors except households'. $\boldsymbol{h_c}$ is called the household consumption coefficient. $\boldsymbol{h_w}$ is called the labour input coefficient. And $\boldsymbol{h}$ depicts household production, which is assumed to be 0 in Batey (1985) in order to simply the model. In this scenario, the original interdependence equation (8) then can be rewritten as:

$$\begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{x_h} \end{pmatrix} = \begin{pmatrix} \boldsymbol{1} - \boldsymbol{A} & -\boldsymbol{h_c} \\ -\boldsymbol{h_w} & \boldsymbol{1} \end{pmatrix}^{-1} \begin{pmatrix} \boldsymbol{f} \\ \boldsymbol{f_h} \end{pmatrix} \tag{17}$$

where $\boldsymbol{x}$ and $\boldsymbol{f}$ are total output and final demand without household consumption respectively. $\boldsymbol{x_h}$ is the total income of households. And $\boldsymbol{f_h}$ is the exogenous income.

What Miyazawa (1976) does is to "expand" $\boldsymbol{x_h}$, $\boldsymbol{h_w}$, and $\boldsymbol{h_c}$, so that they are no long to be single column/row vectors but to be matrices with multiple columns and rows. Each column/row represents one unique type of households, which can be flexibly defined by urban-rural as this paper does, by gender, by occupation, etc.

Assume that there are $\boldsymbol{q}$ distinct household groups and $\boldsymbol{n}$ sectors. Let a matrix $\boldsymbol{C}_{n\times q} = [\boldsymbol{c}_{ih}]$ be the number of products made in sector $\boldsymbol{i}$ consumed per unit of income by the households of group $\boldsymbol{h}$, while $\boldsymbol{h}$ could be $\mathbf{1}, \mathbf{2}, \cdots, \boldsymbol{q}$. Also let another matrix $\boldsymbol{V}_{q\times n} = [\boldsymbol{v}_{gj}]$ be the wage paid to household of group $\boldsymbol{g}$ per unit of income worth of output in sector $\boldsymbol{j}$, while $\boldsymbol{g}$ could be $\mathbf{1}, \mathbf{2}, \cdots, \boldsymbol{q}$. In matrix form:

$$\boldsymbol{C} = \begin{bmatrix} c_{11} & c_{1\ldots} & c_{1q} \\ c_{21} & c_{2\ldots} & c_{2q} \\ c_{31} & c_{1\ldots} & c_{3q} \\ c_{41} & c_{1\ldots} & c_{4q} \\ \cdots & \cdots & \cdots \\ c_{n1} & c_{n\ldots} & c_{nq} \end{bmatrix} = \begin{bmatrix} f_{c11}/x_1 & f_{c1\ldots}/x_1 & f_{c1q}/x_1 \\ f_{c21}/x_2 & f_{c2\ldots}/x_2 & f_{c2q}/x_2 \\ f_{c31}/x_3 & f_{c3\ldots}/x_3 & f_{c3q}/x_3 \\ f_{c41}/x_2 & f_{c4\ldots}/x_4 & f_{c4q}/x_4 \\ \cdots & \cdots & \cdots \\ f_{cn1}/x_n & f_{cn\ldots}/x_n & f_{cnq}/x_n \end{bmatrix} \tag{18}$$

$$\boldsymbol{V} = \begin{bmatrix} v_{11} & v_{12} & v_{13} & v_{14} & \cdots & v_{1n} \\ v_{\ldots 1} & v_{\ldots 2} & v_{\ldots 3} & v_{\ldots 4} & \cdots & v_{2n} \\ v_{q1} & v_{q2} & v_{q3} & v_{q4} & \cdots & v_{qn} \end{bmatrix}$$

$$= \begin{bmatrix} w_{11}/x_1 & w_{12}/x_2 & w_{13}/x_3 & w_{14}/x_4 & \cdots & w_{1n}/x_n \\ w_{\ldots 1}/x_1 & w_{\ldots 2}/x_2 & w_{\ldots 3}/x_3 & w_{\ldots 4}/x_4 & \cdots & w_{\ldots n}/x_n \\ w_{q1}/x_1 & w_{q2}/x_2 & w_{q3}/x_3 & w_{q4}/x_4 & \cdots & w_{qn}/x_n \end{bmatrix} \tag{19}$$

where $\boldsymbol{f}_{cih}$ is the final consumption of sector $\boldsymbol{i}$'s products contributed by household group $\boldsymbol{h}$, and $\boldsymbol{w}_{gj}$ is the total wage paid to workers in group $\boldsymbol{g}$ in sector $\boldsymbol{j}$. To simplify the analysis, household production is assumed to be zero. The technical coefficient matrix in equation (13) hence becomes:

$$\overline{\boldsymbol{A}} = \begin{pmatrix} \boldsymbol{A} & \boldsymbol{C} \\ \boldsymbol{V} & \mathbf{0} \end{pmatrix} \tag{20}$$

In the input-output system of endogenized household income, the following equation holds:

$$\begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{pmatrix} = \begin{pmatrix} \boldsymbol{A} & \boldsymbol{C} \\ \boldsymbol{V} & \mathbf{0} \end{pmatrix} \begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{pmatrix} + \begin{pmatrix} \boldsymbol{f}^* \\ \boldsymbol{g} \end{pmatrix} \tag{21}$$

where vector $\boldsymbol{x}$ is the total output for each sector without any household group. Vector $\boldsymbol{y}$ is the sum of income for each household group. $\boldsymbol{f}^*$is the "remaining final demand", equal to the difference between total final demand and total household consumption. And $\boldsymbol{g}$ is the exogenous income term, which is also assumed to be zero in Miyazawa model. Then equation (21) becomes:

$$\begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{pmatrix} = \begin{pmatrix} \mathbf{1}-\boldsymbol{A} & -\boldsymbol{C} \\ -\boldsymbol{V} & \mathbf{1} \end{pmatrix}^{-1} \begin{pmatrix} \boldsymbol{f}^* \\ \mathbf{0} \end{pmatrix} \tag{22}$$

Let $\boldsymbol{B} = (\mathbf{1} - \boldsymbol{A})^{-\mathbf{1}}$ be the Leontief inverse for matrix $\boldsymbol{A}$. The standard method in Miyazawa (1976) shows that the equation below holds:

$$\begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{pmatrix} = \begin{pmatrix} \boldsymbol{B}(\mathbf{1} + \boldsymbol{C}(\mathbf{1} - \boldsymbol{VBC})^{-\mathbf{1}}\boldsymbol{VB}) & \boldsymbol{BC}(\mathbf{1} - \boldsymbol{VBC})^{-\mathbf{1}} \\ (\mathbf{1} - \boldsymbol{VBC})^{-\mathbf{1}}\boldsymbol{VB} & (\mathbf{1} - \boldsymbol{VBC})^{-\mathbf{1}} \end{pmatrix}^{-\mathbf{1}} \begin{pmatrix} \boldsymbol{f}^* \\ \mathbf{0} \end{pmatrix} \tag{23}$$

For simplification, let $\boldsymbol{L} = \boldsymbol{VBC}$ and $\boldsymbol{K} = (\mathbf{1} - \boldsymbol{L})^{-\mathbf{1}}$. Equation (23) becomes:

$$\begin{pmatrix} \boldsymbol{x} \\ \boldsymbol{y} \end{pmatrix} = \begin{pmatrix} \boldsymbol{B}(\mathbf{1} + \boldsymbol{CKVB}) & \boldsymbol{BCK} \\ \boldsymbol{KVB} & \boldsymbol{K} \end{pmatrix} \begin{pmatrix} \boldsymbol{f}^* \\ \mathbf{0} \end{pmatrix} \tag{24}$$

Meanwhile:

$$\boldsymbol{x} = (\boldsymbol{B}(\mathbf{1} + \boldsymbol{CKVB}))\boldsymbol{f}^* \tag{25}$$

$$\boldsymbol{y} = \boldsymbol{KVBf}^* \tag{26}$$

Each element in matrix $\boldsymbol{L}$ is $\boldsymbol{v_{gi}b_{ij}c_{jh}}$, which is explained from the right to the left as: expenditure of $\boldsymbol{c_{jh}}$ by the $\boldsymbol{h}$ household group for the total output of sector $\boldsymbol{j}$ calls $\boldsymbol{b_{ij}c_{jh}}$ in output from sector $\boldsymbol{i}$. This in turn means wage compensation from sector $\boldsymbol{i}$ in the amount of $\boldsymbol{v_{gi}b_{ij}c_{jh}}$ to the $\boldsymbol{g}$ household group.

What interest us most are two matrices, $\boldsymbol{K}$ and $\boldsymbol{KVB}$. The first one, $\boldsymbol{K}$, which equals to $(\mathbf{1} - \boldsymbol{L})^{-\mathbf{1}}$, is interpreted as “inter-relational income multiplier”, indicating the total increase of income of one group resulting from additional income expenditures from another. It has the following form with $\boldsymbol{q}$ household groups:

$$\boldsymbol{K} = \begin{bmatrix} \boldsymbol{k_{11}} & \boldsymbol{k_{12}} & \cdots & \boldsymbol{k_{1q}} \\ \boldsymbol{k_{21}} & \boldsymbol{k_{22}} & \cdots & \boldsymbol{k_{2q}} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{k_{q1}} & \boldsymbol{k_{q2}} & \cdots & \boldsymbol{k_{qq}} \end{bmatrix} \tag{27}$$

The economics interpretations of equation (27) are: with one-unit direct increase in the income expenditure to household group $\boldsymbol{h}$, the increase in income payments for household group 1 will be $\boldsymbol{k_{h1}}$, that for household group 2 will be $\boldsymbol{k_{h2}}$, that for household group 3 will be $\boldsymbol{k_{h3}}$ etc., and that for household group $\boldsymbol{q}$ will be $\boldsymbol{k_{hq}}$.

The other one, $\boldsymbol{KVB}$, which is called the “multi-sector income multiplier”, indicating the induced income increase for each group generated by the initial final demand. With $\boldsymbol{n}$ sectors and $\boldsymbol{q}$ groups, the form of this matrix is:

$$\boldsymbol{KVB} = \begin{bmatrix} \boldsymbol{kbv_{11}} & \boldsymbol{kbv_{12}} & \boldsymbol{kbv_{13}} & \boldsymbol{kbv_{14}} & \cdots & \boldsymbol{kbv_{1n}} \\ \boldsymbol{kbv_{21}} & \boldsymbol{kbv_{22}} & \boldsymbol{kbv_{23}} & \boldsymbol{kbv_{24}} & \cdots & \boldsymbol{kbv_{2n}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{kbv_{q1}} & \boldsymbol{kbv_{q2}} & \boldsymbol{kbv_{q3}} & \boldsymbol{kbv_{q4}} & \cdots & \boldsymbol{kbv_{qn}} \end{bmatrix} \tag{28}$$

Equation (28) says that with one-unit increase in the final demand of products produced in sector $\boldsymbol{i}$, $\boldsymbol{kbv_{1i}}$ units income increase will be generated for household group 1, $\boldsymbol{kbv_{2i}}$ units income increase will be generated for group 2, $\boldsymbol{kbv_{3i}}$ units income increase will be generated for group 3 etc., and $\boldsymbol{kbv_{qi}}$ units increase will be generated for the $\boldsymbol{q}$th group.

3.3 Miyazawa's Framework Within A Multiregional Input-Output Table

To emphasize studies on urban-rural gaps in a cross-region background, moving from the single-region table to the multiregional one is necessary. Due to the enormous regional gap existing in China, the effect caused by expenditure stimulation policies vary across regions.

Assume there are $\boldsymbol{m}$ regions, and $\boldsymbol{n}$ industrial sectors equally distributed in each region, so the intermediate production flow matrix $\boldsymbol{Z} = \boldsymbol{Z_{mn\times mn}}$. Every basic element within it, is no longer to be a number, but to be a submatrix will full industrial series. Let $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ denote any two regions (coinciding is allowed that $\boldsymbol{\alpha} = \boldsymbol{\beta}$), $\boldsymbol{Z(R\alpha R\beta)}$ means the whole intermediate production come from region $\boldsymbol{\alpha}$ and received by region $\boldsymbol{\beta}$. In matrix form for any submatrix:

$$\boldsymbol{Z} = \begin{bmatrix} [\boldsymbol{Z(R1R1)}] & [\boldsymbol{Z(R1R2)}] & [\boldsymbol{Z(R1R3)}] & [\boldsymbol{Z(R1R4)}] & \cdots & [\boldsymbol{Z(R1Rm)}] \\ [\boldsymbol{Z(R2R1)}] & [\boldsymbol{Z(R2R2)}] & [\boldsymbol{Z(R2R3)}] & [\boldsymbol{Z(R2R4)}] & \cdots & [\boldsymbol{Z(R2Rm)}] \\ [\boldsymbol{Z(R3R1)}] & [\boldsymbol{Z(R3R2)}] & [\boldsymbol{Z(R3R3)}] & [\boldsymbol{Z(R3R4}] & \cdots & [\boldsymbol{Z(R3Rm)}] \\ [\boldsymbol{Z(R4R1)}] & [\boldsymbol{Z(R4R2)}] & [\boldsymbol{Z(R4R3)}] & [\boldsymbol{Z(R4R4)}] & \cdots & [\boldsymbol{Z(R4Rm)}] \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ [\boldsymbol{Z(RmR1)}] & [\boldsymbol{Z(RmR2)}] & [\boldsymbol{Z(RmR3)}] & [\boldsymbol{Z(RmR4)}] & \cdots & [\boldsymbol{Z(RmRm)}] \end{bmatrix} \quad (29)$$

Or:

$$\boldsymbol{Z} = \begin{bmatrix} \begin{bmatrix} z_{1_11_1} & \cdots & z_{1_11_n} \\ \vdots & \ddots & \vdots \\ z_{1_n1_1} & \cdots & z_{1_n1_n} \end{bmatrix} & \cdots & \cdots & \begin{bmatrix} z_{1_1m_1} & \cdots & z_{1_1m_n} \\ \vdots & \ddots & \vdots \\ z_{1_nm_1} & \cdots & z_{1_nm_n} \end{bmatrix} \\ \vdots & \ddots & \vdots & \vdots \\ \vdots & \cdots & \ddots & \vdots \\ \begin{bmatrix} z_{m_11_1} & \cdots & z_{m_11_n} \\ \vdots & \ddots & \vdots \\ z_{m_n1_1} & \cdots & z_{m_n1_n} \end{bmatrix} & \cdots & \cdots & \begin{bmatrix} z_{m_1m_1} & \cdots & z_{m_1m_n} \\ \vdots & \ddots & \vdots \\ z_{m_nm_1} & \cdots & z_{m_nm_n} \end{bmatrix} \end{bmatrix} \quad (30)$$

Let $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ denote two industrial sectors (they could also be equal that $\boldsymbol{\gamma} = \boldsymbol{\delta}$):

$$\boldsymbol{Z(R\alpha R\beta)} = \begin{bmatrix} z_{\alpha_1\beta_1} & z_{\alpha_1\beta_2} & \cdots & z_{\alpha_1\beta_n} \\ z_{\alpha_2\beta_1} & z_{\alpha_2\beta_2} & \cdots & z_{\alpha_2\beta_n} \\ \vdots & \vdots & \ddots & \vdots \\ z_{\alpha_n\beta_1} & z_{\alpha_n\beta_2} & \cdots & z_{\alpha_n\beta_n} \end{bmatrix} \quad (31)$$

The value of $\boldsymbol{z_{\alpha_\gamma\beta_\delta}}$ means products made in region $\boldsymbol{\alpha}$'s $\boldsymbol{\gamma}$ sector bought by region $\boldsymbol{\beta}$'s $\boldsymbol{\delta}$ sector.

Similarly, for the final demand term, submatrix $\boldsymbol{F(R\alpha R\beta)}$ depicts region $\boldsymbol{\beta}$'s final consumption of products made in region $\boldsymbol{\alpha}$. In matrix form:

$$F(R\alpha R\beta)=\begin{bmatrix} f_{\alpha_1\beta_1} & f_{\alpha_1\beta_2} & f_{\alpha_1\beta_{\dots}} & \cdots \\ f_{\alpha_2\beta_1} & f_{\alpha_2\beta_2} & f_{\alpha_2\beta_{\dots}} & \cdots \\ \vdots & \vdots & \ddots & \vdots \\ f_{\alpha_n\beta_1} & f_{\alpha_n\beta_2} & f_{\alpha_n\beta_{\dots}} & \ddots \end{bmatrix} \tag{32}$$

Let $\boldsymbol{\varepsilon}$ denote any one type of final consumption groups, $\boldsymbol{f_{\alpha_\gamma\beta_\varepsilon}}$ means the final demand of group $\boldsymbol{\varepsilon}$ in region $\boldsymbol{\beta}$ made by sector $\boldsymbol{\gamma}$ in region $\boldsymbol{\alpha}$.

For the value-added matrix, we have:

$$V=\begin{bmatrix} \begin{vmatrix} v_{111} & v_{112} & \cdots & v_{11n} \\ v_{121} & v_{122} & \cdots & v_{12n} \\ v_{131} & v_{132} & \ddots & v_{13n} \\ \vdots & \vdots & \vdots & \vdots \end{vmatrix} & \begin{vmatrix} v_{211} & v_{212} & \cdots & v_{21n} \\ v_{221} & v_{222} & \cdots & v_{22n} \\ v_{231} & v_{232} & \ddots & v_{23n} \\ \vdots & \vdots & \vdots & \vdots \end{vmatrix} & \cdots & \begin{vmatrix} v_{m11} & v_{m12} & \cdots & v_{m1n} \\ v_{m21} & v_{m22} & \cdots & v_{m2n} \\ v_{m31} & v_{m32} & \ddots & v_{m3n} \\ \vdots & \vdots & \vdots & \vdots \end{vmatrix} \end{bmatrix} \tag{33}$$

Let $\boldsymbol{\theta}$ denote any value-added category, each element in equation (33) is written as: $\boldsymbol{v_{\alpha\theta\gamma}}$, where definitions of $\boldsymbol{\alpha}$ (any region) and $\boldsymbol{\gamma}$ (any sector) are the same as those in equations above. This term, $\boldsymbol{v_{\alpha\theta\gamma}}$, means the value-added surveyed in group $\boldsymbol{\theta}$ in sector $\boldsymbol{\gamma}$ of region $\boldsymbol{\alpha}$. The total output matrix can be expressed as:

$$X=\begin{bmatrix} \begin{bmatrix} x_{11} \\ x_{12} \\ \vdots \\ x_{1n} \end{bmatrix} \\ \begin{bmatrix} x_{21} \\ x_{22} \\ \vdots \\ x_{2n} \end{bmatrix} \\ \vdots \\ \begin{bmatrix} x_{m1} \\ x_{m2} \\ \vdots \\ x_{mn} \end{bmatrix} \end{bmatrix} \tag{34}$$

Each element is written as $\boldsymbol{x_{\alpha\gamma}}$, meaning the total output of sector $\boldsymbol{\gamma}$ in region $\boldsymbol{\alpha}$.

For the technical coefficient matrix under multiregional background, the computation process is still similar to what have been defined in equation (5). It has the following form:

$$A=\begin{bmatrix} [A(R1R1)] & [A(R1R2)] & \cdots & [A(R1Rm)] \\ [A(R2R1)] & [A(R2R2)] & \cdots & [A(R2Rm)] \\ \vdots & \vdots & \ddots & \vdots \\ [A(RmR1)] & [A(RmR2)] & \cdots & [A(RmRm)] \end{bmatrix} \tag{35}$$

Or:

$$
\boldsymbol{A}=\begin{bmatrix}\begin{bmatrix}a_{1_11_1} & \cdots & a_{1_11_n}\\ \vdots & \ddots & \vdots\\ a_{1_n1_1} & \cdots & a_{1_n1_n}\end{bmatrix} & \cdots & \cdots & \begin{bmatrix}a_{1_1m_1} & \cdots & a_{1_1m_n}\\ \vdots & \ddots & \vdots\\ a_{1_nm_1} & \cdots & a_{1_nm_n}\end{bmatrix}\\ \vdots & \ddots & \vdots & \vdots\\ \vdots & \cdots & \ddots & \vdots\\ \begin{bmatrix}a_{m_11_1} & \cdots & a_{m_11_n}\\ \vdots & \ddots & \vdots\\ a_{m_n1_1} & \cdots & a_{m_n1_n}\end{bmatrix} & \cdots & \cdots & \begin{bmatrix}a_{m_1m_1} & \cdots & a_{m_1m_n}\\ \vdots & \ddots & \vdots\\ a_{m_nm_1} & \cdots & a_{m_nm_n}\end{bmatrix}\end{bmatrix} \tag{36}
$$

Combined with (30) and the diagonalization of (34), equation (36) can be calculated by:

$$
\boldsymbol{A}=\boldsymbol{Z}/\boldsymbol{diag}(\boldsymbol{X}) \tag{37}
$$

And the Leontief Inverse stills equals to $(\mathbf{1}-\boldsymbol{A})^{-\mathbf{1}}$.

Above are a brief introduction to the multiregional table and relevant mathematical expressions with exogenous household behaviours. Below is a framework for multiregional input-output table with Miyazawa's method under the settings above:

First, the intermediate production matrix is given by:

$$
\overline{\boldsymbol{Z}}=\begin{bmatrix}\boldsymbol{Z}_{\boldsymbol{mn}\times\boldsymbol{mn}} & \boldsymbol{C}_{\boldsymbol{mn}\times\boldsymbol{mq}}\\ \boldsymbol{V}_{\boldsymbol{mq}\times\boldsymbol{mn}} & \mathbf{0}\end{bmatrix} \tag{38}
$$

where $\boldsymbol{Z}_{\boldsymbol{mn}\times\boldsymbol{mn}}$ is identical with that in equation (30), covering all intermediate flows without household consumption or income. $\boldsymbol{C}_{\boldsymbol{mn}\times\boldsymbol{mq}}$ is the consumption matrix for each region's $\boldsymbol{q}$ household groups drawn from the final demand matrix. It has the following form:

$$
\boldsymbol{C}_{\boldsymbol{mn}\times\boldsymbol{mq}}=\begin{bmatrix}\begin{bmatrix}c_{1_11_1} & \cdots & c_{1_11_q}\\ \vdots & \ddots & \vdots\\ c_{1_n1_1} & \cdots & c_{1_n1_1}\end{bmatrix} & \cdots & \begin{bmatrix}c_{1_1m_1} & \cdots & c_{1_1m_q}\\ \vdots & \ddots & \vdots\\ c_{1_nm_1} & \cdots & c_{1_nm_1}\end{bmatrix}\\ \vdots & \ddots & \vdots\\ \begin{bmatrix}c_{m_11_1} & \cdots & c_{m_11_q}\\ \vdots & \ddots & \vdots\\ c_{m_n1_1} & \cdots & c_{m_n1_1}\end{bmatrix} & \cdots & \begin{bmatrix}c_{m_1m_1} & \cdots & c_{1_1m_q}\\ \vdots & \ddots & \vdots\\ c_{m_nm_1} & \cdots & c_{m_nm_1}\end{bmatrix}\end{bmatrix} \tag{39}
$$

where $\boldsymbol{c}_{\boldsymbol{\alpha_\gamma\beta_\varepsilon}}$ means the households' final consumption of group $\boldsymbol{\varepsilon}$ in region $\boldsymbol{\beta}$ made by sector $\boldsymbol{\gamma}$ in region $\boldsymbol{\alpha}$.

$\boldsymbol{V}_{\boldsymbol{mq}\times\boldsymbol{mn}}$ is the income matrix split from the value-added matrix with the following form:

$$\boldsymbol{V}_{mq\times mn} = \begin{bmatrix} \begin{bmatrix} v_{111} & \cdots & v_{11n} \\ \vdots & \ddots & \vdots \\ v_{1q1} & \cdots & v_{1qn} \end{bmatrix} & \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} & \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} \\ \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} & \begin{bmatrix} v_{\dots 11} & \cdots & v_{\dots 1n} \\ \vdots & \ddots & \vdots \\ v_{\dots q1} & \cdots & v_{\dots qn} \end{bmatrix} & \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} \\ \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} & \begin{matrix} \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \end{matrix} & \begin{bmatrix} v_{m11} & \cdots & v_{m1n} \\ \vdots & \ddots & \vdots \\ v_{mq1} & \cdots & v_{mqn} \end{bmatrix} \end{bmatrix} \quad (40)$$

where $\boldsymbol{v}_{\alpha\theta\gamma}$ means the wage compensation for the group $\boldsymbol{q}$ workers in sector $\boldsymbol{\gamma}$ of region $\boldsymbol{\alpha}$.

With equations above, it is possible to study the urban-rural gap across China's regions by calculating $\boldsymbol{K}$ and $\boldsymbol{KVB}$ as already defined in equation (27) and (28). Meanwhile, this method is open to the aggregation of regions by summing neighbourhood submatrices. Aggregation means that several regions originally defined in the table can be summed as one bigger region (i.e., aggregating several neighbourhood provinces to be one region). This helps for highlighting the regional disparities and make the results more visible.

I here show an example of aggregation by dividing $\boldsymbol{m}$ regions in equation (29) into 3 group: Region 1&2, Region 3&4, and the rest.

$$\boldsymbol{Z}_{aggregation} = \begin{bmatrix} \boldsymbol{Z}(\boldsymbol{R12R12}) & \boldsymbol{Z}(\boldsymbol{R12R34}) & \boldsymbol{Z}(\boldsymbol{R12Rrest}) \\ \boldsymbol{Z}(\boldsymbol{R34R12}) & \boldsymbol{Z}(\boldsymbol{R34R34}) & \boldsymbol{Z}(\boldsymbol{R34Rrest}) \\ \boldsymbol{Z}(\boldsymbol{RrestR12}) & \boldsymbol{Z}(\boldsymbol{RrestR34}) & \boldsymbol{Z}(\boldsymbol{RrestRrest}) \end{bmatrix} \quad (41)$$

Colour equation (29) for contrasting:

$$\boldsymbol{Z} = \begin{bmatrix} [\boldsymbol{Z}(\boldsymbol{R1R1})] & [\boldsymbol{Z}(\boldsymbol{R1R2})] & [\boldsymbol{Z}(\boldsymbol{R1R3})] & [\boldsymbol{Z}(\boldsymbol{R1R4})] & \cdots & [\boldsymbol{Z}(\boldsymbol{R1Rm})] \\ [\boldsymbol{Z}(\boldsymbol{R2R1})] & [\boldsymbol{Z}(\boldsymbol{R2R2})] & [\boldsymbol{Z}(\boldsymbol{R2R3})] & [\boldsymbol{Z}(\boldsymbol{R2R4})] & \cdots & [\boldsymbol{Z}(\boldsymbol{R2Rm})] \\ [\boldsymbol{Z}(\boldsymbol{R3R1})] & [\boldsymbol{Z}(\boldsymbol{R3R2})] & [\boldsymbol{Z}(\boldsymbol{R3R3})] & [\boldsymbol{Z}(\boldsymbol{R3R4}] & \cdots & [\boldsymbol{Z}(\boldsymbol{R3Rm})] \\ [\boldsymbol{Z}(\boldsymbol{R4R1})] & [\boldsymbol{Z}(\boldsymbol{R4R2})] & [\boldsymbol{Z}(\boldsymbol{R4R3})] & [\boldsymbol{Z}(\boldsymbol{R4R4})] & \cdots & [\boldsymbol{Z}(\boldsymbol{R4Rm})] \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ [\boldsymbol{Z}(\boldsymbol{RmR1})] & [\boldsymbol{Z}(\boldsymbol{RmR2})] & [\boldsymbol{Z}(\boldsymbol{RmR3})] & [\boldsymbol{Z}(\boldsymbol{RmR4})] & \cdots & [\boldsymbol{Z}(\boldsymbol{RmRm})] \end{bmatrix} \quad (42)$$

Matrices with the same colour are aggregated. For example, $\boldsymbol{Z}(\boldsymbol{R12R12}) = \boldsymbol{Z}(\boldsymbol{R1R1}) + \boldsymbol{Z}(\boldsymbol{R1R2}) + \boldsymbol{Z}(\boldsymbol{R2R1}) + \boldsymbol{Z}(\boldsymbol{R2R2})$. This method allows us to aggregate $\boldsymbol{m}$ regions into 1 region (country level) at least or $\boldsymbol{m-1}$ regions at most with Miyazawa's income distribution model applied.

4. Data

The key dataset used for this paper is the Chinese multiregional input-output table (MRIOT) surveyed by the academic Chinese research Institute of Geographical Science and Natural Resource Research (IGSNRR) for year 2012 (see Table A1 in Appendix for a simplified version of the Chinese MRIOT, in which all denotations are same with those used in section 3.3).

This dataset has four distinctive advantages compared with others. First, it comprises the 31

Chinese provinces, including the economy of Tibet, one of the largest autonomous regions in China (see Table A2 in Appendix for a detailed list and Figure A1 for the geographical location). Data targeting Tibet economy is often omitted in previous documents in this topic. It helps to better understand the whole interindustry and interregional production flows in mainland China, especially in the southwest to have Tibet data in. Second, the statistic error generated in modelling process is controlled to an insignificant level with an average magnitude of -0.5%. One of the research concerns when using multiregional tables (for example, the WIOD table) is the errors occurred due to minor differences in statistical method. Numbers in this dataset are based on a variety of sources including model estimation, reconsideration of regional disparities, customs report etc. Statistic checks and corrections suit it more convincing. Third, rural household's consumption is distinguished from its urban counterpart in the table, and origins of commodity destinations of consumption are also available. And forth, the economy of each province is divided into 42 sectors, ranging across agriculture, manufacturing, and services (see Table A3 in Appendix for details regarding sectoral classifications).

This information can be directly used for analysing income-consumption relationship for all 31 province-level regions, including provinces, autonomous regions, and municipalities directly controlled by the central government. For simplification, this paper refers these province-level regions by using the word "province" in short. To investigate such interdependence across larger regions, this paper recombines all 31 provinces as seven bigger regions mainly based on their locations in the map and distances to each other. They are: north (1-5), northeast (6-8), east (9-15), centre (16-18), south (19-21), southeast (22-26), and west (27-31) regions. Figure A2 in Appendix presents these seven aggregated regions with distinguishable colours.

Although there are a variety of strategies for such classifications that some studies do it in a slightly different way, locations on the map and distances to others are shown to be one of the key concerns. For instance, Zhang et al. (2016) uses input-output analysis to study the domestic trade flows and energy flows in China 2012, with seven regions being classified and thirty provinces included. Similar strategies were implemented except for Jiangxi province, which is bonded to two central provinces (Hunan and Hubei) was categorized to be part of the centre. In Cui & Liu (2000), all Chinese provinces are categorized into seven regions based on boundaries and economic status.

The Chinese multiregional input-output table provides rich information regarding national and regional accounts. Table 1 shows the main regional economic features such as the share of regional GDP in national GDP, the share of regional sectoral GDP in regional GDP, and the share of regional sectoral GDP in national.

Table 1: Chinese regional economic features, 2012

	Total		Sector		
Region	GDP Contribution		Sector	GDP Contribution	Local GDP Contribution
North	14.21%		*Agriculture*	0.61%	4.27%
			Industry	8.96%	63.05%
			Service	4.64%	32.68%
Northeast	8.53%		*Agriculture*	0.65%	7.58%
			Industry	5.73%	67.25%
			Service	2.15%	25.17%
East	40.49%		*Agriculture*	1.59%	3.92%
			Industry	28.73%	70.96%
			Service	10.17%	25.12%
Centre	12.25%		*Agriculture*	1.01%	8.22%
			Industry	8.53%	69.66%
			Service	2.71%	22.12%
South	11.46%		*Agriculture*	0.56%	4.93%
			Industry	7.52%	65.60%
			Service	3.38%	29.48%
Southwest	8.24%		*Agriculture*	0.68%	8.28%
			Industry	5.35%	64.84%
			Service	2.22%	26.88%
West	4.82%		*Agriculture*	0.40%	8.39%
			Industry	3.13%	64.86%
			Service	1.29%	26.76%

Source: own elaboration from Chinese multiregional input-output table, 2012

Notes: (1) "GDP contribution" in the second column refers to regional GDP share in China's total GDP. (2) "GDP contribution" in the fifth column refers to regional sectoral GDP share in China's total GDP. (3) "Local GDP contribution" in the sixth column refers to regional sectoral GDP share in region's own total GDP.

Composed by seven out of thirty-one provinces in the eastern coast and interior land nearby, east China contributes over 40 percent in national GDP. Each of north, centre, and south contributes over 10 percent, while west, south, and northeast contribute less. Defining sector 1 as agricultural sector, sectors 2-28 as industrial sector, and others as the service sector, industrial sector and service sector create almost all values in regional accounts, while the contribution from agriculture sector is less significant compared with the other two. This evidence about regional disparities is in line with literatures mentioned above.

The Chinese multiregional input-output table also provides information about the foreign sector (trade sector) composed by cargo import $(\boldsymbol{IM})$ and export $(\boldsymbol{EX})$. Since trade is not among the interests of this paper, net export $(\boldsymbol{NX})$, which equals to the difference of export and import, is used for computing the exogenous final demand instead of us choosing to endogenizing this sector. Since import $(\boldsymbol{IM})$ is a row vector locating in the last row in matrix (30) and export $(\boldsymbol{EX})$ is a column vector in matrix (9), the net export $(\boldsymbol{NX})$ is given by:

$$\boldsymbol{NX} = \boldsymbol{EX} - \boldsymbol{transpose}(\boldsymbol{IM}) \tag{43}$$

Although Chinese multiregional input-output table includes the consumption by household-type for 42 sectors, original dataset doesn't distinguished wage compensation of urban and rural households. This paper estimates urban and rural labour compensation at sectoral level suing information about urban & rural average disposable income and urban & rural population scale distributed in 31 provinces published by China Rural Statistical Yearbook (2013) and China Population & Employment Statistical Yearbook (2013), that summarize data in a wide range covering urban & rural living standards. The resulting computed income share owned by each household-type is presented in Table A4 in the Appendix.

The process to estimate urban and rural income share is as follows. Back to equation (40), here let $\boldsymbol{v_{\alpha u\gamma}}$ denote the wage compensation for urban households in sector $\boldsymbol{\gamma}$ of region $\boldsymbol{\alpha}$, and let $\boldsymbol{v_{\alpha r\gamma}}$ denote that for their rural counterparts. Hence $\boldsymbol{q}$ (number of groups) is composed by $\boldsymbol{u}$ (urban) and $\boldsymbol{r}$ (rural). Also let $\boldsymbol{v_{\alpha\gamma}}$ denote the total wage compensation for those working in sector $\boldsymbol{\gamma}$ of region $\boldsymbol{\alpha}$, $\boldsymbol{s_{\alpha u}}$ denote the share of urban household income in region $\boldsymbol{\alpha}$, and $\boldsymbol{s_{\alpha r}}$ denote the share of urban household income in the same region. Obviously, $\boldsymbol{v_{\alpha\gamma}}$, $\boldsymbol{s_{\alpha u}}$, and $\boldsymbol{s_{\alpha r}}$ can be obtained through three datasets mentioned in order to estimate $\boldsymbol{v_{\alpha u\gamma}}$ and $\boldsymbol{v_{\alpha r\gamma}}$, as following:

$$\boldsymbol{v_{\alpha u\gamma}} = \boldsymbol{v_{\alpha\gamma}} \times \boldsymbol{s_{\alpha u}} \tag{44}$$

$$\boldsymbol{v_{\alpha r\gamma}} = \boldsymbol{v_{\alpha\gamma}} \times \boldsymbol{s_{\alpha r}} \tag{45}$$

Applying this estimation strategy, the multiregional input-output table with endogenized household behaviours are filled.

5. Results

Following the methodology presented before, this paper gets results in three levels: country-level, region-level, and province-level. In the country-level part, China's urban-rural inequality problem is regarded as a whole, meaning that no spatial element is included. It helps generate a first insight of the research question. In the region-level part, this paper includes the interdependence analysis among seven regions, which emphasizes impacts of one region's urban-rural consumption changes on another region. Because of the overwhelming size of result matrices at province-level, this section mainly discusses the economic ideas of the first two parts. Results of interdependences among thirty-one provinces are available upon author's request.

5.1 Country-Level Result

Through aggregating all provinces' interregional and interindustry flow matrices, and applying the Miyazawa model for one region (Miyazawa, 1976) the "inter-relational income multiplier" $\boldsymbol{K}$ based on the totally aggregated input-output table is shown in Table 2 and Figure 1:

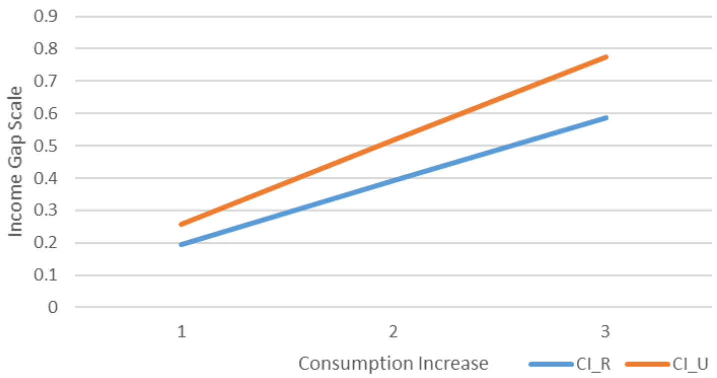
Table 2: Inter-relational income multiplier $\boldsymbol{K}$, China 2012

	Rural	**Urban**
Rural	1.0835	0.1086
Urban	0.2791	1.3668

Source: own elaboration from Chinese multiregional input-output table, 2012

Focus on the marginal effect of consumption increase: with 1-unit expenditure increase of Chinese rural households, their income is expected to additionally increase 0.08 units, and urban households' income is expected to increase 0.27 units. With the same amount of expenditure increase of urban households, their income is expected to additionally increase 0.36 units while that of the rural households is expected to increase 0.10 units only.

Figure 1: Inter-relational income multiplier $\boldsymbol{K}$, China 2012



Source: own elaboration from Chinese multiregional input-output table, 2012

Figure 1 is the graphical elaboration of Table 2, in which the vertical axis represents the urban-rural gap on income increase scale arising from consumption increase, the horizontal axis is the units of additional consumption made by urban or rural households. The orange line is for urban households and the blue line is for rural households. A positive scale or a line above horizontal axis means urban households dominate rural ones. Suppose urban households and rural households are identical in initial income, this trend figure says that additional income gained by urban individuals is always higher than that by rural ones. In other words, rural households are always dominated. And it could severer in practice since the initial income gap has already been large.

Regarding the second key interest matrix, the "multi-sector income multiplier" $\boldsymbol{KVB}$ Table 3 and Figure 2 show the results:

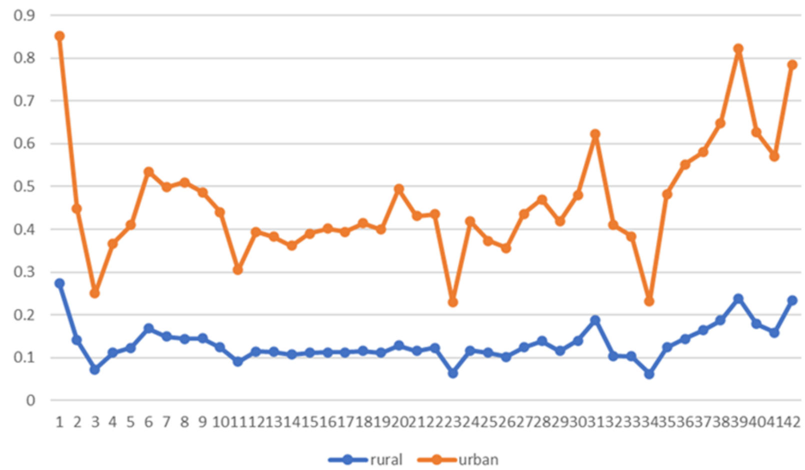
Table 3: Multi-sector income multiplier $\boldsymbol{KVB}$, China 2012

Sector	**1**	**2**	**3**	**4**	**5**	**6**
R	0.274622	0.141257	0.07256	0.111609	0.122625	0.167792
U	0.851113	0.447585	0.250514	0.367018	0.409954	0.535202
Sector	**7**	**8**	**9**	**10**	**11**	**12**
R	0.149759	0.14453	0.1456	0.12451	0.090334	0.114815
U	0.498192	0.510184	0.486632	0.440046	0.305097	0.394608
Sector	**13**	**14**	**15**	**16**	**17**	**18**
R	0.113754	0.107666	0.111582	0.112741	0.112384	0.116022
U	0.38259	0.361392	0.389627	0.401834	0.393818	0.414339
Sector	**19**	**20**	**21**	**22**	**23**	**24**
R	0.111538	0.128197	0.115801	0.122736	0.063687	0.1166
U	0.399882	0.493745	0.431304	0.434874	0.230462	0.418196
Sector	**25**	**26**	**27**	**28**	**29**	**30**
R	0.111301	0.102055	0.12436	0.139022	0.116053	0.140213
U	0.372729	0.356761	0.435805	0.469758	0.418762	0.480822

Sector	**31**	**32**	**33**	**34**	**35**	**36**
R	0.188015	0.104141	0.10328	0.061939	0.124347	0.143967
U	0.622535	0.410116	0.383547	0.231192	0.482018	0.552077
Sector	**37**	**38**	**39**	**40**	**41**	**42**
R	0.163975	0.187293	0.238713	0.178351	0.158336	0.233117
U	0.58025	0.648126	0.822342	0.62621	0.571282	0.785426

Source: own elaboration from Chinese multiregional input-output table, 2012

Figure 2: Multi-sector income multiplier $\boldsymbol{KVB}$, China 2012



Source: own elaboration from Chinese multiregional input-output table, 2012

There are a variety of interpretations:

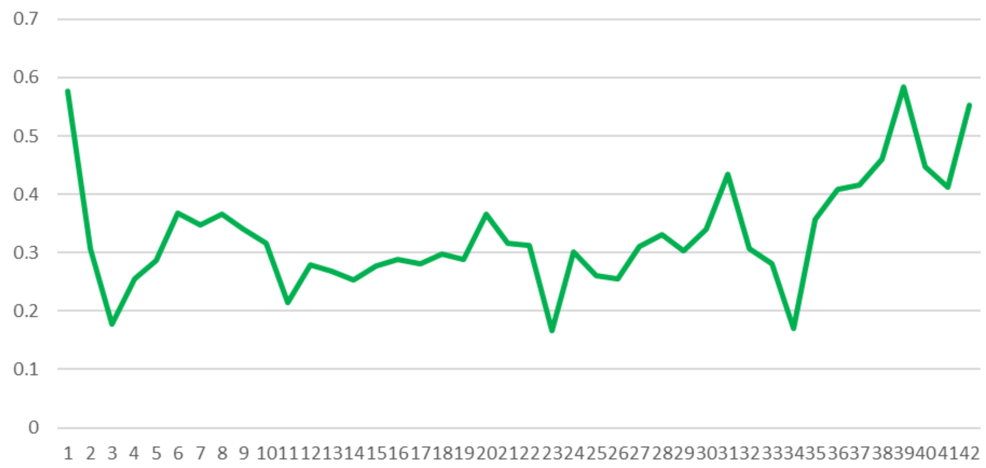
First by looking at Table 3, with 1-unit demand increase for goods produced in sector 1 (agriculture), 0.27 units of new income and 0.85 units of new income are generated for rural households and urban households respectively. This is the sector with the higher income increase in both household-types. For other sectors, the interpretation method is the same.

Second, based on the graphical result in Figure 2, rural group is “dominated” by their urban counterpart. Whatever sectors in which additional demand stimulation effect works, urban households always benefit more in terms of newly increased income.

Third, for either group, an additional unit of demand for commodities produced in sector 1 (agriculture), sector 31 (accommodation and meals), sector 39 (education) or sector 42 (public administration and social security) stimulates to generate more income. But such stimulation is pretty weak when it happens to sector 3 (oil extraction), sector 23 (scarp waste), sector 26 (gas) or sector 34 (real estate). In order to have income better improved for both groups, it is recommended to pay more in sector 1, 31, 39, and 42.

However, this general better-off orientated strategy is double-edged. Figure 3 describes the difference in new income gained by rural households and urban households. New demands for productions in sectors 1, 31, 39, and 42 are here to be shown to generate more income inequalities as well, though they are more efficient.

Figure 3: Gaps in multi-sector income multiplier $\boldsymbol{KVB}$, China 2012



Source: own elaboration from Chinese multiregional input-output table, 2012

5.2 Region-Level Result

Results for the seven regions are presented in Tables 4 and 5. First, according to results from Table 4, when consumption increases in one region's urban or rural households for one unit, other thirteen ones' income increase pulsed is shown. For example, if rural households living in the north consumes 1-unit more, rural households in the northeast are expected to gain 0.0044 units of additional income, while urban households in the east are expected to gain 0.049.

Second, numbers coloured with red in one column are those two which benefit most when consumption is stimulated for this column group, and numbers coloured with blue are those two which benefit least. It can be shown that the spill-over effect is weaker than internal effect globally. The red parts always appear in the diagonal area, which means the new expenditure in one region from either its rural residents or urban residents will stimulate local income most.

Third, this spill-over effect insignificantly benefits the rural households in northeast and west. Blue numbers appear mainly in two rows: northeast and west, which says with additional expenditure increases in other regions, it is hard to observe significant income increase for rural households living in northeast and west.

By normalising the results in Table 4, Table 5 presents the interdependence across different regions without urban/rural division. For instance, with 1-unit consumption increase in the north, income of the south is expected to increase 0.023 units. Those coloured blue are regions benefit in last two positions, referring to west and southwest. Also, the numbers for northeast are still very low, implying that these regions' income increase slower than others due to consumption stimulation effect.

Table 4: Inter-relational income multiplier $\boldsymbol{K}$, regions of China 2012

		north		northeast		east		centre		south		southwest		west	
		R	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**
north	**R**	**1.06E+00**	**4.96E-02**	6.77E-03	7.00E-03	8.63E-03	7.27E-03	5.98E-03	5.85E-03	7.47E-03	6.89E-03	7.02E-03	6.29E-03	7.62E-03	7.18E-03
	U	**2.28E-01**	**1.19E+00**	2.62E-02	2.71E-02	3.25E-02	2.74E-02	2.34E-02	2.30E-02	2.76E-02	2.57E-02	2.70E-02	2.42E-02	3.00E-02	2.83E-02
northeast	**R**	4.35E-03	**4.09E-03**	**1.08E+00**	**7.23E-02**	5.21E-03	4.36E-03	**3.04E-03**	**2.85E-03**	**6.62E-03**	**5.43E-03**	**5.35E-03**	**4.45E-03**	**4.42E-03**	**3.86E-03**
	U	1.52E-02	1.43E-02	**2.67E-01**	**1.26E+00**	1.81E-02	1.52E-02	1.07E-02	1.00E-02	2.30E-02	1.89E-02	1.87E-02	1.56E-02	1.56E-02	1.37E-02
east	**R**	1.29E-02	1.28E-02	1.27E-02	1.32E-02	**1.09E+00**	**7.10E-02**	1.05E-02	1.02E-02	1.57E-02	1.40E-02	1.56E-02	1.42E-02	1.55E-02	1.56E-02
	U	4.90E-02	4.86E-02	4.88E-02	5.07E-02	**3.30E-01**	**1.27E+00**	4.00E-02	3.88E-02	5.86E-02	5.26E-02	5.96E-02	5.43E-02	6.00E-02	6.05E-02
centre	**R**	7.85E-03	7.53E-03	6.53E-03	6.51E-03	1.02E-02	8.61E-03	**1.12E+00**	**1.15E-01**	1.16E-02	9.64E-03	9.32E-03	7.92E-03	8.08E-03	7.63E-03
	U	1.89E-02	1.81E-02	1.57E-02	1.57E-02	2.46E-02	2.07E-02	**2.96E-01**	**1.28E+00**	2.78E-02	2.32E-02	2.24E-02	1.91E-02	1.95E-02	1.84E-02
south	**R**	**4.16E-03**	4.13E-03	4.63E-03	4.60E-03	**4.91E-03**	**4.21E-03**	3.41E-03	3.23E-03	**1.08E+00**	**7.00E-02**	5.73E-03	5.00E-03	**5.00E-03**	**4.84E-03**
	U	1.90E-02	1.88E-02	2.16E-02	2.15E-02	2.20E-02	1.88E-02	1.55E-02	1.48E-02	**3.45E-01**	**1.32E+00**	2.65E-02	2.33E-02	2.37E-02	2.31E-02
southwest	**R**	4.59E-03	4.46E-03	**4.29E-03**	**4.25E-03**	5.85E-03	4.97E-03	3.70E-03	3.54E-03	7.08E-03	6.15E-03	**1.15E+00**	**1.12E-01**	5.30E-03	4.86E-03
	U	1.15E-02	1.11E-02	1.07E-02	1.07E-02	1.45E-02	1.24E-02	9.25E-03	8.88E-03	1.76E-02	1.53E-02	**3.70E-01**	**1.28E+00**	1.33E-02	1.22E-02
west	**R**	**3.21E-03**	**3.20E-03**	**3.16E-03**	**3.14E-03**	**4.77E-03**	**4.05E-03**	**3.14E-03**	**2.93E-03**	**4.75E-03**	**4.06E-03**	**3.95E-03**	**3.35E-03**	**1.08E+00**	**7.12E-02**
	U	8.93E-03	8.87E-03	8.82E-03	8.77E-03	1.32E-02	1.13E-02	8.76E-03	8.19E-03	1.31E-02	1.13E-02	1.10E-02	9.32E-03	**2.15E-01**	**1.20E+00**

Source: own elaboration from Chinese multiregional input-output table, 2012

Table 5: Inter-relational income multiplier $\boldsymbol{K}$ normalized values, regions of China 2012

	north	**northeast**	**east**	**centre**	**south**	**southwest**	**west**
north	1.27E+00	3.36E-02	3.79E-02	2.91E-02	3.39E-02	3.23E-02	3.66E-02
northeast	1.90E-02	1.34E+00	2.15E-02	1.33E-02	2.70E-02	2.21E-02	1.88E-02
east	6.15E-02	6.25E-02	1.38E+00	4.98E-02	7.05E-02	7.20E-02	7.60E-02
centre	2.62E-02	2.22E-02	3.21E-02	1.41E+00	3.61E-02	2.94E-02	2.68E-02
south	2.31E-02	2.62E-02	2.50E-02	1.85E-02	1.41E+00	3.03E-02	2.83E-02
southwest	1.59E-02	1.50E-02	1.89E-02	1.27E-02	2.31E-02	1.46E+00	1.79E-02
west	1.21E-02	1.20E-02	1.67E-02	1.15E-02	1.66E-02	1.38E-02	1.29E+00

Source: own elaboration from Chinese multiregional input-output table, 2012

Table 6 sums of each column in Table 4. Red ones denote the largest two while blue ones denote the lowest two still. The red means total economic returns to consumptions for this specific group is the highest, and the blue is in the opposite. If the policy targets to increase the income for whole country, it is recommended to advocate rural consumptions in the south and southwest, instead of focusing on the northern region.

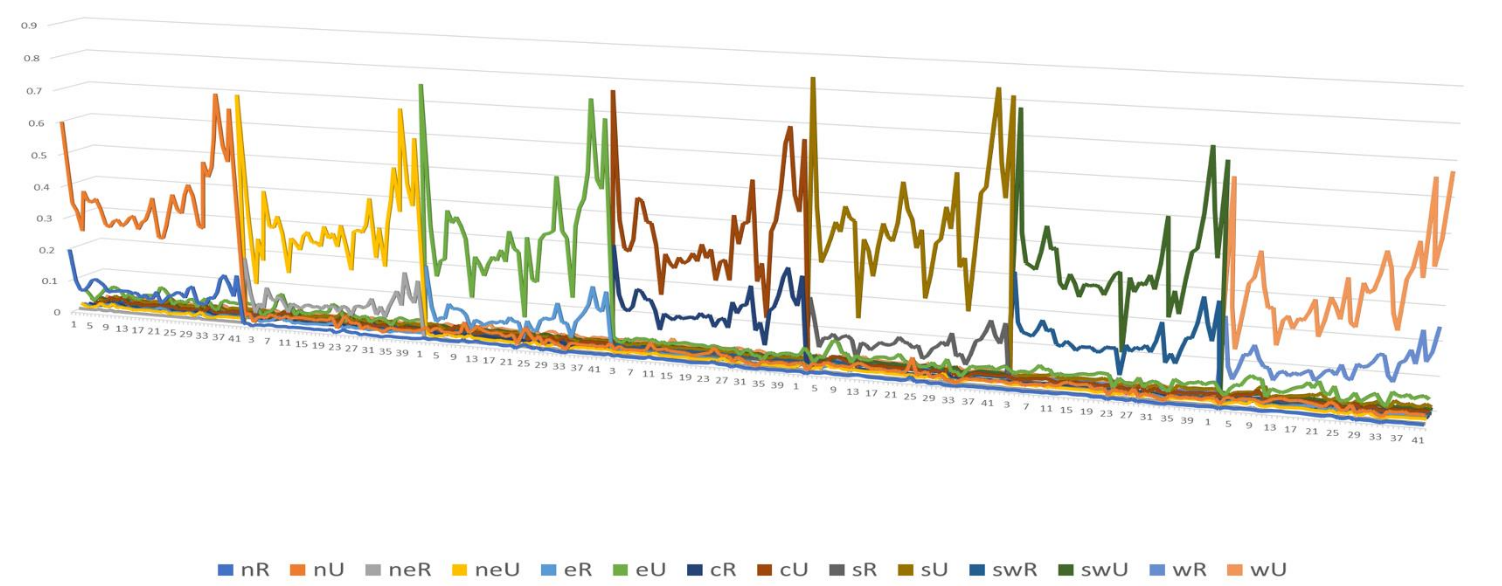
The graphical version for region-level of the multi-sector income multiplier $\boldsymbol{KVB}$ matrix is shown in Figure 4. First, urban households still dominate rural counterparts regarding potential income increase caused by new added demand in different sectors generally, which is in line with the conclusions from matrix $\boldsymbol{K}$ of inter-relational income multiplier. Second, the spill-over effect is smaller compared with the internal impact within each region since the indigenous line belonging to each region is always on top. Third, economic returns in sectors like agriculture are high for all regions. Forth, it shows significant spatial disparities for returns to new consumption in a same sector differ across regions.

Table 6: Total returns for inter-relational income multiplier $\boldsymbol{K}$ by regions of China 2012

	north		northeast		east		centre		south		southwest		west	
	R	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**
Total Returns	1.45E+00	1.40E+00	1.52E+00	1.51E+00	1.58E+00	1.48E+00	1.55E+00	1.53E+00	1.65E+00	1.58E+00	1.73E+00	1.58E+00	1.50E+00	1.47E+00

Source: own elaboration from Chinese multiregional input-output table, 2012

Figure 4: Multi-sector income multiplier $\boldsymbol{KVB}$, regions of China 2012



Source: own elaboration from Chinese multiregional input-output table, 2012

6. Conclusion

Back to the research question of this paper that to what extent China's economic structure can alleviate the urban-rural income gap on its own, this paper applied Miyazawa income distribution model under a multiregional and multisectoral background. Through region aggregations, this paper gets results in three levels: country-level, region-level, and province-level. Results from the interdependence between income and consumption, shows that the income gap between urban and rural households is likely to increase when consumption is pushed to a higher level (either by urban or rural household). Though some of them benefit the country's income greatly, the gap itself is not to be alleviated. In the cross-region analysis, I evaluate the spill-over effects and discuss spatial disparities, finding that the spill-over effect is always smaller than the internal effect, suggesting the importance of balanced development mode in China today, since it is hard to push poorer regions by strengthening the richer ones and look forward strong positive spill-over effects. The regional gap in China is still big, that west, southwest, and northeast are ones expected to gain less income when other regions' households consume. In terms of sectors, sectors including agriculture, accommodation and meals, education, public administration, and social security should be paid with more attention, since the urban-rural income gap is likely to enlarge more for consumption in these more "profitable" sectors.

These findings suggest that eliminating the urban-rural income gap due to an exogenous increase of income that could be translated into a higher consumption is likely to be in vain. Since this gap has already been large, tools apart from consumption stimulations should be implemented, including taxation, government transfers etc. aimed at reinforcing the redistribution of income.

Future research targeting this topic include:

(i) Inclusion of household production. Miyazawa's model assumes all household productions to be zero. In practice, we can observe the significant contribution to GDP from household production. And it is plausible that rural household may take more house production activities than urban ones due to the lack for amenities in rural China, though household production is in another topic.

(ii) The varying trend of urban-rural gap. This paper applies data in a single year 2012. If data in the following years are collected and published, such trend regarding values in matrices $\boldsymbol{K}$ and $\boldsymbol{KVB}$ can be plotted to see if such gap is larger or smaller across years.

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Appendix: **Table A1: Simplified version of the Chinese multiregional input-output table, 2012**

			BUYING SECTOR					FINAL DEMAND					TOTAL OUTPUT
			R1	**R2**	**R3**	**R..**	**Rm**	**R1**	**R2**	**R3**	**R..**	**Rm**	
			S1 S.. Sn	S1 S.. Sn	S1 S.. Sn	S1 S.. Sn	S1 S.. Sn	f1 f…	f1 f…	f1 f…	f1 f…	f1 f…	X
SELLING SECTOR	**R1**	S1											
		S..	Z(R1R1)	Z(R1R2)	Z(R1R3)	Z(R1R4)	Z(R1R5)	F(R1R1)	F(R1R2)	F(R1R3)	F(R1R4)	F(R1R5)	X(R1)
		Sn											
	R2	S1											
		S..	Z(R2R1)	Z(R2R2)	Z(R2R3)	Z(R2R4)	Z(R2R5)	F(R2R1)	F(R2R2)	F(R2R3)	F(R2R4)	F(R2R5)	X(R2)
		Sn											
	R3	S1											
		S..	Z(R3R1)	Z(R3R2)	Z(R3R3)	Z(R3R4)	Z(R3R5)	F(R3R1)	F(R3R2)	F(R3R3)	F(R3R4)	F(R3R5)	X(R3)
		Sn											
	R..	S1											
		S..	Z(R4R1)	Z(R4R2)	Z(R4R3)	Z(R4R4)	Z(R4R5)	F(R4R1)	F(R4R2)	F(R4R3)	F(R4R4)	F(R4R5)	X(R4)
		Sn											
	Rm	S1											
		S..	Z(R5R1)	Z(R5R2)	Z(R5R3)	Z(R5R4)	Z(R5R5)	F(R5R1)	F(R5R2)	F(R5R3)	F(R5R4)	F(R5R5)	X(R5)
		Sn											
VALUE ADDED		v1 v…	V(R1)	V(R2)	V(R3)	V(R4)	V(R5)						
TOTAL INPUT		X	X(R1)	X(R2)	X(R3)	X(R4)	X(R5)						

Source: own elaboration

Notes: Notation is the same as section 3.3.

Appendix: **Table A2: Chinese provinces and regions**

Order in Table	Province Name	Region
1	Beijing	North China
2	Tianjin	
3	Hebei	
4	Shanxi	
5	Inner Mongolia	
6	Liaoning	Northeast China
7	Jilin	
8	Heilongjiang	
9	Shanghai	East China
10	Jiangsu	
11	Zhejiang	
12	Anhui	
13	Fujian	
14	Jiangxi	
15	Shandong	
16	Henan	Central China
17	Hubei	
18	Hunan	
19	Guangdong	South China
20	Guangxi	
21	Hainan	
22	Chongqing	Southwest China
23	Sichuan	
24	Guizhou	
25	Yunnan	
26	Tibet	
27	Shaanxi	West China
28	Gansu	
29	Qinghai	
30	Ningxia	
31	Xinjiang	

Source: Own translation from Chinese multiregional input-output table, 2012

Appendix: **Table A3: Industrial classification of the Chinese multiregional input-output table, 2012**

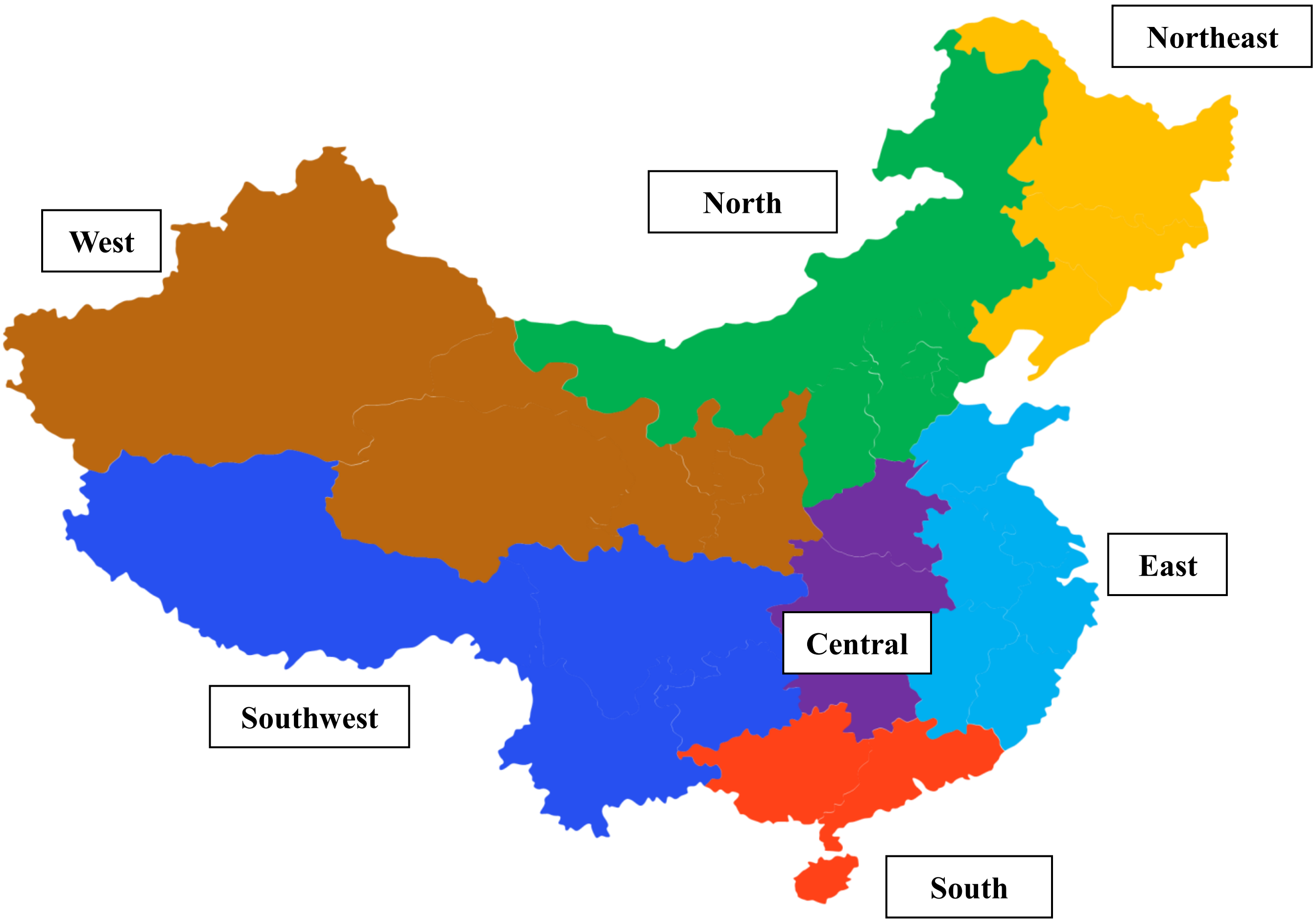
Order	Sector		Order	Sector
1	Agriculture, forestry, animal husbandry, fishery products and services		22	Other manufactured products
2	Coal mining products		23	Scrap waste
3	Oil and Gas Extraction Products		24	Metal Products, Machinery and Equipment Repair Services
4	Metal ore mining products		25	Production and supply of electricity and heat
5	Non-metallic ores and other mining products		26	Production and supply of gas
6	Food and tobacco		27	Production and supply of water
7	Textile		28	Construction industry
8	Textile garments, shoes, hats, leather, down and their products		29	Wholesale and Retail
9	Woodwork and Furniture		30	Transportation, Warehousing and Post
10	Paper printing and cultural, educational and sporting goods		31	Accommodation and meals
11	Petroleum, coking products and nuclear fuel processed products		32	Information transmission, software and information technology services
12	Chemical products		33	Financial industry
13	Non-metallic mineral products		34	Real estate industry
14	Metal smelting and rolling processed products		35	Rental and Business Services
15	Metal products		36	Scientific research and technical services
16	General equipment		37	Management of water conservation, environment and public utilities
17	Professional equipment		38	Residential Services, Repairs and Other Services
18	Transportation equipment		39	Education
19	Electrical machinery and equipment		40	Health and Social Work
20	Communication equipment, computers and other electronic equipment		41	Culture, Sports and Recreation
21	Instrumentation		42	Public Administration, Social Security and Social Organization

Source: Own translation from Chinese multiregional input-output table, 2012

Appendix: **Figure A1: Map of 31 Chinese provinces**

Source: own elaboration

Appendix: **Figure A2: Map of 7 Chinese regions**



Source: own elaboration

Appendix: **Table A4: Urban and Rural labour compensation share, Chinese provinces 2012**

Province	Rural Income Share	Urban Income Share
Beijing	6.74%	93.26%
Tianjin	9.67%	90.33%
Hebei	30.90%	69.10%
Shanxi	22.85%	77.15%
Inner Mongolia	19.40%	80.60%
Liaoning	17.45%	82.55%
Jilin	26.84%	73.16%
Heilongjiang	26.84%	73.16%
Shanghai	5.04%	94.96%
Jiangsu	19.45%	80.55%
Zhejiang	19.69%	80.31%
Anhui	28.15%	71.85%
Fujian	19.41%	80.59%
Jiangxi	30.34%	69.66%
Shandong	24.97%	75.03%
Henan	33.31%	66.69%
Hubei	24.67%	75.33%
Hunan	28.53%	71.47%
Guangdong	14.44%	85.56%
Guangxi	26.84%	73.16%
Hainan	24.94%	75.06%
Chongqing	19.53%	80.47%
Sichuan	30.90%	69.10%
Guizhou	30.74%	69.26%
Yunnan	28.41%	71.59%
Tibet	51.86%	48.14%
Shaanxi	21.73%	78.27%
Gansu	29.34%	70.66%
Qinghai	25.28%	74.72%
Ningxia	23.28%	76.72%
Xinjiang	31.25%	68.75%

Source: own elaboration from China Rural Statistical Yearbook (2013) and China Population & Employment Statistical Yearbook (2013)