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Which is important?—the economy or people's livelihood

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ABSTRACT

The adjustment of industrial structure not only is an important driving force of economic development but also affects the income gap between urban and rural areas through the effect of resource allocation. Based on this, this article constructs an index of the adjustment range and adjustment quality of the industrial structure. The results show that the adjustment of industrial structure in the eastern region has significantly promoted economic catch-up but inhibited the widening of the income gap between urban and rural areas. The adjustment range and quality of industrial structure in central China has promoted economic catch-up, but the adjustment quality has inhibited economic catch-up. In the western region, the adjustment range and quality of the industrial structure have restrained the regional economy from catching up and expanding the income gap between urban and rural areas. In the eastern and central regions, economic catch-up and the narrowing of the urban-rural income gap significantly promote each other, while in the western region, economic catch-up and the urban-rural income gap significantly promote each other. This shows that both economic development and people's livelihood improvement can be achieved in economically developed areas but not in underdeveloped areas.

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1. Introduction

Economic development and the income distribution have long been two important research topics in economics. For any country, economic growth is undoubtedly important because it is a prerequisite for realising socioeconomic modernisation and a necessary condition for strengthening the country and enriching the people. However, the income distribution is also important because the prerequisite for achieving long-term sustainable economic growth is achieving a fair distribution of wealth, which is also the basic condition for achieving social harmony and stability (Neves & Silva, 2014; Majeed, 2016). In fact, in the initial stage of economic development, when the income level is generally low and the problem of food and

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clothing provision has not been solved, the development model of giving priority to economic growth is undoubtedly correct, and economic catch-up must be given priority. Therefore, the total growth of China's gross domestic product (GDP) has been the primary political task of regional governments since the 1980s. Promoting economic growth has been more important than achieving a fair income distribution and protecting the ecological environment. However, after decades of rapid economic growth, the problem of food and clothing provision has been solved, and people's living standards have generally improved. Since the 1990s, the income gap between urban and rural areas has been wider than international recommendations (Sicular et al., 2007; Risso & Sánchez Carrera, 2012), and the increasingly serious income gap caused by rapid economic growth has become the focus of much attention. The inexorable widening trend of the income gap and the unfair income distribution naturally cause widespread dissatisfaction and worry among the public.

Because economic development has been in an unbalanced state for a long time, the most important issues are resource allocation and the adjustment of industrial structure. Some industries enjoy higher marginal returns to resource allocation efficiency than others. Driven by the goal of maximising the benefits of labour and capital, the market mechanism drives the inefficient resource allocation of labour and capital elements to balanced industries or regions with high resource allocation efficiency and high marginal return. In this dynamic process of continuous evolution, the resource allocation effect and economic incentives constantly promote the adjustment of industrial structure and regional economic catch-up behaviour. It is in this situation that the development model that gives priority to economic development must be changed to a development model that pays equal attention to growth and the income distribution.

With the process of economic growth and the change in the economic structure, the income gap first expands and then narrows, but analyses of experiences in different periods and different parts of the world yield heterogeneous conclusions. Chenery (1960), the main representative of the theory of economic growth, believed that there is a close correlation between the change in industrial structure and economic growth, and the composition of industries, as well as the connection and proportional relationship among various industries, are important manifestations of a country's economic structure. In particular, the change in industrial structure under unbalanced conditions (factor market segmentation or lagging industrial adjustment) can not only accelerate economic growth but also have an important impact on social welfare. In explaining the process of economic development, the new economic growth theory emphasises the urban-rural income gap caused by the accumulation of specialised human capital, the knowledge spill-over effect and the bias of technological progress, but when explaining the source of long-term economic development, it does not answer why the income gap changes dynamically. Therefore, this article investigates the relationship between the adjustment of industrial structure, the income gap between urban and rural areas and the results of the catching up of the regional economy.

2. Literature review

Under the current political centralisation and performance appraisal system in China, political performance appraisal constitutes the main incentive for local governments to promote regional economic competition and links economic growth with officials' promotion through the political system, forming a system in which economic performance appraisal is linked with political performance appraisal (Li & Zhou, 2005; Guo, 2007). To win the 'promotion competition', local officials should not only ensure the growth rate of GDP but also assess the ranking of their jurisdiction according to GDP and other indicators, which makes local governments compete to catch up with each other in terms of economic 'growth'. In the process of chasing economic performance indicators, such as regional GDP, an 'economic emphasis' has developed, with a focus on industrial restructuring and regional economic catch-up; however, narrowing the income gap between urban and rural areas and 'emphasizing people's livelihood' are both important. The existing theoretical research on the income gap and economic growth shows that there are many ways economic catch-up influences the urban-rural income gap. First, economic catch-up sacrifices people's livelihood investment. According to this view, under the condition of limited resources, people's livelihood investment squeezes the resources available for economic development (Wan et al., 2006; Wang et al., 2019). Therefore, in the process of trying to catch up economically, the regional government pays too much attention to the priority allocation of resources to investment and production, ignoring the corresponding investment in people's livelihood, which worsens the relationship between the urban and rural income distribution and economic development. Second, the income gap between urban and rural areas can be resolved through the rapid economic growth brought about by economic catch-up. This view holds that in the case of excessive downward pressure on developing economies, the government's increased expenditure on people's livelihood unnecessarily interferes with economic development (Galor & Zeira, 1993; Risso & Sánchez Carrera, 2012; Halter et al., 2014). Third, there is a nonlinear influencing mechanism between the income gap and economic growth. Kuznets (1955) proposed the hypothesis that economic growth and income distribution have an inverted U-shaped relationship. The income distribution is inevitably affected in the process of economic development, and a country's income inequality first expands and then shrinks. When the per capita income level is low, economic growth is accompanied by a widening income gap; when the economy develops to a certain extent, economic growth can help alleviate the income gap.

In fact, while economic development can have three effects on the income gap between urban and rural areas, theoretical studies of the income gap and economic growth present the following views. First, the income gap can hinder economic growth. McCann and Folta (2008) empirically confirmed that the income gap aggravates macroeconomic volatility through transmission mechanisms such as the capital market and monetary policy, thus inhibiting economic growth. Wang et al. (2019) used cross-sectional data and time series data for China's provincial regions in different sample intervals and time periods to study the interaction mechanism between the income gap among residents and economic growth and showed that the expansion of the urban-rural income gap hindered economic growth under the condition

of a low human capital level, especially in the middle and late 1990s. Second, there can be a positive correlation between the income gap and economic development. According to this view, an appropriate income gap is beneficial to economic growth because the marginal saving tendency of the rich is higher than that of the poor (Dynan et al., 2004), and the difference in the income gap can enhance the efficiency of total investment, which is beneficial to economic growth. In addition, scholars have considered fiscal and tax policies, technological innovation (Fang et al., 2008; Acemoglu et al., 2018), and public expenditure (Dynan et al., 2004; Prete, 2013) and confirmed that there is a steady and significant positive correlation between the income distribution and economic growth. Finally, the income gap does not have a curve relationship that completely inhibits economic growth (Carlsson & Rooth, 2007; Alonso & Raurich, 2018; Cai, 2007). The impact of the income gap on economic growth varies across different stages of development.

While economic development and the urban-rural income gap influence each other, industrial structure adjustment brings specialisation and the social division of labour, which determines the economic growth mode (Erman & Kaat, 2019; Foellmi & Zweimüller, 2008). Because there are different industrial levels in society, the level of productivity presents a gradient, and the flow of production factors from low-productivity industries to high-productivity industries is the driving force promoting economic growth. Structuralists represented by Chenery (1960) and Kuznets (1991) believe that economic development mainly depends on structural transformation, and the faster the structural transformation occurs, the higher the level of economic development. Nielsen and Alderson, (1997) and Fishman and Simhon (2002) think that different speeds and tracks of regional industrial structure evolution bring about differences in economic growth efficiency. The higher the level of economic development is, the faster the industrial structure evolution. The developed manufacturing and service industries in developed regions lead to the concentration of resources in developed regions. China's regional economic gap originates from the differences in industrialisation levels and the changes in industrial structure (Sicular et al., 2007; Lee, 2016b). Neoclassical economic growth theory emphasises that technological progress is the source of economic growth in the long run, and economic development eventually converges across regions. An empirical study by Su et al. (2015) shows that there is no universal convergence in regional economic development, but three convergence clubs have formed in the eastern, central and western regions, and there are conditional convergence effects in China's regional economic development.

The abovementioned studies have deepened the research on industrial structure adjustment, economic growth and the urban-rural income gap, but the existing research on the impact of industrial structure adjustment on the urban-rural income gap ignores the role of the regional economy in the catching-up process and has not established a theoretical model of the endogenous relationship among the three aspects. This article attempts to contribute to the literature in the following three aspects. First, the quality and range of industrial structure adjustment, economic catch-up and urban-rural income gap are placed in a unified framework, and the relationship among them is discussed. Second, based on the perspective of regional economic differences, the spatial model is used to analyse the impact of industrial

structure adjustment on economic catch-up and the urban-rural income gap. Third, this article discusses the relationship between regional economic catch-up and urban-rural income gap by using spatial simultaneous equation.

3. Research design

3.1. The interpreted variables

3.1.1. Economic catch-up

Local governments take neighbouring regions or regions with high economic development levels as benchmarks and compete for regional resource allocation, economic development, urban construction, infrastructure, etc., to narrow the gap between themselves and other regions (Reiffenstein, 2008; Lee, 2016a; Anthony, 2020). Economic catch-up usually stimulates local economic growth with the GDP growth of neighbouring provinces, which is reflected in the competition and catch-up of regional economic development. In addition, the regions with high economic development levels in a regional cluster still face catch-up at the national level. Therefore, the dimensions of neighbouring provinces and the nation are selected to jointly determine the economic catch-up level of each region, and the calculation formula is as follows:

$$\begin{aligned} \text{Economic catch-up}(\text{eco}) = & \frac{\text{Highest per capita GDP in the neighboring region}}{\text{Per capita GDP of this region}} \\ & \times \frac{\text{The highest per capita GDP in China}}{\text{Per capita GDP of this region}} \end{aligned} \quad (1)$$

3.1.2. Income gap between urban and rural areas

The Gini index, Theil index and income ratio of urban and rural residents are commonly used to measure the urban-rural income gap. The Gini coefficient can compare the income gap of only the whole population in a country or region and easily ignores the interests of the low-income class, and it cannot well explain the characteristics of the income gap. The Theil index considers not only the population structure but also the relative changes in residents' income and reflects the realistic background of the urban-rural dual economic structure. Therefore, the macro-level measurement of urban-rural income in the Theil index is more in line with the current situation of the income gap between high- and low-income groups. The Theil index is very sensitive in calculating the income gap. Therefore, it is reasonable to choose the Theil index as the index of the urban-rural income gap.

$$thi_{it} = I_{uit}/I_{it} \ln \left((I_{uit}/I_{it}) / (P_{uit}/P_{it}) \right) + I_{rit}/I_{it} \ln \left((I_{rit}/I_{it}) / (P_{rit}/P_{it}) \right) \quad (2)$$

Among them, thi indicates the Theil index, I denotes the region, t denotes the period, I_{uit} and I_{it} indicate the disposable income of urban and rural areas, P_{uit} and

P_{rit} represent the population of urban and rural areas, respectively, and I_{it} indicates the region's total income.

3.2. Core explanatory variables

3.2.1. The adjustment range of the industrial structure

The adjustment range of the industrial structure is the degree of change in the process of industrial development. With reference to Findeisen & Südekum (2008), the adjustment range of the industrial structure (*adj*) can be reflected by measuring the intensity of the reconfiguration of the total employment of industrial enterprises in a region.

$$adj_{it} = \left\{ \left[\sum_{i=1}^n |e(i, t+1) - e(i, t)| \right] - |e(t+1) - e(t)| \right\} / e(t) \quad (3)$$

Among them, *adj* represents the adjustment range of the industrial structure, $e(i, t)$ represents an area, i denotes the industry, and t denotes the number of employees in industrial enterprises during period $e(t)$. In a given region, t is an index that reflects the range of labour force allocation in the industry.

3.2.2. Quality of industrial structure adjustment

The quality of industrial structure adjustment causes the transfer of market factors from departments with low productivity to those with high productivity and technical complexity. Generally, there are two connotations of the quality of industrial structure adjustment from labour-intensive to capital intensive and knowledge-based technology intensive: one is the change in the proportion of input factors, and the other is the improvement in labour productivity. The calculation method is as follows:

$$qua_{it} = \sum_{j=1}^n S_{ijt} \times F_{ijt} \quad (4)$$

Among them, S_{ijt} is the proportion of industry i in region j in terms of added value in the regional GDP at time t , and F_{ijt} is the labour productivity at time t of industry i in region j .

3.3. Control variables

The other control variables selected in this article include the following: (1) urbanisation construction (*urb*). The ratio of the urban population to the registered population is adopted for measurement. (2) Fiscal expenditure (*gov*). Measure fiscal expenditure as a percentage of GDP. (3) The level of economic openness (*ope*). The ratio of FDI to GDP is used to measure the level of regional economic opening to the outside world. (4) Unemployment rate (*une*). (5) Convenient transportation (*roa*). This variable is expressed by the ratio of the sum of railway operating mileage and highway mileage to the regional area. (6) Education level (*edu*). The average years of

Table 1. Descriptive analysis.

Variables	Abbr.	Obs	Mean	Std. Dev.	Min	Max
Economic catch-up	<i>ecup</i>	600	5.8223	4.9037	0.3896	29.9101
Urban-rural income gap	<i>thi</i>	600	0.1242	0.0591	0.0127	0.2936
Adjustment range of industrial structure	<i>adj</i>	600	15.0129	15.3251	0.0000	86.6472
Adjustment quality of industrial structure	<i>qua</i>	600	8.4004	5.5779	1.1102	31.7423
Urbanization	<i>urb</i>	600	0.4986	0.1518	0.1819	0.8960
Fiscal expenditure	<i>gov</i>	600	0.5114	0.1888	0.1483	0.9509
Economic opening	<i>ope</i>	600	0.6306	0.7173	0.0662	7.6258
Unemployment	<i>une</i>	600	3.5049	0.7165	0.8000	6.5000
Education	<i>edu</i>	600	8.5437	1.0926	5.4383	12.7820
Transportation	<i>roa</i>	600	2.7961	3.5204	0.2326	18.1182
Regional economic development	<i>pgdp</i>	600	3.3112	2.6797	0.2759	16.4563
Environmental regulation	<i>poll</i>	600	15.3265	13.6438	0.2062	110.3387

Source: Author calculation.

education are adopted to measure the regional education level. (7) The level of regional economic development (*pgdp*). This article uses the GDP per capita of each region to express the level of economic development. (8) Environment rules (*poll*). It is measured by the ratio of the investment amount of regional pollution control to GDP.

Considering the availability of data and statistical calibre, this article selects the economic weight matrix to analyse the panel data of 30 provinces (autonomous regions and municipalities) from 2000 to 2019. Due to lack of data, Tibet was eliminated from the sample. The data sources include the China Statistical Yearbook, the statistical yearbooks of provincial units, and the China Population and Employment Statistical Yearbook. The statistical data of some provinces are missing. We also use the interpolation method to supplement the data. Because the processed data are too small, the relevant variables are enlarged, and the data structure is not changed. The statistical characteristics of each variable after treatment are shown in Table 1.

3.4. Construction of measurement model

Based on the above analysis, we first establish the following basic model:

$$\ln thi_{it} = \alpha_0 + \alpha_1 ind_{it} + \delta \ln X_{it} + \varepsilon_{it} \quad (5)$$

$$\ln eco_{it} = \beta_0 + \beta_1 ind_{it} + \chi \ln X_{it} + \mu_{it} \quad (6)$$

Among them, *thi* is the Theil index that measures the urban-rural income gap, *eco* denotes the regional economic catch-up, *ind* is the adjustment of industrial structure (adjustment range and quality), X_{it} is the set of control variables, α_0 and β_0 are the intercept items, and ε_{it} and μ_{it} are random error terms.

In fact, with the change in factor inputs in the process of industrial structure adjustment, the flow of resource allocation in a region may be impacted by other regional behaviours. If the spatial correlation between factor input and resource redistribution is ignored, errors may result that are inconsistent with reality (Krugman, 1991). In view of this, this article selects a spatial econometric model to study the relationship between industrial structure and economic catch-up. Common spatial

econometric models include the spatial autoregressive model (SAR) and the spatial error model (SEM).

$$Y_{it} = \alpha_0 + \rho WY_{it} + \sum_{j=1}^n \alpha_j X_{itj} + \varepsilon_{it}, \varepsilon_{it} \sim (0, \sigma^2 I) \quad (6)$$

$$Y_{it} = \alpha_0 + \sum_{j=1}^n \alpha_j X_{itj} + \varepsilon_{it}; \varepsilon_{it} = \lambda W\varepsilon_{it} + \mu_{it}; \mu_{it} \sim (0, \sigma^2 I) \quad (7)$$

In formula (6) and formula (7), Y and x represent the dependent variable and independent variable, respectively; α_j , ρ and λ are the coefficients of the variables, ε_{it} and μ_{it} are error terms obeying the normal distribution, and other variables are the same as above. W is the spatial weight matrix. Finally, the following model is constructed:

$$\ln Y_{it} = \rho \sum_{j=1}^n W_{ij} \ln Y_{it} + \alpha X_{it} + \delta \ln \text{Contr}_{it} + \alpha_i + v_i + \varepsilon_{it} \quad (8)$$

$$\varepsilon_{it} = \lambda \sum_{j=1}^n W_{ij} \varepsilon_{it} + \mu_{it}$$

where Contr is the control variable, α_i , v_i and ε_{it} and are the regional effect, time effect and random disturbance term, and other explanatory variables are the same as in the above formula. Although spatial econometric models can be described by different models according to different spatial effects, they examine only the single causal relationship between an economic variable and the changes affecting it but cannot examine the two-way causal relationship. The spatial simultaneous equation can study the interdependence of the whole economic system. Moreover, the simultaneous equation can solve the endogeneity caused by the causal relationship between the explanatory variable and the explained variable. Therefore, to better investigate the interaction between economic catch-up and the urban-rural income gap and its spatial spill-over effect, generalised spatial three-stage least squares (GS3LS) panel simultaneous equations are constructed. The remarkable advantage of the GS3LS model is that both the potential spatial correlation of endogenous variables and the possible correlation of random disturbance terms of each equation are considered, as shown below.

$$\ln \text{eco}_{it} = \alpha_0 + \alpha_1 \sum_{j=1}^n W_{ij} \ln \text{eco}_{it} + \alpha_2 \sum_{j=1}^n W_{ij} \ln \text{thi}_{it} + \alpha_3 \ln \text{thi}_{it} + \delta \ln Z_{it} + \varepsilon_{it} \quad (9)$$

$$\ln \text{thi}_{it} = \beta_0 + \beta_1 \sum_{j=1}^n W_{ij} \ln \text{thi}_{it} + \beta_2 \sum_{j=1}^n W_{ij} \ln \text{eco}_{it} + \beta_3 \ln \text{eco}_{it} + \delta \ln T_{it} + \varepsilon_{it} \quad (10)$$

where Z represents the control variable related to economic catch-up, and T represents the control variable related to the urban-rural income gap. Other explanatory variables are consistent with the above formula. Considering that the important reason for regional economic catch-up is the difference in regional economic development levels, when choosing the spatial weight matrix, the weight of economic distance (W_{ij}) can reflect the difference in economic development between regions.

This variable is constructed by taking the reciprocal of the absolute value of the difference between the current regional per capita GDP between two regions during the investigation period as the weight, namely, $W_{ij} = 1/|X - Y|(i \neq j)$.

4. Results

4.1. The impact of industrial structure adjustment on economic catch-up and the urban-rural income gap

On the basis of the above analysis, we consider the impact of industrial restructuring on the economic catch-up and disposable income in urban and rural areas (Table 2). Holding the control variables constant, adding core explanatory variables does not change the significance and direction of the core explanatory variables, so our model is robust. From model (1) to model (3) in Table 2, it can be found that the adjustment range of industrial structure promotes regional catch-up. The quality of industrial structure adjustment is significantly negative (-0.5014) for economic catch-up, indicating that it inhibits economic catch-up. The quality of industrial structure adjustment means that the allocation of input elements of resources flows from low-productivity departments to high-productivity departments, which leads to the improvement in labour productivity. However, in recent years, with the change in the

Table 2. Influence of industrial structure adjustment on economic catch-up and the urban and rural disposable income gap.

Variables	Economic catch-up			Urban-rural income gap		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>adj</i>	0.0206*** (2.82)		0.0101** (1.99)	0.0175** (2.01)		0.0203** (1.98)
<i>qua</i>		-0.8068*** (8.82)	-0.5014** (-2.11)		0.2008*** (3.68)	0.2396*** (3.81)
<i>urb</i>	-0.6978*** (-6.97)	-0.1056*** (-3.23)	-0.1485* (-1.76)	-0.5942*** (-5.06)	-0.6447*** (-6.06)	-0.6531*** (-6.15)
<i>gov</i>	-1.0672*** (-9.45)	-0.7391*** (-8.09)	-0.5642* (-1.63)	-0.4156*** (-3.41)	-0.5805*** (-4.05)	-0.5867*** (-4.56)
<i>ope</i>	0.0773** (2.12)	0.0900*** (3.09)	-0.0089 (-1.03)	0.0528 (1.41)	0.0486 (1.51)	0.0484 (1.31)
<i>une</i>	-0.2619*** (-3.04)	-0.0558* (-1.81)	-0.0613* (-1.91)	0.1617* (1.60)	0.1674* (1.74)	0.1880** (1.96)
<i>edu</i>	-2.1670*** (-8.20)	0.1848 (0.75)	0.0938*** (3.90)	-0.1346 (-1.33)	-0.2951 (-0.73)	-0.3399 (-0.84)
<i>roa</i>	-0.2950*** (-6.36)	0.0326* (1.79)	0.0122 (1.31)	0.1812*** (3.31)	0.1405** (2.52)	0.1311** (2.35)
<i>pgdp</i>	0.2418*** (4.63)	0.3079*** (7.46)	0.2577*** (6.34)	0.2588*** (4.55)	0.1951*** (3.35)	0.2029*** (3.48)
<i>poll</i>	0.0093 (1.51)	-0.0046 (-1.32)	-0.4806*** (-3.41)	0.0939*** (4.81)	0.0770*** (4.49)	0.0890*** (4.59)
Regional fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
ρ	-0.106** (-2.29)	-0.308*** (-7.64)	0.328 (0.68)	-0.345*** (-5.56)	-0.327*** (-5.08)	-0.332*** (-5.37)
R^2	0.611	0.759	0.564	0.401	0.251	0.204
LogL	-77.861	125.497	-1235.812	33.816	39.109	41.060
<i>N</i>	600	600	600	600	600	600

*, **, ***Show significant levels at 10%, 5%, and 1%.

Source: Author's estimations.

economic development mode, regional governments have transferred or terminated enterprises and projects with high pollution, high energy consumption and low efficiency in the process of seeking high-quality economic development. These measures supporting the quality of economic development also reduce the speed of economic development. This verifies that the quality of industrial structure adjustment inhibits economic catch-up behaviour through the spatial spill-over coefficient. We also find that neither the adjustment range nor the adjustment quality has inhibited the widening of the income gap between urban and rural areas (Table 2). In this regard, we observe that the adjustment of industrial structure generally takes place in cities, such that industries tend to develop in urban areas, and an industrial policy centred on cities is formed. The government pays less attention to the development of non-urban industries, resulting in unbalanced development between urban and rural industries (Howell, 2019). The adjustment of the industrial structure generally affects the income gap between urban and rural areas through indirect effects, such as labour mobility and population structure changes caused by the upgrading of the industrial structure. With the increasingly detailed division of labour and the deepening of the proprietary degree of human capital, the quality of industrial structure adjustment is continuously improved. However, in the employment market, rural low-skilled workers are in a disadvantaged position, facing various employment or maladjustment problems, which leads to income reduction in different situations. In addition, the long-standing dual management system of the urban and rural economy and society restricts the disposable income of both rural and urban residents, but considering their contributions, the wage increase experienced by migrant workers is not enjoyed by rural labourers. Cities use urban-oriented policies to obtain more surplus from migrant workers, and the urban and rural labourers are obviously unequally positioned (Wan et al., 2006). Finally, the effect of the unequal opportunities and income motivates many rural labourers.

4.2. Economic catch-up and income gap mutual influence estimation

According to the model identification conditions, the simultaneous equation model in this article is over-identified, so the generalised spatial three-stage least square (GS3SLS) method can be used to estimate the simultaneous equations as a whole. In the process of empirical regression, considering the multicollinearity among variables, this article analyses the correlation between the explanatory variables of each equation, and the correlation coefficient is less than 0.5. Second, to avoid the distortion of model estimation caused by multicollinearity, the variables are tested by the variance inflation factor (VIF), and the variables with VIF greater than 10 are centralised. To improve the effectiveness of the overall estimation of the model, as a comparative analysis, this article also reports the 3SLS estimation results, as shown in Table 3.

Based on the estimation results of the interaction effect between economic catch-up and the urban-rural income gap (Table 3), there is no obvious change in the sign of the regression coefficient of each variable, and the regression coefficient and significance level of each variable are basically stable. In this article, the GS3SLS regression results including spatial effects are selected for analysis. First, from the

Table 3. Simultaneous equation estimation of economic catch-up and the urban-rural income gap.

Variables	Economic catch-up		Urban-rural income gap	
	3SLS (1)	GS3SLS (2)	3SLS (3)	GS3SLS (4)
<i>w*ecoup</i>		0.0213** (2.38)		0.1550** (1.98)
<i>w*thi</i>		2.028** (2.20)		-0.2580*** (-3.84)
<i>ecoup</i>			-0.0149*** (-3.12)	-0.2753*** (-4.63)
<i>thi</i>	-1.6343*** (-3.84)	-1.9585*** (-4.45)		
<i>urb</i>	-1.8898*** (-3.83)	-3.6220*** (-3.57)	-0.9166*** (-2.69)	-0.6324*** (-5.74)
<i>gov</i>	-1.1232 (-2.13)	-3.8951*** (-3.67)	-0.3161*** (-4.64)	-0.7391*** (-6.01)
<i>ope</i>	-0.0995 (-0.39)	-0.1826** (-1.96)	-0.0103 (-1.42)	0.0583* (1.66)
<i>une</i>	-0.2246 (-1.35)	0.5962* (1.71)	0.0108 (1.18)	0.0980 (1.56)
<i>edu</i>	-4.0256** (-1.99)	2.5925* (1.88)	-1.0894*** (-5.38)	0.3699** (1.97)
<i>roa</i>	0.7207*** (3.77)	-2.1415*** (-4.05)	-0.0093 (-1.50)	0.1374*** (2.54)
<i>pgdp</i>	1.1116*** (3.41)	1.8086*** (3.54)	0.0013 (1.04)	0.1864*** (3.30)
<i>poll</i>	-0.3119 (-1.57)	0.5065*** (2.93)	0.0806*** (4.31)	0.0660*** (3.53)
<i>R</i> ²	0.5487	0.457	0.6807	0.525
<i>N</i>	600	600	600	600

***Show significant levels at 10%, 5%, and 1%.

Source: Author's estimations.

perspective of the impact of the urban-rural income gap on economic catch-up, the expansion of the urban-rural income gap has an inhibitory effect on economic catch-up (-1.9585). Through the analysis of spatial spill-over effects in other regions, it is found that the urban-rural income gap has a positive spatial spill-over effect on economic catch-up. The widening of the urban-rural income gap in neighbouring areas promotes (2.028) local economic catch-up behaviour, and the spatial spill-over effect of economic catch-up on economic catch-up is positive (0.0213), indicating that the economic catch-up behaviour in neighbouring areas promotes local economic catch-up. The existing research evidence shows that the effect of the urban-rural income gap on economic growth depends on the level of economic development and the extent of the income gap itself (Li & Zhou, 2005; Fang et al., 2008). When the level of economic development is low and the income gap is relatively small, the appropriate income gap between urban and rural areas has a positive impact on economic growth; when the level of economic development is high, the expansion of the income gap between urban and rural areas has a negative effect on economic growth. At present, as the second largest economy in the world, China's economic development is at a relatively high level, and its overall industrialisation level has entered the second half of the middle stage of industrialisation. An excessive income gap leads to serious social differentiation, which is not conducive to the improvement of the

whole society's consumption level, thus affecting production and inhibiting the stable development of the regional economy.

In addition, the regression results of economic catch-up and the urban-rural income gap indicate that economic catch-up restrains the widening of the urban-rural income gap (-0.2753), but in comparison, urban-rural income expansion has a stronger restraining effect on economic catch-up. The spatial spill-over effect in other regions widens the urban-rural income gap in a given region (0.1550), while the spatial spill-over of the urban-rural income gap in neighbouring areas restrains the widening of the local income gap (-0.2580). In this regard, we highlight the significant economic differences between China and developed countries. There is a large gap between China and developed countries in terms of per capita GDP and per capita disposable income, and there is still room for greater economic growth in China. China will remain a 'catching-up country' for a long period in the future. In the process of catching-up, macro-level management with economic growth as the goal is still effective and remains the basic premise for the development of various undertakings in the country, and it is an important means to reduce the income gap between urban and rural residents.

4.3. Economic catch-up and the income gap between urban and rural areas by region

Due to geographical location, environmental factors, human capital and other factors, regions have very different economic development levels. The economic development level of the eastern coastal provinces is relatively high, while that of the central and western regions is relatively backward, which, not only requires industrial structure adjustment to catch up with the regional economy but also leads to great income differences between urban and rural residents. Therefore, we choose to divide the study area into the eastern, central and western regions according to the level of economic development¹ to further distinguish between 'the emphasis on the economy' and the 'emphasis on people's livelihood' at different economic development levels (Table 4).

Through the study of different regions, it is found that the adjustment range and quality of industrial structure are significantly positive (0.0152 and 0.5081) for economic catch-up in the eastern region, while the adjustment range and quality of industrial structure significantly reduce the income gap between urban and rural areas (-0.0489 and -0.4483). This shows that the adjustment of industrial structure in highly developed areas can not only ensure economic growth but also benefit people's livelihood. The reason for this is that the eastern region has given priority to development since the 1980s and has usually adopted a competitive strategy presenting characteristics of a 'race to the bottom', which attracted a large number of multinational companies to invest and promoted local economic growth. While this strategy increased employment and promoted economic growth to a certain extent, it also brought a series of long-term problems, especially regarding sustainable development. However, at present, China has eliminated the use of the race to the bottom strategy and entered a new stage favouring the race to the top. In particular, the eastern region has entered the transition from the late industrialisation stage to the post-

Table 4. Influence of industrial structure adjustment on economic catch-up and disposable income in urban and rural areas.

	East		Centre		West	
	Economic catch-up	Urban-rural income gap	Economic catch-up	Urban-rural income gap	Economic catch-up	Urban-rural income gap
<i>adj</i>	0.0152** (2.11)	-0.0489** (1.99)	0.0351*** (3.48)	-0.0860* (-1.92)	-0.0829** (-2.17)	0.0021*** (2.77)
<i>qua</i>	0.5081*** (7.82)	-0.4483** (-2.06)	-3.6300*** (-3.22)	-0.0102 (-1.55)	-0.8157*** (-11.23)	0.1572*** (3.44)
<i>urb</i>	-0.2598 (-0.41)	-1.0450 (-4.72)	-6.3935*** (-7.17)	-0.5814*** (-5.77)	0.5927*** (3.29)	-0.1138 (-1.01)
<i>gov</i>	-0.3437 (-1.29)	-1.6024*** (-3.77)	-3.0616 (-1.26)	0.4277*** (4.08)	-0.4150*** (-2.88)	-0.1483* (-1.65)
<i>ope</i>	0.2293 (0.94)	-0.0404 (-1.47)	0.7971** (1.97)	-0.0728** (-2.02)	-0.1032** (-2.46)	-0.0253 (-1.21)
<i>une</i>	1.2081** (2.19)	0.1050 (1.54)	0.3872 (1.23)	0.5581*** (6.35)	-0.1723 (-1.22)	0.0555* (1.63)
<i>edu</i>	0.4772 (0.15)	-0.4369 (-0.38)	-5.9735 (-0.80)	0.5300* (1.62)	0.4025 (0.90)	-0.0429 (-1.16)
<i>roa</i>	-1.2299*** (-4.21)	0.2240** (2.23)	2.2084 (1.29)	0.3554*** (7.72)	0.0242 (1.31)	-0.1019** (-2.13)
<i>pgdp</i>	0.7294 (1.22)	0.7661*** (3.64)	0.1016 (1.40)	0.0971*** (2.38)	0.0299 (1.44)	0.0220 (0.52)
<i>poll</i>	-0.3716*** (-3.10)	0.1144*** (2.72)	-0.1298 (-1.31)	-0.0981 (-1.44)	0.0213 (0.82)	0.0896*** (5.77)
<i>Regional fixed effect</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Time fixed effect</i>	Yes	Yes	Yes	Yes	Yes	Yes
ρ	-0.568*** (-10.81)	-0.379*** (-5.22)	-0.094** (-2.18)	-0.1449** (-2.29)	-0.1839** (1.98)	0.0127 (1.12)
R^2	0.650	0.311	0.503	0.358	0.658	0.257
<i>LogL</i>	-280.98	-171.817	-301.897	121.433	194.070	199.212
<i>N</i>	220	220	160	160	220	220

*, **, ***Show significant levels at 10%, 5%, and 1%.

Source: Author's estimations.

industrialisation stage, and the growth rate of fixed asset investment in the whole society has slowed down. China's economic development has changed from being factor-driven and investment-driven to being innovation-driven. On the basis of a certain economic development strategy, the regional industrial structure has been constantly adjusted and optimised so that both an emphasis on the economy and an emphasis on people's livelihood can be achieved.

In the central region, the quality of industrial structure adjustment significantly inhibited (-3.6300) economic catch-up, while the industrial structure adjustment significantly promoted (0.0351) economic catch-up. In the western region, the adjustment range and quality of the industrial structure significantly expanded the income gap between urban and rural areas (0.0021 and 0.1572) and significantly inhibited economic catch-up (-0.0829 and -0.8157). This can be interpreted in the following way. Different from the eastern region, the central and western regions have developed their economies mainly by adopting catching-up behaviours. With the transformation of China's economic development strategy from focussing on high-speed growth to focussing on high-quality development, the industries with high pollution and high energy consumption in the central and western regions have been eliminated and integrated, and the economic catch-up in these regions is bound to be

adversely affected by the adjustment of industrial structure in the process of keeping up with the national economic development strategy. However, regarding the income gap between urban and rural areas in the central and western regions, simple manual labour is gradually being replaced in the process of industrial restructuring or transformation and upgrading, while the employment opportunities of the vast majority of rural workers are still low level and mainly in the secondary industry. The improvement in the quality of industrial restructuring increases the need for high-skilled human capital, which leads to an increase in the unemployment rate of low-skilled workers. In the early stage of economic development, the income gap caused by the severe division of the urban and rural systems and unequal development opportunities cannot be quickly reversed, which inevitably leads to the continuous expansion of the income gap between urban and rural areas.

By estimating the interactive effect between economic catch-up and the urban-rural income gap in Table 5, it is found that in the eastern region, the widening of the urban-rural income gap and economic catch-up have significant mutual inhibition effects (-1.2838 and -0.0948). Through the spatial spill-over effect, it is found that economic catch-up in neighbouring regions has inhibited (-0.5134) economic catch-up and significantly expanded (0.1691) the urban-rural income gap in this region, and the urban-rural income gap in neighbouring regions is significant. A possible explanation is that the eastern region has a good economic foundation, a high degree

Table 5. Estimation of the simultaneous equation between regional economic catch-up and the urban-rural income gap.

Variables	East		Centre		West	
	Economic catch-up	Urban-rural income gap	Economic catch-up	Urban-rural income gap	Economic catch-up	Urban-rural income gap
<i>w*ecoup</i>	-0.5134*** (-4.60)	0.1691*** (2.83)	-0.3432*** (-3.98)	-0.0983 (-1.25)	-0.2599** (-2.60)	0.0169*** (3.07)
<i>w*thi</i>	1.282*** (2.86)	-0.1364** (-2.40)	-2.9091 (-1.10)	-0.1652** (-2.05)	2.4809*** (2.83)	-0.5643*** (-5.65)
<i>ecoup</i>		-0.0948*** (-4.45)		-0.0134*** (-3.16)		0.0111*** (4.46)
<i>thi</i>	-1.2838*** (-2.66)		-6.0977*** (-3.64)		8.0069*** (4.49)	
<i>urb</i>	-3.5274*** (-4.51)	-1.1983*** (-5.15)	-2.1460*** (-2.78)	-0.8235 (-5.01)	-8.3316 (-3.65)	-0.2538 (-2.98)
<i>gov</i>	-0.6755 (-1.48)	-0.9355** (-2.26)	-6.7447*** (-2.67)	0.1588 (1.38)	-11.9917*** (-3.85)	0.1824*** (3.02)
<i>ope</i>	0.5947** (2.05)	-0.0872 (-1.03)	4.1998*** (3.99)	-0.0303* (-1.61)	-1.3678*** (-2.64)	-0.0221 (-1.10)
<i>une</i>	0.7558 (0.98)	0.4929** (2.19)	7.2238*** (3.31)	0.7140*** (2.89)	-1.3324* (-1.69)	-0.3689*** (-5.32)
<i>edu</i>	-2.4020* (-1.69)	-1.1859 (-1.14)	-3.8735*** (-5.16)	-0.2140* (-1.63)	-3.1490 (-0.57)	0.2848 (1.35)
<i>roa</i>	-0.7713** (-2.17)	0.1033 (0.95)	9.6713*** (4.20)	0.5763*** (5.99)	4.8966*** (7.89)	-0.1724*** (-6.82)
<i>pgdp</i>	1.2700* (1.74)	1.0809*** (5.18)	0.3665 (1.14)	0.1152*** (2.87)	0.2518 (1.28)	0.0154 (1.45)
<i>poll</i>	-0.0449 (-1.32)	0.0820 (1.95)	1.1619 (-1.41)	-0.0158 (-0.71)	0.6613* (1.75)	0.0824*** (6.43)
<i>R</i> ²	0.545	0.305	0.823	0.452	0.963	0.687
<i>N</i>	220	220	160	160	220	220

*, **, ***Show significant levels at 10%, 5%, and 1%.

Source: Author's estimations.

of marketisation, diversified industrial development, many channels for farmers to increase their income, and a reasonable social welfare level and income distribution, such that economic development can complement the narrowing of the income gap. From the perspective of the spatial spill-over effect, the central region bordering the eastern region has developed rapidly in recent years and enjoyed good transportation infrastructure and a solid economic foundation, and its economic growth is at the forefront of the country, with no obvious shortcomings. The central region is in the transition from the early stage of industrialisation to the middle stage, with strong industrialisation momentum and high economic vitality, leading to the acceleration of the trend of economic catch-up.

As in the eastern region, the expansion of the urban-rural income gap and economic catch-up in the central region have significant mutual inhibition effects (-6.0977 and -0.0134), and the spatial spill-over effect shows that the urban-rural income gap in neighbouring regions significantly inhibits the expansion of the urban-rural income gap in this region (-0.1652). Different from developed regions, whose industrial structure is in the late stage of industrialisation, the central region is still in the middle or even early stage of industrialisation, with a low-level industrial structure, and is facing arduous and urgent economic development tasks. Different from the central and eastern regions, the economic catch-up and the urban-rural income gap in the western region are mutually promoting (0.0111 and 8.0069), and the spatial spill-over effect shows that the urban-rural income gap in neighbouring regions promotes (2.4809) local economic catch-up and reduces (-0.5643) the local urban-rural income gap, while the economic catch-up in neighbouring regions inhibits (-0.2599) the local economic catch-up. This article indicates that there is still a large gap between the economic development of the western region and that of the central and eastern regions. In the process of economic development, the income gap between urban and rural areas, the gap between rich and poor, the division of urban and rural systems and the unequal opportunities for development cannot be reversed in the short term. Although the economic catch-up behaviour in neighbouring areas can stimulate local economic development, it places the local economic development in a rising stage, leads to the absorption of a large amount of enterprise investment, promotes the employment of low-skilled workers, drives an increase in residents' income, and narrows the income gap between urban and rural residents. However, attracting a large number of migrants not only promotes economic growth in the destination regions but also leads to the loss of human capital and inhibits economic growth in the sending regions.

4.4. Robustness test

Considering that there may be some errors in the model setting and variable selection, which may affect the accuracy of the regression results, we choose to replace the Theil index (*thi*) with the urban-rural income ratio (*Dthi*) to further test the robustness of our findings regarding the relationship among industrial structure adjustment, regional economic catch-up and the income gap. In addition, we replace the economic catch-up variable with the difference between the government's economic growth target and the actual economic growth target (*Drat*) as the level of effort

Table 6. Robustness test.

Variables	SAR		GS3SLS	
	Drat	Dthi	Drat	Dthi
<i>w* Drat</i>			0.3716** (2.19)	0.2347*** (4.19)
<i>w* Dthi</i>			-0.2698*** (-4.10)	-0.0187** (-2.05)
<i>Drat</i>				-0.0110** (-2.16)
<i>Dthi</i>			-0.1068*** (-4.14)	
<i>adj</i>	-0.0106** (1.97)	0.0457** (2.34)		
<i>qua</i>	-0.2065* (-1.66)	0.0318** (2.09)		
<i>Control variables</i>	Yes	Yes	Yes	Yes
<i>District Controlled</i>	Yes	Yes	Yes	Yes
<i>Time controlled</i>	Yes	Yes	Yes	Yes
ρ	0.0737** (2.33)	0.5161** (2.11)		
R^2	0.315	0.532	0.447	0.753
<i>LogL</i>	-912.921	2157.278		
<i>N</i>	600	600	600	600

*, **, ***Show significant levels at 10%, 5%, and 1%.

Source: Author's estimations.

exerted for regional economic development. The smaller the Drat value is, the higher the level of regional economic effort, while larger values indicate lower levels of effort. The robustness test results are shown in Table 6.

The robustness test indicates that the significance and direction of the coefficient of the substitute variable (Drat) and the urban-rural income ratio (Dthi) of industrial structure adjustment for economic catch-up under the spatial autoregressive (SAR) model are slightly different from those in the above analysis, but this difference does not affect the interpretation of the above regression results. Under the spatial simultaneous equation, the interactive effect between Drat and Dthi is significant, and the result is consistent in terms of direction. Because of space limitations, the coefficients of the control variables are not listed.

5. Conclusion and recommendations

Based on the panel data of 30 provincial-level units in China from 2000 to 2019, this article analyses whether the adjustment of industrial structure and amplitude quality in China promotes economic catch-up or narrows the income gap between urban and rural areas. It investigates whether local economic development is purely 'economic', whether it mainly benefits 'people's livelihood', or whether economic development and people's livelihood can both benefit. The range of industrial structure adjustment promotes regional economic catch-up, while the quality of industrial structure adjustment inhibits regional economic catch-up, but both aspects widen the income gap between urban and rural areas. The simultaneous spatial equation of economic catch-up and the urban-rural income gap shows that economic catch-up and the narrowing of the urban-rural income gap promote each other. Second, the results at the regional level show that the adjustment of industrial structure in the eastern

region significantly promotes economic catch-up but inhibits the widening of the income gap between urban and rural areas. The adjustment range of the industrial structure in the central region promotes economic catch-up, but the quality of industrial structure adjustment inhibits economic catch-up. Both the adjustment range and quality of the industrial structure in the western region inhibit regional economic catch-up and simultaneously widen the income gap between urban and rural areas.

Based on the above analysis, this article draws the following policy implications:

First, because China's regions differ greatly economically, each region should formulate practical industrial development policies according to its current industrial development level to avoid the 'divorced from reality' behaviour of industrial development. Second, it is important to focus on economic development, making it benefit all residents, realising the synchronous growth of urban and rural residents' income, paying attention to the distribution of resources from the regional, industrial and urban-rural perspectives in the process of economic development, strengthening the government's regulatory role in income distribution, paying attention to the fairness of the implementation of the redistribution system, and preventing the further widening of the income gap and the related social problems. Third, regions' strategy for catching up and surpassing other regions economically should be changed from favouring the race to the bottom to emphasizing the race to the top. Especially in the current high-quality development stage of China's economy, the low-value-added industries brought by the race to the bottom have low technological content and low human capital, and the resulting industrial structure will be low-level and low value-added and lead to the expulsion of high-level industries. In this way, a vicious circle will be formed, and high-level human capital will have no room to play its role.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. The National Bureau of Statistics divides China's economic belt into eastern, central, western and northeast regions, and it is of little significance to separate the northeast region. This paper divides China's economic belt into three major economic belts: central, eastern and western. The eastern region includes 11 provinces (municipalities): Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan. The central region includes Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan Provinces. The western region includes 11 provinces (autonomous regions and municipalities directly under the Central Government): Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.

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