Relationship between Transport Infrastructure and Employment: Evidence from the Chinese Inland Provinces under the "One Belt, One Road" Initiative

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https://riiopenjournals.com/index.php/business-perspective-review/index

Doi: https://doi.org/10.38157/business-perspective-review.v2i1.103

Citation: Li, J.H., Rim, G.N. & An, C.J. (2020). Relationship between Transport Infrastructure and Employment: Evidence from the Chinese Inland Provinces under the "One Belt, One Road" Initiative. *Business Perspective Review*, 2(1), 13-28. Doi: https://doi.org/10.38157/business-perspective-review.v2i1.103

Research Article

Abstract

Purpose: *This paper discusses the impact of transport infrastructure on employment in the Chinese inland provinces directly affecting by "One Belt, One Road" initiative.*
Methods: *The authors analyzed the impact of railways and highways- two key elements of transport infrastructure on employment in five Chinese inland provinces directly affected by the "One Belt, One Road" initiative. The data was collected from the National Bureau of Statistics of China and some databases related to "One Belt, One Road" for the period of 2008-2017. Descriptive statistics and graphic presentation approaches were used to analyze the data.*
Results: *The findings show that there are unclear relationships between transport infrastructure and employment in the inland provinces under study as affected by the "One Belt, One Road".*
Implications: *Improvement of transport infrastructure as well as other relevant factors in creating jobs should be considered for generating employment in the provinces under study.*

Keywords: Transport Infrastructure, Employment, 'One Belt, One Road' (OBOR), China

1. Introduction

"One Belt, One Road" (Hereafter, OBOR) initiative is the most important line for foreign policy in China. In September and October 2013, China's President Xi Jinping proposed the initiative for construction of the "Silk Road Economic Belt" and the "Twenty-First-Century Maritime Silk Road" during his visits to Kazakhstan and Indonesia respectively, which is officially referred to as the "One Belt, One Road" (OBOR) initiative (Cheng, 2016; Huang, 2016). What is important in "One Belt, One Road" (OBOR) initiative proposed by China is the Land Road "Silk Road Economic Belt."

The OBOR initiative will contribute in creating jobs in China and concerned countries (National Development and Reform Commission, et al. 2015a). The key element in OBOR initiative is the infrastructural connectivity, and transport infrastructure such as railways, roads, ports, and airports will be a particular focus (Haggai, 2016). These infrastructural elements will stimulate the economic growth in China and affect most of the Chinese provinces. Furthermore, some of the Chinese provinces will be directly affected by the initiative, since the New Silk Road will go through the provinces. In this context, it is required to consider how the transport infrastructure (TI) will affect employment in the Chinese inland provinces directly affected by the initiative. In fact, employment is the indicator reflecting the socio-economic situation and the important factor that affects the people's income and consumption in a given region. Until now, only a few studies on impact of investment in TI on employment have been done. The result of such studies are mixed as follows; (a) TI has a positive impact on employment (For example, Munnell & Cook, 1990; Dalenberg et al. 1998; Clark & Murphy, 1996), (b) TI has not significant impact on employment (For example, Fageda & Gonzalez-Aregall, 2017), (c) TI has positive impact in short- and medium-run but not in long-run (For example, Demetriades & Mamuneas, 2000), and (d) TI has negative impact on employment in some aspects (For example, Cohen & Paul, 2004). Many scholars have conducted in-depth studies of impact of TI on employment considering many factors. However, in fact, they do not consider the features of certain regions in their studies. They simply consider the general trend of TI's impact on employment.

Certain country or region has its own features in economic development, which affect employment. Such situation ought to be considered in studying the TI's impact on employment. In particular, how TI contributes to employment under OBOR initiative is one of the interesting issues in China, and thus, studies on relationship between TI and employment have certain significances in management of infrastructural investment under OBOR initiative. From the limitations of previous studies the paper aims to analyze the impact of specific elements of TI on employment in the Chinese inland provinces directly affected by OBOR initiative. Based on research purpose, our paper is organized as follows. In first section, authors discuss the successes of previous studies which analyzed the impact of infrastructure on employment. Second section analyzes the relationship between TI and employment using the data from 2008 to 2017. The rest of the paper discusses the results, discussions, and conclusion.

2. Previous study on impact of infrastructure on employment

In the past, several scholars studied the impact of infrastructural investment on employment based on premise that infrastructure and employment are correlated. Previous researchers demonstrated the effects of infrastructure, in particular, TI on employment in different regions and countries using long-term time series data. According to research results, the directions of impact of TI on employment are largely divided into three; positive, zero, and negative. Among them, mainstream is positive. For example, Munnell & Cook (1990) say that deteriorating infrastructure will lead to real job losses throughout the economy. Duffy-Deno & Dalenberg (1993) find that holding all other factors constant, the effect of a 10 per cent greater level of per capita public capital stock is a 0.6 and 12.9 per cent higher demand for and supply of municipal workers in the short run using a sample of 48 large US cities during the 1970-80 period. Dalenberg et al. (1998) find that state specific road construction is positively correlated with employment increase through research of relation between public capital and state specific employment increase using data from 1972 to 1991 of 48 states in US. Duranton & Turner (2012) estimate the effects of major roads and public transit on the growth of major cities in the US between 1980 and 2000 and find that a 10% increase in a city's stock of roads causes about a 2% increase in its population and employment. Bottaso et al. (2013) find that port traffic promotes the increase of regional employment (including the service and manufacturing sectors) using the samples of 550 regions in 10 European countries. Clark & Murphy (1996) demonstrated the positive and significant role of highways on employment increase, and Ferrai et al. (2010) found positive impact of port on regional employment. Brueckner (2003) found the significant casual relation between airline traffic and employment in service related industries but not in goods related industries. Blonigen & Cristea (2012) demonstrated that airline traffic had significant impact on employment in wholesale and retail industries considering the impact of airline traffic on employment in US urban regions. Percoco (2010) mentioned the positive special spillovers of airline traffic on employment for Italian airports. Albalate & Fageda (2014) find that the density of motorways and the number of air services promote employment growth by drawing on a sample of 182 European regions for the period 2002-2010 and implementing a dynamic panel-data estimator.

In contrary, some scholars mention the zero impact of TI on employment. For example, Fageda & Gonzalez-Aregall (2017) found that airline and railway had no correlations with industrial employment increase by studying the total, direct, and indirect impacts of given Spanish transport way on industrial employment increase over 1995-2008. Others argue the negative impact of TI on employment. For example, Cohen & Paul (2004) recognize that TI can increase the labor productivity, and thus, decrease the demand for labor force because there exists the confront relation between road infrastructure and labor power according to US states. Jiwattanakulpaisarn et al. (2009) found that state specific road expansion could hinder the employment in manufacturing sectors using data of 48 US states. In some studies, the positive impact of TI on employment in some aspects and negative impact in other aspects were discussed. For example, Demetriades and Mamuneas (2000) studied the efficiency of public infrastructural capital using data of 12 OECD countries over 1972-1991 period and found that long-run impact of public infrastructural capital is smaller than medium or short-run impact. Discussing the impact of TI on economic growth, some scholars analyzed its effect in correlation with unemployment and other factors. Ylander (2017) conducted the regression analysis using various variables such as railways, highways, unemployment rate, labor productivity, and so on affecting the Gross Regional Products in order to demonstrate that OBOR and its infrastructural projects

affect the regional economic growth in China. In China, too, several scholars discussed the casual relation between TI and employment.
As seen from analysis of previous studies, TI has diverse influences on employment in several aspects. However, in general, previous studies focus on causal relation between TI investment and employment in whole country or individual industry. Chinese provinces have their own features in economic development due to diverse socio-economic factors, and these ought to be considered in studying the impact of TI on employment. In other words, either TI has positive impact on employment or not according to provinces. It is our view that various factors are affecting the employment due to features of economic development in individual provinces, and thus, increase in employment does not entirely depend on individual TI. This paper focuses on analyzing the impact of infrastructural elements under OBOR initiative on regional employment, and thus, discusses the influences of TI on province's employment in the Chinese provinces directly affected by OBOR initiative.

3. Material and Methods

3.1. Collection of Data

The OBOR will have a direct effect on five Chinese inland provinces since the route will go through these provinces (National Development and Reform Commission, et al. 2015b). The Provinces include Shaanxi, Gansu, Ningxia Autonomous Region (Hereafter, Ningxia), Qinghai, and Xinjiang Uygur Autonomous Region (Hereafter, Xinjiang). Therefore, we conduct the analysis based on data from 2008 to 2017 for five Chinese inland provinces. Data are from the National Bureau of Statistics of China and various databases. Important elements of TI under study are railways and highways. Furthermore, we use relative values not absolute values regarding TI such as railways and highways in order to ensure the comparability among provinces under study.
This study aims to investigate the relationship between development level of TI and employment in Chinese inland provinces, and thus, it ensures the comparability among provinces which is of much significance. In general, previous studies did not consider region specific features from purpose of studying the whole TI, and thus, they did not bring forward the issue of ensuring the comparability among provinces. This led to wrong conclusion that the larger the absolute value of individual TI is, the higher the development level of certain region is. This means that the magnitude of provinces under study should be considered in analysis in order to ensure the comparability. From this, we will use indicators such as density of railways (㎞/1000 ㎢) and density of highways (㎞/1000 ㎢) as they reflect TI's development level. Given that province-wide employment rate in China is not revealed, we use the employment rate in urban units according to inland provinces, which is calculated based on number of sampling population and number of age-specific population collected in sample survey, and number of employed in urban units. And we assume population at working age as population in 15-64 years age bracket. On these assumption, formulating the process of calculating the urban employment rate is as follows:

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$$\frac{\text{Number of population aged 15−64(by sample survey)}}{\text{Number of population of sample}} = \text{ratio of population at working age (\%)} \times$$

$$\text{number of urban population} = \text{number of persons at working age in urban units} \quad (1)$$

$$\text{Employment rate in urban units (\%)} = \frac{\text{Number of employed in urban units}}{\text{Number of persons at working age in urban units}} \times 100 \quad (2)$$

Primary data to make above calculations are collected from National Bureau of Statistics of China. Authors collected the data regarding number of population by sample survey (person), number of population at age interval of 15-64 by sample survey, number of urban population (10 000 persons), number of employed in urban units (10 000 persons), length of railways in operation, and length of highways for five Chinese inland provinces directly affecting by OBOR as follows (See Table 1).

Table 1. Province- and year- specific number of population

Province	Indicator	Year									
		2008	2009	2010[e]	2011	2012	2013	2014	2015	2016	2017
Shaanxi	Population aged 15-64 (person)[a]	25147	24884	24884	24457	24007	23324	23204	439664	23826	23190
	Population (Sample, person)	33999	33504	33504	31976	31315	31063	31155	589346	32014	31649
	Urban population (10 000 persons)	1565	1621	1709	1770	1877	1931	1985	2045	2110	2178
	Number of employed in urban units (10 000 persons)[b]	344.39	352.39	364.8	393.7	411.22	505.33	516.52	511.84	511.39	510.39
	Length of railways in operation (㎞)[c]	3200	3300	4100	4100	4100	4400	4500	4500	4600	5000
	Length of highways (㎞)	131000	144100	147500	152000	161400	165200	167100	170100	172500	174400
	Area (1000 ㎢)[d]										205.6
Gansu	Population aged 15-64 (person)	16902	17033	17033	16260	15960	15813	15970	29772	16049	15666
	Population (Sample, person)	23739	23405	23405	21908	21507	21311	21381	404863	21960	21720
	Urban population (10 000 persons)	856	891	925	953	999	1036	1080	1123	1166	1218
	Number of employed in urban units (10 000 persons)[b]	192.55	192.98	194.3	199.29	211.33	256.65	264.74	261.76	260.96	259.22
	Length of railways in operation (㎞)[c]	2400	2400	2400	2400	2500	2600	3400	3800	4100	4700
	Length of highways (㎞)	105600	114000	118900	123700	131200	133600	138100	140100	143000	142300
	Area (1000 ㎢)[d]										425.8
Qinghai	Population aged 15-64 (person)	3576	3554	3554	3568	4361	3479	3592	66728	3643	3559
	Population (Sample, person)	5007	4934	4934	4854	4782	4769	4814	91611	4987	4939

	Urban population (10 000 persons)	226	234	252	263	272	280	290	296	306	317
	Number of employed in urban units (10 000 persons)	47.02	50.63	52.6	60.59	61.69	64.19	63.19	62.71	63.09	63.35
	Length of railways in operation (㎞)	1700	1700	1900	1900	1900	1900	2100	2300	2300	2300
	Length of highways (㎞)	56600	60100	62200	64300	66000	70100	72700	75600	78600	80900
	Area (1000 ㎢)										722.3
Ningxia	Population aged 15-64 (person)	3909	3953	3953	4021	3888	3924	4012	75315	4140	4117
	Population (Sample, person)	5533	5504	5504	5463	5400	5399	5460	103820	5666	5627
	Urban population (10 000 persons)	278	288	303	319	328	340	355	369	380	395
	Number of employed in urban units (10 000 persons)	57.13	58.1	59.3	60.85	67.42	72.18	73.25	73.12	70.69	71.14
	Length of railways in operation (㎞)	800	900	1200	1300	1300	1300	1300	1300	1300	1400
	Length of highways (㎞)	2100	21800	22500	24500	26500	28600	31300	33200	33900	34600
	Area (1000 ㎢)										66.4
Xinjiang	Population aged 15-64 (person)	13660	13690	13690	13860	13546	13605	13657	261207	14165	14114
	Population (Sample, person)	19004	18979	18979	18871	18630	18688	18969	367631	20165	20210
	Urban population (10 000 persons)	845	860	940	962	982	1007	1059	1115	1159	1207
	Number of employed in urban units (10 000 persons)	248.17	249.42	255	279.38	288.77	309.51	316.65	317.25	320.48	335.01
	Length of railways in operation (㎞)	2800	3700	4200	4300	4700	4700	5500	5900	5900	5900
	Length of highways (㎞)	146700	1507	152800	155200	165900	170200	175500	178300	182100	185300
	Area (1000 ㎢)										1660

Source: National Bureau of Statistics of China (2019)

Note: [a] Population data of 2005 are estimates from the national 1% population sample survey. And data of other years are 1% national sample survey on population change.

[b] Data of employed persons in urban units do not include those of private enterprises.

[c] Length of Railways in Operation refers to the total length of the trunk line for passenger and freight transportation in full operation or temporary operation calculated the actual length of the period between two stations. Any full or partial lane and above lines, in calculated in the actual length of the first line; tracks, station lines, segments, branch lines and special purpose lines and does not calculate shipping connecting lines of business mileage.
[d] From http://baike.baidu.com
[e] Assumed by 2009 year data due to missing sampling data.

These primary data can serve as basis for calculating the indicators to ensure the comparability among provinces in our study.

3.2. Processing of data and graphic description

In order to analyze the relationship between physical elements of TI and employment, we calculate the proportion of population at working age, rate of urban employment, and densities of railways and highways according to provinces and years based on formulas (1) and (2), and put these processed data into graphs. Table 2 calculates the proportion of population at working age in provinces under study

Table 2. Province- and year-specific proportion of population at working age (%)

Year	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
2008	0.7396394	0.7119929	0.7142001	0.7064883	0.718796
2009	0.7427173	0.7277505	0.7203081	0.7182049	0.7213236
2010	0.7427173	0.7277505	0.7203081	0.7182049	0.7213236
2011	0.7648549	0.7421946	0.7350639	0.7360425	0.7344603
2012	0.7666294	0.742084	0.9119615	0.72	0.7271068
2013	0.7508612	0.7420112	0.729503	0.7268013	0.7280073
2014	0.7447922	0.7469248	0.746157	0.7347985	0.7199642
2015	0.7460202	0.7353747	0.7283841	0.7254383	0.7105141
2016	0.7442369	0.7308288	0.7304993	0.7306742	0.7024547
2017	0.7327246	0.7212707	0.7205912	0.731651	0.6983671
Total	7.4751932	7.3281827	7.4569764	7.2483039	7.1823177
Average	0.7475193	0.7328183	0.7456976	0.7248304	0.7182318

Source: Own calculation

As seen above, we can find that there exist a little differences in proportion of population at working age among provinces. Among 5 inland provinces, Shaanxi has the highest proportion (on average, 0.7475). Describing these data with graph, we can show above situations more clearly (Fig 1).

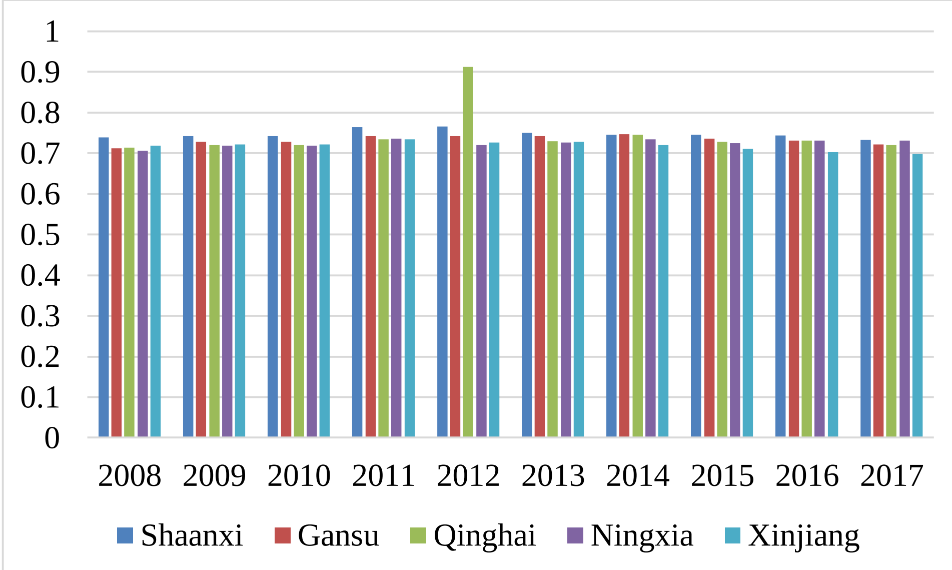

Fig 1. Proportion of population at working age according to provinces (%)

From fig 1, we can find that although there exist a little differences according to provinces, Qinghai has the highest proportion in 2012. Table 3 calculates province- and year-specific employment rate in urban units

Table 3. Province- and year-specific employment rate in urban units (%)

Year	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
2008	29.751999	31.593234	29.130924	29.088038	40.858921
2009	29.269616	29.761314	30.038192	28.088934	40.207095
2010	28.740163	28.863472	28.977901	27.249822	37.60817
2011	29.081252	28.175705	31.341525	25.915944	39.541389
2012	28.577516	28.506416	24.869632	28.548442	40.442907
2013	34.852439	33.386514	31.425503	29.209377	42.219151
2014	34.937476	32.818514	29.202506	28.080898	41.531026
2015	33.549832	31.696759	29.086041	27.315513	40.045533
2016	32.565562	30.623847	28.224048	25.459544	39.363993
2017	31.981846	29.506855	27.733099	24.615735	39.743554
Total	313.3077	304.93263	290.02937	273.57225	401.56174
Average	31.33077	30.493263	29.002937	27.357225	40.156174

Source: Own calculation

Here we find that employment rate in urban units is relatively lower than proportion of population at working age according to provinces. Among 5 provinces, Xinjiang is the highest (on average, 40.156174), other provinces have a little differences. Figure 2 shows the calculation in graphs.

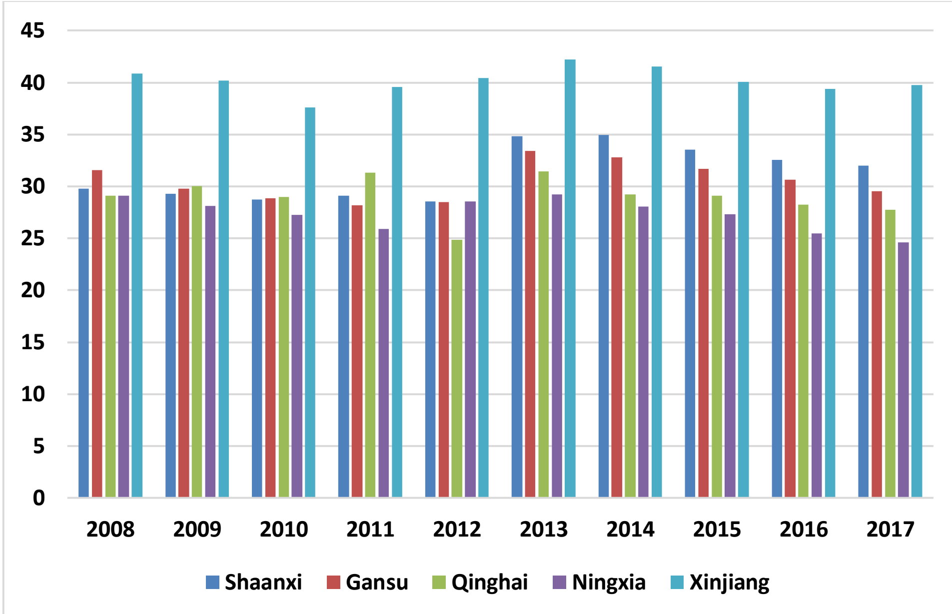

Fig 2. Province- and year-specific employment rate in urban units (%)

As seen from fig 2, Xinjiang has relatively higher employment rate in urban units, and is followed by Shaanxi. Ningxia has the lowest. Table 4 shows the calculation of the province- and year-specific density of railways (See Table 4).

Table 4. Province- and year-specific density of railways (㎞/1 000 ㎢)

Year	Shaanxi	Ningxia	Gansu	Xinjiang	Qinghai
2008	15.564202	12.048193	5.636449	1.686747	2.3535927
2009	16.050584	13.554217	5.636449	2.2289157	2.3535927
2010	19.941634	18.072289	5.636449	2.5301205	2.6304859
2011	19.941634	19.578313	5.636449	2.5903614	2.6304859
2012	19.941634	19.578313	5.8713011	2.8313253	2.6304859
2013	21.400778	19.578313	6.1061531	2.8313253	2.6304859
2014	21.88716	19.578313	7.9849695	3.313253	2.9073792
2015	21.88716	19.578313	8.9243776	3.5542169	3.1842725
2016	22.373541	19.578313	9.6289338	3.5542169	3.1842725
2017	24.319066	21.084337	11.038046	3.5542169	3.1842725
Total	203.30739	182.22892	72.099577	28.674699	27.689326
Average	20.330739	18.222892	7.2099577	2.8674699	2.7689326

Source: Own calculation

As seen above, Shaanxi has the highest density of railways, followed by Ningxia. Figure 3 exhibits the graphical presentation of the data.

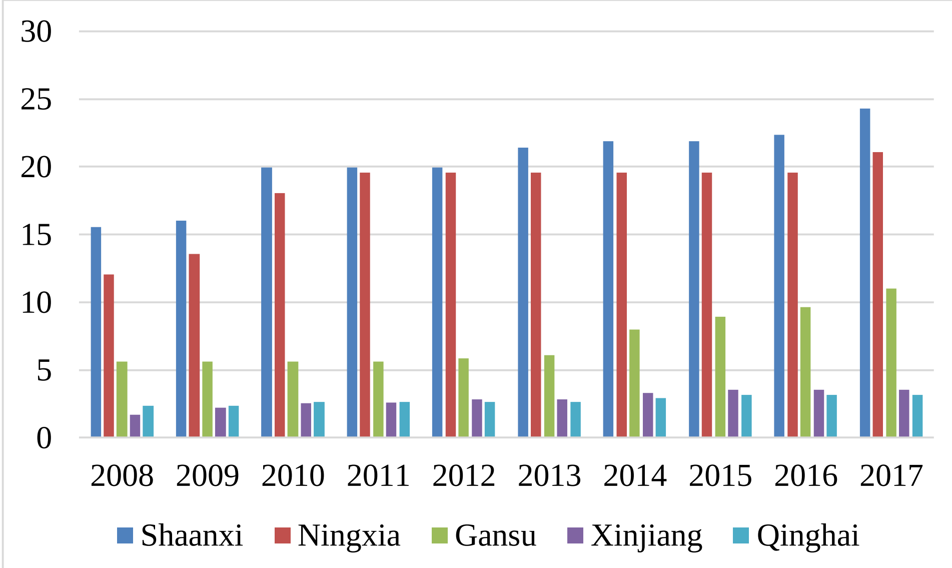

Fig 3. Province- and year-specific density of railways (㎞/1 000 ㎢)

Source: Own Calculation

As seen from fig 3. Shaanxi has the highest density of railways, and is followed by Ningxia. Xinjiang and Qinghai have the lowest density. It also shows that the density of railways increased gradually in all provinces. Table 5 depicts the province- and year-specific density of highways

Table 5.Province- and year-specific density of highways (㎞/1000 ㎢)

Year	Shaanxi	Ningxia	Gansu	Xinjiang	Qinghai
2008	637.15953	316.26506	248.00376	88.373494	78.360792
2009	700.87549	328.31325	267.73133	90.783133	83.206424
2010	717.41245	338.85542	279.23908	92.048193	86.113803
2011	739.29961	368.9759	290.51198	93.493976	89.021182
2012	785.01946	399.09639	308.12588	99.939759	9.1374775
2013	803.50195	430.72289	313.76233	102.53012	97.051087
2014	812.74319	471.38554	324.33067	105.72289	100.6507
2015	827.33463	500	329.02771	107.40964	104.66565
2016	839.00778	510.54217	335.83842	109.6988	108.81905
2017	848.24903	521.08434	334.19446	111.62651	112.00332
Total	7710.6031	4185.241	3030.7656	1001.6265	869.02949
Average	771.06031	418.5241	303.07656	100.16265	86.902949

Source: Own calculation

While Shaanxi has the highest density of highways, Qinghai and Xinjiang have the lowest. Figure 4 provides a graphical view of the calculations.

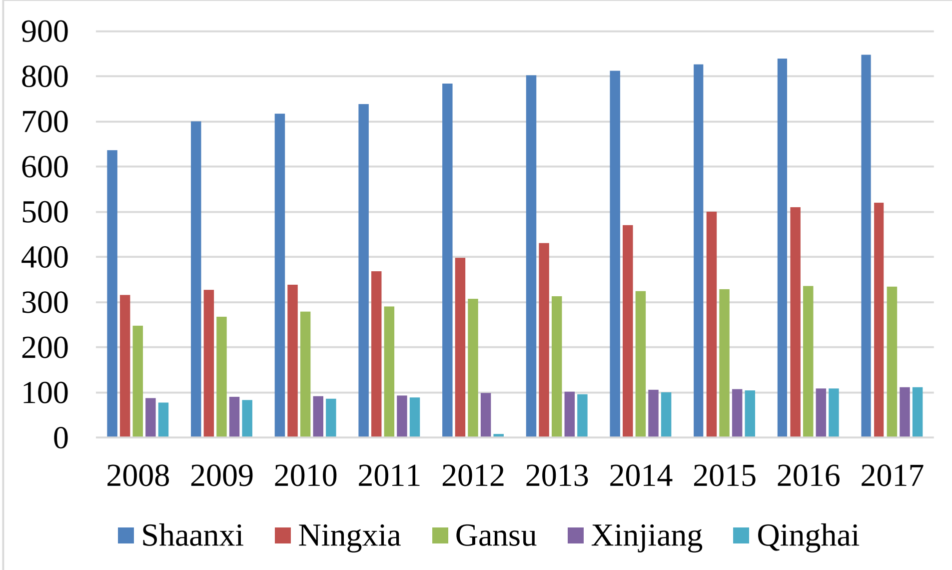

Fig 4. Province- and year-specific density of highways (㎞/1000 ㎢)
Source: Own calculation

On graph, we find that density of highways increases over time in all provinces, and among them, growth rate of Ningxia is the highest.
Above calculation shows the highest or lowest province according to indicators, slowdown in growth of employment rate in urban units, and gradual increase of densities of railways and highways. In other words, TI's development level has been increasing in all provinces over period of 2008-2017. However, this only shows the differences in employment rate and TI's development level among provinces, and thus, it is difficult to analyze the relationships between three indicators with these results. Therefore, it is rational to calculate certain summary statistics such as average and to compare one another in order to facilitate the comparison.

3.3. Calculation of Statistical Indicators

From earlier discussions, we could consider the dynamics of three indicators in order to analyze the relationships. This makes it possible to compare three indicators in relation to one another.
For comparison, we calculate average values regarding the absolute values of every indicators, and put these values into graph as follows (See Table 6 and Fig 5).

Table 6. Average values of three indicators according to provinces

Indicator	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
Employment rate (%)	31.33077	30.493263	29.002937	27.357225	40.156174
Density of railways (㎞/1000 ㎢)	20.330739	7.2099577	2.7689326	18.222892	2.8674699
Density of highways (㎞/1000 ㎢)	771.06031	303.07656	86.902949	418.5241	100.16265

Source: Own calculation

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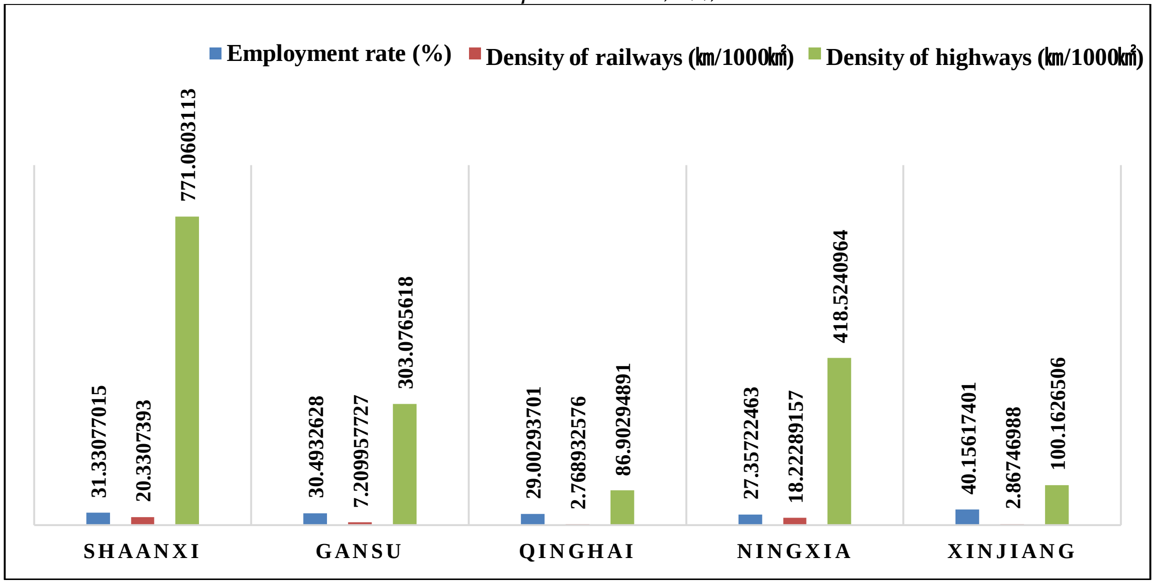

Fig 5. Comparison of average values of three indicators according to provinces

It is seen that figure 5 represents the differences between indicators according to provinces and their relations intuitively. In other words, while Shaanxi is the highest, Qinghai is the lowest regarding the development level of highways. Qinghai and Xinjiang are the lowest in the development level of railways. This indicates the features of natural and geographic conditions in given provinces. However, Xinjiang has the highest employment rate.

4. Results and discussions

Results calculated above are significant in showing the representative level of indicators. However, they do not indicate the systematic changes. Considering the indicators in movement, we could analyze the impact of TI on employment. For this, we may calculate the change rates of above indicators as follows (See Tables 7, 8, 9. and 10).

Table 7. Movement of employment rate in urban units (% growth rate to previous year)

Year	Shaanxi	Growth rate (%)	Gansu	Growth rate (%)	Qinghai	Growth rate (%)	Ningxia	Growth rate (%)	Xinjiang	Growth rate (%)
2008	29.751999		31.593234		29.130924		29.088038		40.858921	
2009	29.269616	0.9837865	29.761314	0.9420154	30.038192	1.0311445	28.088934	0.96565	40.207095	0.9840469
2010	28.740163	0.9819112	28.863472	0.9698319	28.977901	0.9647019	27.249822	0.97012	37.60817	0.9353615
2011	29.081252	1.011868	28.175705	0.9761717	31.341525	1.0815664	25.915944	0.95105	39.541389	1.0514042
2012	28.577516	0.9826783	28.506416	1.0117374	24.869632	0.7935042	28.548442	1.10157	40.442907	1.0227994
2013	34.852439	1.2195755	33.386514	1.171193	31.425503	1.2636095	29.209377	1.02315	42.219151	1.0439198
2014	34.937476	1.0024399	32.818514	0.9829871	29.202506	0.9292614	28.080898	0.96136	41.531026	0.9837011
2015	33.549832	0.9602821	31.696759	0.9658194	29.086041	0.9960118	27.315513	0.97274	40.045533	0.9642317
2016	32.565562	0.9706625	30.623847	0.9661508	28.224048	0.970364	25.459544	0.93205	39.363993	0.9829809
2017	31.981846	0.9820757	29.506855	0.9635254	27.733099	0.9826053	24.615735	0.96685	39.743554	1.0096423
Average (%)		1.0105866		0.9943814		1.0014188		0.98273		0.9975653

Source: Own calculation

Table 8. Movement of density of railways (% growth rate to previous year)

Year	Shaanxi		Gansu		Qinghai		Ningxia		Xinjiang	
2008	15.5642		5.6364		2.35359		12.0481		1.68674	
2009	16.0505	1.03125	5.6364	1	2.35359	1	13.5542	1.125	2.22891	1.32142
2010	19.9416	1.24242	5.6364	1	2.63048	1.1176471	18.0722	1.33333	2.53012	1.13513
2011	19.9416	1	5.6364	1	2.63048	1	19.5783	1.08333	2.59036	1.02380
2012	19.9416	1	5.87130	1.04166	2.63048	1	19.5783	1	2.83132	1.09302
2013	21.4007	1.07317	6.10615	1.04	2.63048	1	19.5783	1	2.83132	1
2014	21.8871	1.02272	7.98496	1.30769	2.90737	1.1052632	19.5783	1	3.31325	1.17021
2015	21.8871	1	8.92437	1.11764	3.18427	1.0952381	19.5783	1	3.55421	1.07272
2016	22.3735	1.02222	9.62893	1.07894	3.18427	1	19.5783	1	3.55421	1
2017	24.3190	1.08695	11.0380	1.14634	3.18427	1	21.0843	1.07692	3.55421	1
Average (%)		1.0531946		1.0813661		1.0353498		1.0687322		1.09070

Source: Own calculation

Table 9. Movement of density of highways (% growth rate to previous year)

Year	Shaanxi	Growth rate (%)	Gansu	Growth rate (%)	Qinghai	Growth rate (%)	Ningxia	Growth rate (%)	Xinjiang	Growth rate (%)
2008	637.159		248.003		78.36072		316.26506		88.373494	
2009	700.875	1.1	267.731	1.07954	83.2064	1.0618375	328.31325	1.0380952	90.783133	1.0272665
2010	717.412	1.02359	279.239	1.04298	86.1138	1.0349418	338.85542	1.0321101	92.048193	1.013935
2011	739.299	1.03050	290.511	1.04037	89.0211	1.0337621	368.9759	1.0888889	93.493976	1.0157068
2012	785.019	1.06184	308.125	1.06063	91.3747	1.0264386	399.09639	1.0816327	99.939759	1.0689433
2013	803.501	1.02354	313.762	1.01829	97.0510	1.0621212	430.72289	1.0792453	102.53012	1.0259192
2014	812.743	1.01150	324.330	1.03368	100.650	1.0370899	471.38554	1.0944056	105.72289	1.0311398
2015	827.334	1.01795	329.027	1.01448	104.665	1.03989	500	1.0607029	107.40964	1.0159544
2016	839.007	1.01410	335.838	1.02069	108.819	1.0396825	510.54217	1.0210843	109.6988	1.0213124
2017	848.249	1.01101	334.194	0.99510	112.003	1.0292621	521.08434	1.020649	111.62651	1.0175728
Average (%)		1.03267		1.03397		1.0405584		1.0574238		1.0264167

Source: Own calculation

Table 10. Comparison of growths of three indicators

Indicator	**Shaanxi**	**Gansu**	**Qinghai**	**Ningxia**	**Xinjiang**
Average employment growth rate (%)	1.010587	0.994381	1.001419	0.982731	0.997565
Average density of railways growth rate (%)	1.053195	1.081366	1.03535	1.068732	1.090704
Average density of highways growth rate (%)	1.032674	1.033977	1.040558	1.057424	1.026417

Source: Own calculation

Putting these data into graph is described as follows (Fig 6).

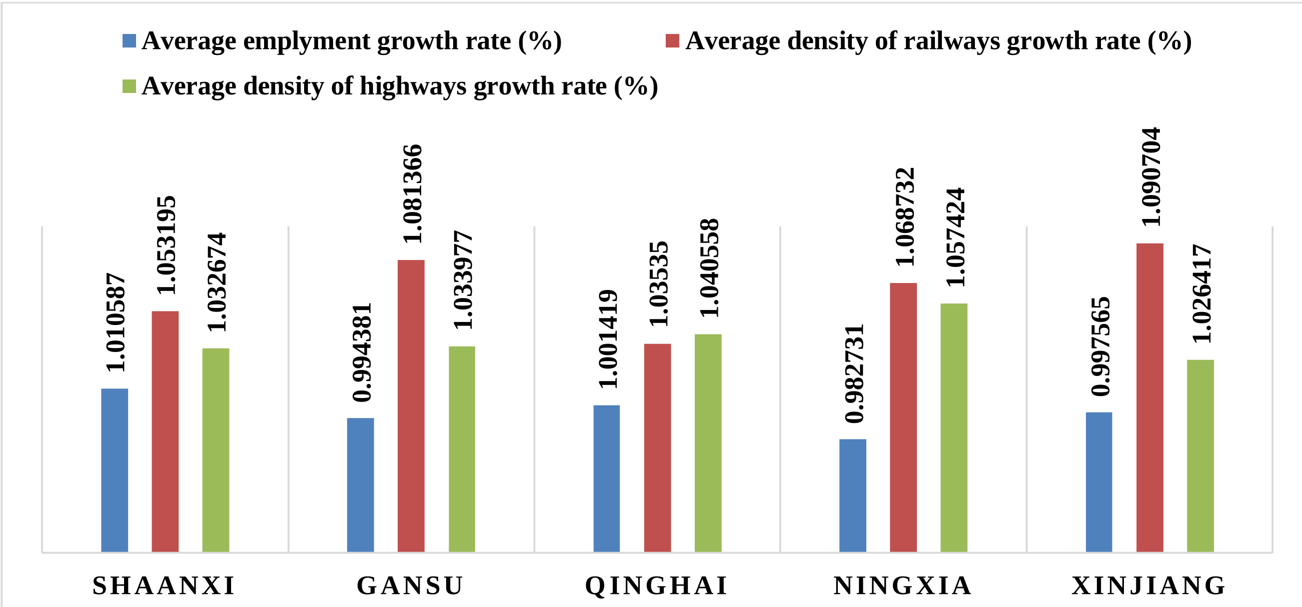

Fig 6. Comparison of average growth rates of three indicators.

Source: Own calculation

Above figure gives the intuitive description on relation between employment and TI's elements with differences in growth rates of three indicators. As seen in figure 6, Shaanxi has the highest average growth rate of employment among the provinces. In other words, as seen earlier, while Xinjiang is the highest in average employment rate, Shaanxi is highest in average growth rate and Ningxia is the lowest in average growth rate of employment. While Xinjiang is the highest in average growth rate of density of railways, Ningxia is the lowest in this indicator. This means that investment in railways increased gradually over past 10 years. Xinjiang is the lowest in density of highways as well as its average growth rate. These facts prove that while in some provinces average growth rate of employment rate depends on those of TI, in other provinces growth of employment rate does not depend on growth rate of TI. This demonstrates that different relationships between three indicators emerge in every provinces.

5. Conclusion

This study calculated the indicators such as employment rate in urban units, density of railways, and density of highways and considered the interrelations of these indicators in order to reveal the relation between employment rate and TI's elements. For this, we illustrated the relevance of data processing for the purpose of ensuring comparability among provinces, calculated the employment rate in urban units, density of railways, and density of highways of provinces under study based on data from National Bureau of Statistics of China, and analyzed the relationships between them in terms of statistical indicators. What is important in these procedures is the calculation of averages and graphic description based on them. Analysis by average values of

 Published by *Research & Innovation Initiative*, 3112 Jarvis Ave, Warren, MI 48091, USA

indicators is significant in presenting the differences according to provinces, but has limitations in analyzing the relationships among them. From this, we calculated the average growth rates of three indicators and compared. We observed that Shaanxi and Qinghai are similar in average growth rates of three indicators, and this shows that growth of TI affects growth of employment rate in urban units. On the other hand, Xinjiang and Gansu have the largest differences in average growth rates of employment rate and the elements of TI. For example, Xinjiang is the lower in average growth rate of individual TI elements, but province's growth of employment rate is the highest than that of other provinces. This means that TI does not have significant impact on employment. There are also other factors that affect employment. Such analysis of relationship between employment and TI's elements based on calculation of statistical indicators implies that in order to ensure purposeful employment in provinces under study, OBOR investment in TI should be conducted duly.

Author Contributions: Jin-Hui Li conceived the idea and collected data; Gwang-Nam Rim analyzed the data; Chol-Ju An wrote the paper.

Conflict of interest: The authors declare no conflict of interest.

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