The Empirical Study of House-price Fluctuations on the Impact of Total Factor Productivity of Manufacturing in China—Based on the Perspective of Misallocation of Resources

Ai-dong WU and Meng-jie Qi
The School of Economic, Tianjin University of Commerce, Tianjin, China
*Corresponding author

Keywords: Price of real estate, Manufacturing, Total factor productivity, Misallocation of resource.

Abstract. The paper establishes theoretical and empirical model that measured and analyzed the impact of distortions of factor price, caused by irrational prosperity of China’s real estate, on misallocation of capital, labor and distortion of overall TFP in manufacturing enterprises during the periods of 2007 to 2016. The main conclusions obtained are at followings: 1) Manufacturing enterprises had significant and varying degree of distortions of capital, labor and overall TFP on three levels of national overall, different regions and ownership systems; 2) Rising real estate prices could obviously cause misallocation of resources and reduce the growth rate of TFP in manufacturing; 3) If the misallocation of resources were eliminated, the TFP would receive a highly increase of 20%-30%. The degree of influence of the virtual economy on the real economy is exactly what China and the countries with related problems need to study in depth. This study will make up the gaps in this research.

Introduction

In 1998, with the acceleration of housing system reform in China (In July 1998, the State Council of the People’s Republic of China issued the Notice on Further Deepening the Reform of Housing Institutions in the Cities to Accelerate Housing Construction. This document removed the welfare housing allocation system, and since then has promoted the development of the real estate industry and gradually became an important pillar industry in China.), the stock of real estate market was fully released; meanwhile, the pace of increment was also accelerated on the increase. The status of real estate in the China’s national economy has become increasingly prominent, and it has continuously become one of mainstay industries to support China’s economy. However, the momentum of real estate development has exceeded the expectations of both government and scholars of China in recent years, mainly because of the excessive rise of real estate prices in China. In 2007, the average selling price of commercial housing in China was 3864 Yuan per square meter, which increased by 7476 Yuan per square meter in 2016, and average sales price of commercial housing in China rose nearly one time during ten years (The data here comes from China Real Estate Statistical Yearbook (2017)). Compared with the entire country, some cities’ selling price of commercial housing has raised sharply likely wild horses. Statistics from the National Bureau of Statistics showed that in 2016 the average sales price of newly-built commercial houses in 35 large and medium-sized cities was higher than that in 2015, there were 13 cities whose growth rate exceeded 10%, accounting for more than 1/3 of these cities. Among the first-tier cities, the prices of commercial housing in Beijing and Shenzhen have even increased by 21.49% and 33.01% respectively compared with the previous year. In the second-tier cities, the sales price of commercial housing in Nanjing reached 17,754 Yuan per square meter which increased by 54.53% year by year (The data here come from the official website of the National Bureau of Statistics of China.).

And, there is a sharp contrast between the prosperity of the real estate market and the shortage of R&D investment in the real economy represented by small and medium-sized enterprises. Meanwhile, China’s economy has been hovering at the bottom of the “L” type in these years, which
is caused by the ‘disintegration and emptiness’ of the process of factor allocation by some economists. Due to the crowding effect of real estate, the financing channels for the higher productivity of the manufacturing sector are squeezed, which dampen the enthusiasm of technological innovation and technological progress in the real economy, and also is detrimental to the improvement of product competitiveness that results in the emergence of high-end consumption from domestic consumers to foreign countries. In addition, the high profits and high returns of the real estate market and the expectation of exchange rate devaluation prompt state-owned and large-scale enterprises, having some sort of connection with formal financial institutions, obtain the vast majority of credit funds an investment in the real estate market to get short-term high profits. The self-employed and institutional investors who originally invested in the stock market and bond market, due to the stock market disaster in 2015 and the debt crisis in 2016, have been shifting to real estate investment under the incentive of high returns or stability. The capital’s investment in the real estate market displaces the investment and financing channels that incentivize the sustainable development of the real economy. This phenomenon of ‘going out of reality’ lead to a reduction in the productivity of manufacturing enterprises, and contribute to the overall demise of the industry-based real economy, ultimately, not be conducive to the sustainable development of the national economy.

**Literature.** It’s a fact that there are significant differences in per capita income between different countries in the world, especially between developed countries and developing countries. In the 21st century, despite the gap between countries in technology has continuously narrowed, the per capita income between countries becomes more and more disparate; therefore, international scholars’ research on economic development has gradually focused on the study of misallocation of resource. Restuccia and Rogerson (2008) report that distortions of factor prices resulting from policy interventions can lead to significant reductions in output, while also reducing total factor productivity by 30%-50% [1]. And Hsieh and Klenow (2009) point out that if the level of resource allocation in China and India was increased to the level of US factor margin product, TFP of them will get an average increase of 40% and 50% [2]. Based on above research methods, later scholars expand the research perspective of misallocation of resource and TFP. Simon Gilchrist (2013) conducted a research on the impact of TFP on the misallocation of resources caused by different borrowing costs due to financial friction between US manufacturing companies from 1985 to 2010 [3].Daniel et al (2016) used the Portuguese industry data to study the impact of resource mismatches on the economic impact of southern Europe and the peripheral countries of Europe before the Eurozone crisis [4].Christian A.L et al (2017) conducted a comparative study on the effects of different stamp duty rates (SDLT) on the purchase of land in the UK for real estate and labor distortions and [4]. With China’s accession to the WTO and the pace of reform and opening up is further advanced, many scholars have also developed a keen research interest in misallocation of China’s resources. Brandt et al (2013) show that the misallocation of resources between local government and non-government agencies is entirely attributed to capital mismatch [5]. Fang Kwan (2017) points out that the role of the allocation of labor in China’s agriculture and non-agricultural industries is more important to the growth of output than to that in cities[6].

From the development process of global industrialization and urbanization, developed countries take the lead in the development stage of industrialization and urbanization. In the process of urbanization and industrialization, they also encounter a series of problems affecting economic and social development, such as the excessively rising house-price and real estate market bubbles, etc., and scholars also conducted in-depth analysis on housing prices from different perspectives. Takats (2013) shows that compared with the benchmark countries, the aging population of 22 advanced economies will cause housing prices to increase by 30 benchmark points annually in the past 40 years, and in the next 40 years, the aging of the population will reduce the average housing price by an average of 80 benchmark points per year[7].William R. Johnson (2014) studies the relationship between real estate prices and the participation rate of married women in U.S. metropolitan area, and find that there is no significant causal relationship among them, but the increase in house prices
will increase the income of married working women [8]. Dettling and Kearney (2014) argue that for every $10,000 increase in house prices, the local population’s fertility rate will increase by 5%, while resulting in a decrease of 2.4% in the fertility of foreigners [9]. And Basten and Koch (2015) argue that every 1% rise in Switzerland’s house prices caused a 0.52% increase in total mortgage loans, while higher house prices lead to an increase in credit demand [10].

From previous literature studies, it can be seen that existing studies have conducted in-depth research on misallocation of resource and house price fluctuation, and also diversify the research fields. The research of this paper is of great significance to the research of Binkai Chen et al. (2015) [12]. They use the micro data of Chinese industrial enterprises before 2007 to conduct a detail study on the relationship between housing prices and misallocation of resource, total factor productivity in industrial enterprises.

On the basis of the former study, and based on the consideration that the price of real estate in China has risen too quickly but the development of the real economy is not ideal during the periods of 2007 to 2016, this paper uses the data of listed companies in the manufacturing enterprises to measure and analyze the degree of distortions of capital, labor and overall TFP, and also measure the space of improvement of TFP after misallocation of resource was eliminated. Then, the paper studies the relationship between real estate price fluctuations and distortions of factors of manufacturing companies, total factor productivity in China.

**Theoretical Transmission Mechanism**

The supply of resources is scarce and the demand of resources exists infinity. Therefore, the basic starting point of economic research is to study how to configure so scarce resources effectively as to achieve Pareto optimality for input-output.

So, how can we achieve the optimal allocation of resources? Generally, it needs to be solved by solving two problems: on the one hand, scarce resources should be put into the places where the social needs are strongest; on the other hand, the limited resources should be allocated as much as possible to the production efficiency producers. The optimal configuration of resources is reflected in the theoretical model, which is the position where the marginal benefit is equal to the marginal cost of the factor input.

In the economic development of cities in China, there is unreasonable allocation of resources caused by non-market effect among industries or between enterprises of different scales within industries; finally, it is the distortion of factor markets that results in the misallocation of supply and demand structure.

Next, from the perspective of market distortion of capital, labor factors, the paper will further explore the theoretical mechanism of the impact of rising real estate prices on total factor productivity.

**The Influence Mechanism of Capital Distortion on TFP**

From the perspective of Hsieh and Klenow (2009) decomposing TFP [2], capital distortion affects TFP in three aspects: R&D squeeze out of enterprises, misplacement of factor resources among enterprises, and formation of barriers to entry and exit of enterprises. Due to the backwardness of China’s capital market development, China’s financial system still deeply depends on the allocation of financial resources through the provision of bank’s credit funds. Most of the major financial institutions, mainly banks, are state-owned with strong financial strength and state-owned and state-owned holding companies are also owned by governments, this “nepotism” relationship is more conducive to the financing of state-owned enterprises. However, for non-state-owned enterprises, the channels for financing through formal financial institutions are crowded by state-owned enterprises, and can only obtain funds through the informal channels at the cost of high interest rates, which is not conducive to the long-term development of manufacturing sector. In recent years, the rise in real estate prices further aggravates such ownership discrimination: state-owned enterprises and large local enterprises obtain credit support through their relationship
with the governments, mainly for investing in the real estate market; meanwhile, the high returns of real estate market also induce more and more non-state-owned small and medium-sized enterprises, with relatively high productivity but low profits, to use their own funds or high-interest credit funds for speculative and capital investment, as a result, real estate investment squeeze out the capital inputs of productive and R&D investment of manufacturing, which is detrimental to the technological progress of the entire sector, and thus affect the overall TFP of manufacturing. With the aid of prosperity of the real estate market, forward and backward related industries of real estate and real estate obtain relatively good development opportunities, and these enterprises were mostly labor-intensive and capital-intensive industries having lower marginal input and output efficiency of the factors. However, high-productivity manufacturing sectors are faced with the loss of financial capital and labor resources which flowed into low-productivity real estate or related industries to result in serious misallocation of financial resources and further reduce the productivity and development vitality of the entire manufacturing sector.

**The Influence Mechanism of Labor Distortion on TFP**

Rising real estate prices will directly and indirectly lead to the distortion of the labor market among industries, thus affecting total factor productivity of manufacturing.

The rise in real estate prices will have a beneficial effect on the number of people living in urban areas. Among those populations who originally worked in the industrial sector, the opportunity cost of choosing leisure is greatly reduced due to the high return on housing prices through housing leasing or investment has yielded considerable returns, leisure will be chosen between leisure and work, thus escaping from the manufacturing sector. While some people without housing are motivated by high profits and high wages in the real estate or related industries, they will choose to enter those industries instead of the original manufacturing enterprises. At the same time, real estate and related departments have characteristics of low added value, lack of research and innovation motivation, thus lower productivity, and will further reduce the total factor productivity of the entire economy. At the same time, the rise in housing prices will virtually form market segmentation: the low-skilled labors will choose to shift from a high-price house to a neighboring city due to its inability to bear excessively high house prices and the high threshold of the high-wage industry. High-skilled labors will also form higher labor costs for the industry which further reduce the incentive for companies to introduce high-skilled labors to promote scientific and technological innovation, thus leading to a reduction in TFP for the entire industry.

**Data Description and Descriptive Statistics**

The main research interval selected in this paper is from the period of 2007 to 2016, and the reason for using 2007 as the starting point of the research, on the one hand, is that the database of Chinese industrial enterprises used by scholars to study China’s overall economy and TFP of industries is limited to data before 2007, and the data update in recent years in these database is not
comprehensive and can’t meet the accuracy of research and data integrity requirements. On the other hand, taking into account the global financial crisis in 2008, the weak global demand and insufficient consumption has a major impact on the Chinese economy; the government has also successively introduced policies to stimulate the economy, including 4 trillion investments in 2010. However, the concrete effects of policy implementation are widely criticized, because related investment mainly flow into real estate-related industries, as a result, some traditional industries are overcapacity, especially in monopoly industries, and also there is a bubble and high leverage in the real estate market. However, the development of the real economy, especially the manufacturing industries with higher productivity, is not satisfactory. Therefore, the selection of such time periods also has a practical significan.

This paper mainly uses the data of listed companies in the A-share manufacturing industry from Wind Financial Terminal, and some data and related indicators are applied to other databases, such as China Statistical Yearbook, China Industrial Statistical Yearbook, China Real Estate Statistical Yearbook and the Guotai Ann CSMAR database. Some indicator data is obtained by processing some of the obtained data.

The explanatory variable in the empirical analysis is real estate prices of China; the specific indicator is the average sales price of commercial housing. The explained variables are the misallocations of capital, labor and total factor productivity (TFP) of manufacturing enterprises. The calculation of TFP and misallocation of resource needs to be calculated using other data through the construction of theoretical models. From the consideration of previous literature research and data availability, these data indicators mainly include the output, capital input, labor input, and total labor compensation in all sectors of manufacturing. The capital input is the capital stock, drawing on the research method of Pei Zhang (2014)[11]. Referring to the method of Wei Liu et al (2014), the amount of labor input is expressed by using the average number of employees in the manufacturing sector [12]. And then, the control variables in the empirical analysis use some relevant data indicators, such as per capita GDP, education level, employment in the real estate industry, and employment in the manufacturing industry.

Table 1. Variable definitions.

| Name                | Code  | Calculation Method                                        |
|---------------------|-------|----------------------------------------------------------|
| Industrial output   | Ln\ Y | Corporate sales revenue decreased by industrial product price index |
| capital stock       | Ln\ K | Net value of fixed assets decreased by fixed asset investment price index |
| Labor input         | Ln\ L | Annual average number of employees in enterprises         |
| Intermediate product input | Ln\ M | Decreased by industrial product price index               |
| Average wage        | Wage  | The rate of employee payroll payable to the average number of employees |
| Business age        | Age   | Reporting period -year established+1                     |

Table 2. The basic statistics of main variables.

| Variable | Average | Median | Variance | Min  | Max  | Sample Size |
|----------|---------|--------|----------|------|------|-------------|
| Ln\ Y    | 20.75   | 20.62  | 1.44     | 11.48| 27.34| 19109       |
| Ln\ K    | 19.81   | 19.74  | 1.55     | 10.63| 25.41| 15107       |
| Ln\ L    | 7.43    | 7.37   | 1.22     | 2.08 | 12.18| 16914       |
| Ln\ M    | 20.25   | 20.14  | 1.58     | 7.22 | 27.37| 19082       |
| Wage     | 8.81    | 8.93   | 1.17     | -2.44| 15.73| 16721       |
| Age      | 14.03   | 14.00  | 5.87     | 1.00 | 58.00| 22307       |
In this section, I present a theoretical framework of my research based on Hsieh and Klenow (2009) model. The C-D production function usually takes the following form.

\[ Y_i = A_i K_i^\alpha L_i^\beta M_i^\gamma \]  

(1)

Where \( Y_i \) means corporate output, \( K_i, L_i, M_i \) respectively represent the inputs of capital, labor and intermediate goods. And \( \alpha, \beta, \gamma \) respectively express input-output elasticity of capital, labor and intermediate goods. And it assumes unchanged scales of compensation: \( \alpha + \beta + \gamma = 1 \).

It assumes that there are \( N \) manufacturing enterprises, of which film \( i \) produces production \( Y_i \). Companies’ production needs factors input, mainly including capital \( K \), labor \( L \) and intermediate input \( M \). In fact, there is a certain degree of information asymmetry in the factor market for the monopolistic competition market. Due to the influence of other non-market factors, the factor configuration is distorted, making the factor market marginal price different. The distortion of capital and labor is represented by a ‘price wedge’, denoted by \( \tau_{ki} \) and \( \tau_{li} \). When there is a price distortion, \( (1 + \tau_{ki}) P_k \) and \( (1 + \tau_{li}) P_L \) respectively mean the prices of capital and labor, among them, \( P_k \) and \( P_L \) express prices when there is no resource mismatch. C-D production function profit maximization formula is as follows.

\[ \max [P_i Y_i - (1 + \tau_{ki}) P_k K_i - (1 + \tau_{li}) P_L L_i - P_M M_i] \]  

(2)

Where \( P_i \) is the production price of film \( i \) that can’t be separate, so this paper replace \( P_i Y_i \) by the product sales revenue of films. \( P_M \) denotes the price of intermediate input product, based on the availability of the data, the research cannot consider its impact and sets it to 1. For enterprises, \( P_k, P_L \) are the costs of capital and labor, by Heish and Klenow (2009) approach, the capital price is defined as 0.1\(^2\). According to the principle of maximizing corporate profits, the first-order derivatives of capital and labor are at follows.

\[ a_i P_i A_i K_i^{\alpha-1} L_i^\beta M_i^\gamma = (1 + \tau_{ki}) P_k \]  

(3)

\[ \beta P_i A_i K_i^\alpha L_i^{\beta-1} M_i^\gamma = (1 + \tau_{li}) P_L \]  

(4)

By formulating the above formulas, the following formula can be obtained:

\[ (1 + \tau_{ki}) = \frac{a_i P_i Y_i}{P_k K_i} \]  

(5)

\[ (1 + \tau_{li}) = \frac{\beta P_i Y_i}{P_L L_i} \]  

(6)

Where \( \tau_{ki} \) and \( \tau_{li} \) express the degree of distortion of capital and labor relative to output, and the degree of misallocation of these factors can be expressed as \( 1 + \tau_{ki} \) and \( 1 + \tau_{li} \). According to (5) (6), the capital to labor ratio can be obtained.

\[ \frac{K_i}{L_i} = \frac{a_i P_L}{\beta P_k} \times \frac{1 + \tau_{li}}{1 + \tau_{ki}} \]  

(7)

This capital-labor ratio formula shows that, due to the existence of a certain degree of information asymmetry in factor markets, the effect of non-market factors has resulted in difference between marginal returns and marginal costs for factor inputs among industries or enterprises; therefore, it results into distortion of factor prices. Assuming that element resources can be reallocated between various departments to achieve the rational allocation of elements, and the total factor productivity of enterprises will also be improved.
By substituting (5), (6) into the above equation, the following formula can be obtained:

\[ L_i = \left( \frac{\alpha}{P_K} \right)^{a} \left( \frac{\beta}{P_L} \right)^{1-a} \frac{1}{(1 + \tau_{K_i})^a (1 + \tau_{L_i})^{1-a}} \times P_i A_i M_i^\gamma \right)^{1/(a+\beta)} \]  

(8)

\[ L = \sum_{i=1}^{N} L_i = \sum_{i=1}^{N} \left[ \left( \frac{\alpha}{P_K} \right)^{a} \left( \frac{\beta}{P_L} \right)^{1-a} \frac{1}{(1 + \tau_{K_i})^a (1 + \tau_{L_i})^{1-a}} \times P_i A_i M_i^\gamma \right]^{1/(a+\beta)} \]  

(9)

\[ K = \sum_{i=1}^{N} K_i = \sum_{i=1}^{N} \frac{K_i}{L_i} L = \frac{aP_L}{\beta P_K} \sum_{i=1}^{N} \frac{(1 + \tau_{L_i}) L_i}{(1 + \tau_{K_i}) L} \]  

(10)

The model uses the total output relationship to calculate total factor productivity. First, the output function of the representative enterprise can be expressed as follows:

\[ P_i Y_i = \frac{1}{\beta} (1 + \tau_{L_i}) P_i L_i \]  

(11)

Through the above equation, the expression of the total output function can be obtained by summing up the output of the enterprise.

\[ Y = \sum_{i=1}^{N} P_i Y_i = \frac{L}{\beta} \sum_{i=1}^{N} (1 + \tau_{L_i}) P_i \frac{L_i}{L} \]  

(12)

By substituting (11) into (12), we obtain the following decomposition:

\[ Y = \sum_{i=1}^{N} P_i Y_i = P A K^a L^\beta M^\gamma = P A \left[ \frac{aP_L}{\beta P_K} \sum_{i=1}^{N} \frac{(1 + \tau_{L_i}) L_i}{1 + \tau_{K_i} L} \right]^{1-a} L^\beta M^\gamma \]  

(13)

\[ \frac{L}{\beta} \sum_{i=1}^{N} \frac{(1 + \tau_{L_i}) P_i L_i}{L} = P A \left( \frac{\alpha P_L}{\beta P_K} \right)^a L^{a+\beta} M^\gamma \left[ \sum_{i=1}^{N} \frac{(1 + \tau_{L_i}) L_i}{1 + \tau_{K_i} L} \right]^{1-a} \]  

(14)

\[ A = \frac{1}{P M^\gamma} \left[ \sum_{i=1}^{N} (1 + \tau_{L_i}) L_i \right] \times \left[ \sum_{i=1}^{N} \frac{(1 + \tau_{L_i}) L_i}{1 + \tau_{K_i} L} \right]^{1-a} \times \left( \frac{a}{P_K} \right)^{1-a} \left( \frac{P_L}{\beta} \right)^{-a} \]  

(15)

By substituting (9) into the second half of (15), we get the following formula.

\[ \left( \frac{a}{P_K} \right)^{-a} \left( \frac{P_L}{\beta} \right)^{-a} \times \left[ \sum_{i=1}^{N} \frac{(1 + \tau_{K_i})^a (1 + \tau_{L_i})^{1-a}}{1 + \tau_{K_i}} \times P_i A_i M_i^\gamma \right]^{1/(a+\beta)} \]  

(16)

And then, the formula for total factor productivity is as follows.
According to (17), the model defines the individual distorted index \( D_i \) and the overall distorted index \( D \) as follows.

\[
D_i = (1 + \tau_{\beta i}) a (1 + \tau_{\alpha i})^{-a}
\]

\[
D = \left[ \sum_{i=1}^{N} (1 + \tau_{\beta i}) - \frac{L_i}{L} \right] \times \left[ \sum_{i=1}^{N} \left( \frac{1 + \tau_{\alpha i} L_i}{1 + \tau_{\beta i} L_i} \right) \right]^{-a}
\]

The overall mismatch index can be expressed as a weighted average of individual mismatch indices. Then the summed TFP expression is the following equation.

\[
A = \frac{1}{M^T} \left[ \sum_{i=1}^{N} (A_i M_i \gamma \times \frac{D}{D_i}) \right]^{-1} \left[ \sum_{i=1}^{N} \left( \frac{1 + \tau_{\beta i} L_i}{1 + \tau_{\beta i} L_i} \right) \right]^{-1-\alpha-\beta}
\]

Where \( A_i = \frac{1 + P_i Y_{i}}{K_i L_i M_i} \) and \( \frac{1}{P_i} \) is unknown that can be ignored during actual operation.

When there is no distortion in the factor market, the total social potential TFP \( (A_0) \) can be obtained, the following formula is a specific calculation result.

\[
A_0 = \frac{1}{M^T} \left[ \sum_{i=1}^{N} A_i M_i \gamma \right]^{-1-\alpha-\beta}
\]

Further, we calculate the loss degree of industry TFP by comparing actual TFP with potential TFP. Therefore, concludes how much room for improvement in actual output when TFP reaches the ideal level.

\[
P_0 = \left( 1 - \frac{Y}{Y_{\text{efficient}}} \right) \times 100\% = \left( 1 - \frac{A}{A_0} \right) \times 100\%
\]

**Factor Distortion Measure**

In this section, from the perspective of overall China, sub-regional and different ownership, the paper measure the TFP of China’s manufacturing sector and misallocation of capital, labor and overall TFP. And also, the research measures the improvement of overall TFP when factor distortions improve.

In order to estimate the distorted level of factors and the total factor productivity of an enterprise, the factor output elasticity must be determined firstly. There is a big difference in the output elasticity of factors in different regions. Therefore, the elasticity of factors output is estimated in different regions. The specific production function formula is as follows:

\[
\ln Y_{ij} = \omega + a_j \ln K_{ij} + \beta_j \ln L_{ij} + \gamma_j \ln M_{ij} + \sum \delta_i \text{ind}_n + \sum \theta_i \text{year}_n + \varepsilon_{ij}
\]
\( \omega \) is the technical level constant, \( a_j, \beta_j \) and \( \gamma_j \) are the output elasticity of the corresponding input, and \( \text{ind} \) is the industry dummy variable, \( \text{year} \) is the annual dummy variable, \( j \) represents the province and \( t \) as the year.

Table 3. Regional business output elasticity.

| Province | Region | \( a_j \) | \( \beta_j \) | \( \gamma_j \) | Province | Region | \( a_j \) | \( \beta_j \) | \( \gamma_j \) |
|----------|--------|-----------|-----------|-----------|----------|--------|-----------|-----------|-----------|
| Beijing  | east   | 0.068     | 0.192     | 0.662     | Shanxi   | central| 0.122     | 0.127     | 0.593     |
| Fujian   | east   | 0.129     | 0.124     | 0.647     | Gansu    | west   | 0.130     | 0.022     | 0.777     |
| Guangdong| east   | 0.040     | 0.171     | 0.697     | Guangxi  | west   | 0.361     | 0.060     | 0.607     |
| Hainan   | east   | 0.125     | 0.018     | 0.592     | Guizhou  | west   | 0.055     | 0.510     | 0.368     |
| Hebei    | east   | 0.121     | 0.120     | 0.682     | Neimenggu| west   | 0.268     | 0.026     | 0.687     |
| Jiangsu  | east   | 0.109     | 0.199     | 0.613     | Ningxia  | west   | 0.113     | 0.451     | 0.507     |
| Liaoning | east   | 0.063     | 0.112     | 0.701     | Qinghai  | west   | 0.070     | -0.080    | 0.736     |
| Shandong | east   | 0.140     | 0.110     | 0.695     | Shanxi   | west   | -0.043    | 0.278     | 0.712     |
| Shanghai | east   | 0.097     | 0.067     | 0.742     | Sichuan  | west   | 0.096     | 0.126     | 0.713     |
| Tianjin  | east   | 0.083     | 0.081     | 0.771     | Xizang   | west   | 0.143     | 0.371     | 0.446     |
| Zhejiang | east   | 0.100     | 0.278     | 0.551     | Xinjiang | west   | 0.192     | 0.269     | 0.598     |
| Anhui    | central| 0.189     | 0.090     | 0.616     | Yunnan   | west   | 0.091     | 0.180     | 0.685     |
| Henan    | central| 0.132     | 0.213     | 0.530     | Chongqing| west   | 0.084     | 0.279     | 0.542     |
| Heilongjiang| central| 0.019   | 0.149     | 0.795     |          |         |          |           |           |
| Hubei    | central| 0.074     | 0.347     | 0.481     | West     |        | 0.126     | 0.160     | 0.657     |
| Hunan    | central| 0.066     | 0.324     | 0.594     | Central  |        | 0.110     | 0.217     | 0.600     |
| Jilin    | central| 0.211     | 0.144     | 0.535     | East     |        | 0.092     | 0.149     | 0.669     |
| Jiangxi  | central| 0.059     | 0.251     | 0.633     | Overall  |        | 0.103     | 0.164     | 0.652     |

The measurement method is OLS estimation. Finally, in China, the overall capital output elasticity is 0.103, the labor output elasticity is 0.164, and the intermediate output elasticity is 0.652. By calculating the output elasticity of the factors through regional regression, both the capital and labor output elasticities in the central and western regions are greater than those in the eastern region, which is consistent with the results obtained in most of the literature.

**National Analysis**

![Figure 2. The distortion of factors and overall TFP of Manufacturing.](image)

From the graph, the distorted indexes of the capital and labor in China’s manufacturing enterprises are greater than 0, and also are increasing year by year. Specifically, prior to 2012, the distorted index of labor and capital is in a weak state of fluctuation, but the degree of distortion of
the capital is better than the distortion of the labor, and the distortion index of total TFP is constantly rising. In 2012, the degree of distortion of resources and overall TFP has been improved to some extent. But after the year of 2012, the distorted degree of capital, labor and total TFP continue to be severe over the time, especially in 2016, the severity of resource mismatch is significantly strengthened, the degree of capital distortion is 19.95, the degree of labor force distortion is 35.99, and the overall TFP distortion is 13.74.

Table 4. Distortion of factor in manufacturing enterprises.

| Year       | 2007-2011 | 2012  | 2013-2016 |
|------------|-----------|-------|-----------|
| Distortion of capital | 5.49      | 5.65  | 13.04     |
| Distortion of labor    | 7.58      | 7.05  | 17.21     |
| Distortion of overall TFP | 4.16      | 4.42  | 10.66     |

By regarding the year of 2012, in which the distortions of factors improve, as the demarcation point, it is that the average values of capital distorted index for 2007-2011 and 2013-2016 are 5.49 and 13.04 respectively, in which the difference between them is 7.55, and also the distortions of labor are 7.58 and 17.21 which difference is 9.63, meanwhile, distortions of total TFP are 4.16 and 10.66 and the difference is 6.5. It can be seen that degree of distortions of the factor of China's manufacturing enterprises are obviously serious after 2012, and the main reason may be the narrow investment channels caused by the expected devaluation of RMB and the immature financial markets in China. Especially owing to the impact of the stock damage and debt disaster in 2015, many investors invested their own funds and credit funds in the real estate sector, promoting more credit funds and labor resource inflow to the industries that were closely related to the real estate market.

For manufacturing enterprises, on the one hand, due to the prosperity of the domestic real estate market and the sluggish stock market, the channels for investment and financing have all been squeezed; on the other hand, the follow-up impact of the global financial crisis has led to a marked weakening of external demand. Meanwhile, the reverse globalization and the rise of trade protectionism lead to a significant reduction in export orders. And what happens along the way is the increasing of various costs in manufacturing companies, especially small and medium-sized enterprises with higher productivity, persistent dilemma in their operations, and then they can only reduce their operating costs by reducing their production activities and employment of labor. Even some companies, having access to credit funds, switch to investing in real estate to obtain short-term high profits and high returns instead of the meager profits of the main business. Based on the above, the misallocation of resource and distortion of TFP continue to deteriorate in China's manufacturing enterprises.

From the view of TFP growth space, if the misallocation of resources can be eliminated effectively, the TFP of manufacturing enterprises will be expected to obtain the growth of 20%-30%.

Regional Analysis

Due to the obviously different levels of economic development and locational traffic conditions, there are great differences in the ability to allocate resources among regions. And because of the existence of urban-rural dual structure, household registration system, and policy barriers, it’s a phenomenon of misallocation of resources in China.

The Analysis of Distortion of Capital. Figure 3 shows that China’s provinces with higher levels of distortion of capital are mainly distributed in the eastern and western regions, such as Zhejiang, Fujian, Shandong, Yunnan, and Gansu, which verify a reality that China’s A-share listed companies are mainly distributed in the eastern and central regions, but sparsely populate in western region.

Compared with the central and western regions, the listed companies in the eastern coastal areas account for nearly 80%-90% of the total number of A-shares listed in China. In recent years, the real estate prices rapidly increase in the first-tier, second-tier cities, and even third- and fourth-tier
hot cities mainly in east coast region. Meanwhile, due to the impact of the nationwide stock damage and debt crisis in 2015, more capital flows into the real estate market, in which investors attempted to obtain high returns in the short-term through such speculative activities. Such a boom in real estate investment has a crowding effect on the capital inputs of manufacturing to engage in production and technological innovation. Meanwhile, due to the meager profits of the manufacturing sector, many enterprises have invested their own funds and credit funds originally used for production and operation and technology research in real estate to obtain short-term high profits. Finally, they exacerbate the degree of distortion of capital elements and are conducive to the healthy development of the real economy.

In the central and western regions, the manufacturing enterprises are faced with corporate transformation and upgrading through equipment updates and technological advancements, but the realization of these needs input of capital elements. However, the shortage of capital has caused such enterprises to fall into dilemma of development.

The unreasonable allocation of capital elements among regions or industries has led to the misallocation of capital elements, which has also reduced the overall TFP in China.

**Figure 3. Distortion of capital.**

**Figure 4. Distortion of labor.**

**Figure 5. Distortion of overall TFP.**

**Figure 6. The growth space of TFP.**

**The Analysis of Distortion of Labor.** Figure 4 shows that the areas, with higher degree of distortion of labor elements, are relatively dispersed. But overall, the differences in economic development levels and locational traffic conditions cause the spatial distribution of labor resources among different regions, and also different misallocations of labor among provinces.

Specifically, in the central and western regions, some provinces with large population bases and relatively large labor resources have single industrial structure and weak industrial foundation, mainly being labor-intensive or capital-intensive industries. Meanwhile, the TFP of these traditional manufacturing industries is relatively low, but due to the demands of the increase of employment rate and gross domestic product in these regionals, these industries are often taken seriously by the
local governments that obtain many financial subsidies and tax incentives. Meanwhile, Some provinces that labor resources are relatively small in the western regions, have a certain scale of industry and influential enterprises, but are not attractive to the labor especially those with high skills and knowledge due to the restrictions of location and traffic, which leads to a lack of labor resources in these provinces.

In the China’s eastern coastal areas, due to the high level of economic development and facilitated traffic conditions, there is a higher net inflow of labor resources each year. However, the wages of labor, especially high-skilled and highly-skilled personnel, are relatively high, and manufacturing enterprises are faced with high labor costs. Meanwhile, the rapid increase in the prices of hot real estate in recent years has caused an operation improvement of real estate and related industries, with a high concentration and a certain degree of monopoly, the enterprises in the industry are mainly state-owned enterprises or large-scale private enterprises, which have more friendly relations with local governments and banks than some manufacturing industries with high productivity and high R&D investment in the east, these enterprises obtain lower interest rate credit funds but have lower TFP and more labor resources than manufacturing enterprises. Finally, there are misallocations of labor resources among industries, or companies.

**The Analysis of Growth Space of Overall TFP.** Figure 6 shows that there is a relatively large space for industrial productivity growth in these areas, including northeast, northwest, southwest, and eastern coastal areas. And if the misallocations of resources faced by manufacturing sector were eliminated, the Total Factor Productivity would achieve an improvement room of 10% or even more than 20%, while there is relatively little room for improvement in manufacturing sector in the central provinces.

**Ownership Analysis**

There is an ownership discriminatory against loans issued by formal financial institutions to enterprises. Because of the ownership nature of state-owned enterprises, there is a close relationship between traditional state-owned enterprises and banks.

Therefore, credit funds, with low interest rates are distributed to stated-owned enterprises from large-scale banks. Often these state-owned enterprises are located in monopolistic or highly concentrated “profiteering” industries that gather excessive capital and labor resources have lower productivity than non-state companies. In the high corporate sector, because of information asymmetry and less collateral, traditional large banks are generally based on the consideration of business scale and loan risk and rarely provide credit funds to non-state-owned enterprises, especially small and medium-sized enterprises with comparative advantages and high productivity.

![Figure 7. Misallocation of resources of state-owned enterprises.](image-url)
Figure 7 shows that the distorted indexes of capital factor, labor factor and overall TFP have basically remained stable in state-owned enterprises before 2015. However, after 2015, the degree of distortion of capital factors had suddenly increased significantly. Specifically, from 2007 to 2016, the degree of distortion of the capital of state-owned enterprises was higher than the distortion of labor factor, it indicates that state-owned enterprises use not these capital elements reasonably and effectively with obvious advantages in financial resources, and also not well translate into matching input-output efficiency, as a result, there is a waste of capital resource.

Especially in 2015 and 2016, most state-owned enterprises involve in the investments of real estate and financial capital, and even, many state-owned enterprises invest more and more in real estate and financial capital than that in main businesses, which have a clearly insufficient investment in production and technological innovation, to lead to a serious misallocation of resources. If the distortion of factors in state-owned enterprises is eliminated through the reconstruction of factor resources, TFP can gain a growth of about 20%.

Figure 8 shows that the distortions of capital, labor, and total TFP of non-state-owned manufacturing companies has been raising year by year, which are the main sources of distortion of total TFP in China’s manufacturing sector. Specifically, one of the reasons of the increase of distortions of capital and labor factors in non-state-owned enterprises in recent years is that: apart from ownership discrimination, there are also competitions for factor inputs among non-state-owned enterprises in China. Owing to the ‘marriage’ relationship with local governments and banks, large enterprises are more likely to be supported by other credit funds to own scale economy than small and medium enterprises, but they have less technical inputs and lower TFP than others. At the same time, due to the scale advantages of economies, large-scale enterprises greatly attribute to local fiscal revenues and employment and therefore attract relatively more labor resources, but most of the labor’s wages are relatively low compared to the value created in large-scale enterprises. Finally, it leads to the misallocation of resources in the entire non-state-owned enterprises.

Compared with state-owned enterprises, non-state-owned enterprises have strong technological innovation capabilities and value creation capabilities to contribute to higher TFP and could better drive the productivity improvement of the entire manufacturing sector. As a result, when the TFP of non-state-owned enterprises is distorted, there is an obviously impact on the total TFP in national manufacturing sector. If the distortion of factors of non-state-owned is eliminated, it will bring about a growth rate of 30% -35% in TFP.

Figure 8. Misallocation of resources of non-state-owned enterprises.
Empirical Analysis

In order to study the impact of real estate prices on total factor productivity and the relationship between real estate prices and misallocation of resources, I construct the following econometric model.

\[
\text{tfp}_n = \beta_0 + \beta_1 \ln(\text{hourprice})_{n-1} + \beta_2 \text{control}_n + \epsilon_n
\]  

\[
\text{misallocation}_n = \beta_0 + \beta_1 \ln(\text{hourprice})_{n-1} + \beta_2 \text{control}_n + \epsilon_n
\]  

Where \( \text{tfp}_n \) is the growth rate of TFP, \( \text{misallocation} \) is the distorted index of capital, labor, and overall TFP. Referring to Binkai Chen's treatment of explanatory variables, the explanatory variable is the logarithm of the average sales price of commercial real estate that lags one stage [13]. The control variables mainly include per capita GDP, per capita GDP squared, education level, employment in real estate industry and manufacturing separately. Meanwhile, \( i \) is an individual factor, \( t \) is a time factor, and \( \epsilon_n \) is a random disturbance item.

Next, the research uses the data of China's manufacturing enterprises in 2007 -2016 to empirically analyze the impact of real estate price changes on China's manufacturing industry TFP and the misallocations of resources.

Table 5. The empirical results of the impact of real estate on China’s Manufacturing.

| TFP | Model one | Model two |
|----|-----------|-----------|
| Logarithm of real estate price | -0.069*** (2.79) | -0.157*** (3.07) |
| Logarithm of per capita GDP\(^1\) | 4.461** (2.38) |  
| Logarithm of per capita GDP squared\(^2\) | -0.225** (2.42) |  
| Education level | 0.0373 (0.74) |  
| employment in real estate industry | 4.870** (2.29) |  
| employment in manufacturing industry | 0.378 (1.36) |  
| Constant term | 0.349* (1.65) | -21.51** (2.30) |
| R2 | 0.0187 | 0.0518 |
| N | 290 | 199 |

Comments: ***, **and* denote significant levels of 1%, 5% and 10% respectively, and the value in parentheses indicates the standard deviation.

1. Since the impact of per capita GDP on Manufacturing sector was not obvious same year, it was later lagging a phase.
2. Here’s the same process as above.

Table5 shows that there is a negative correlation between the sales price of commercial housing and the growth rate of manufacturing TFP, and indicates that the fluctuation of real estate prices has an inhibitory effect on the total factor productivity of manufacturing enterprises. When the control variable is not considered in Model one, the correlation coefficient between the price of commercial
housing and the TFP of manufacturing enterprises is -0.069 which is significant at the 1% level of significance. If the prices of commercial housing rise by one unit, the manufacturing TFP would decrease 0.069 units. When considering the control variables in Model two, the correlation coefficient between commercial housing prices and manufacturing enterprises is -0.157 and is significant at the 1% level, which indicates that rising real estate prices significantly inhibit the TFP growth of manufacturing. When the price of commercial housing rose by one unit, the growth rate of TFP of manufacturing enterprises would reduce by 0.157 units.

In terms of control variables, the coefficient of per capita GDP is 4.461, and the coefficient of its square term is -0.225, which is significant at the level of 5%, indicating that there is a Kuznets ‘inverted U’ relationship between per capita GDP and the TFP of manufacturing. That is, in the initial stage of economic development, the increase in per capita income will generate more demand for material consumption, thus stimulating enterprises to obtain higher TFP through technological research and development. With the increase of per capita income, people's demand for materials will reach a saturation period after the per capita income reaches the critical point, which will reduce the consumption of material products, then enterprises will transform and update instead of the increase of production of existing products, and thus the productivity will be a degree of reduction.

Table 6. The empirical results of the impact of real estate on misallocation of resource of manufacturing enterprises.

|                          | Distortion of capital | Distortion of labor | Distortion of overall TFP |
|--------------------------|-----------------------|---------------------|---------------------------|
|                          | Model one             | Model two           | Model one                 | Model two           | Model one           | Model two           |
| Logarithm of real estate price | 5.512** (2.23)        | 8.396** (2.45)      | 4.573** (0.88)            | 13.06*** (2.91)     | 3.912** (2.24)     | 6.003* (1.87)       |
| Logarithm of per capita GDP\(^1\) | 58.45 (0.62)          | -16.43 (-0.12)      | -84.83 (-0.83)            |
| Logarithm of per capita GDP squared\(^2\) | -2.781 (-0.60)        | 0.816 (0.12)        | 4.226 (0.84)              |
| Education level          | -3.128 (-0.96)        | -0.00686 (-0.00)    | 2.632 (0.83)              |
| employment in real estate industry | -175.5 (-1.27)         | -486.1** (-2.59)     | -240.8* (-1.82)           |
| employment in manufacturing industry | -15.47 (-1.10)         | -50.65** (-2.44)     | -15.00 (-0.99)            |
| Constant term            | -38.52* (-1.85)       | -335.7 (-0.71)      | -26.50* (-1.80)           |
|                         | 310                   | 213                 | 310                       |
|                         | 213                   | 310                 | 213                       |
|                         | 290                   | 300                 | 199                       |

Comments: ***, ** and * denote significant levels of 1%, 5% and 10% respectively, and the value in parentheses indicates the standard deviation.

1.Since the impact of per capita GDP on Manufacturing sector was not obvious same year, it was later lagging a phase.

2.Here’s the same process as above.

Figure 6 shows that there is a clear positive correlation between real estate prices and the distortions of capital, labor and overall TFP. Specifically, for the distortion of the capital factor, in Model two, the coefficient of real estate price is 8.396 and is significant at the significance level of 5%. It indicates that for every rising of 1% in real estate prices, the distortion of the capital factor will increase 8.396%. Excessively rising price of real estate will drives more capital factors to flow into the real estate chain industries through various channels, and has a crowding-out effect on the investment in capital of manufacturing enterprises' production and technological innovation, that leads to the distortion of capital factor.

Regarding the distortion of the labor force factor in Model two, the real estate price coefficient is
13.06, which is significant at the significance level of 1%. The excessively rapid rise in house prices have an objective wealth effect on the housing population. Based on the consideration of the marginal costs between resting and working, these affluent households may choose not to work in the original manufacturing enterprises and but to obtain stable income through rent or investment in real estate. While the excessively rising in housing prices in hot-street cities will has a negative impact on those without housing, and some low-skilled labor cannot afford high housing price because of relatively low wage, and leave their famer cities or industries. Meanwhile, the high wages of the highly skilled and highly-skilled labor will cause manufacturing companies with low profits to face higher labor costs, and the channels of financing are squeezed. These manufacturing enterprises usually choose to reduce the employment of high-salary talents to compress operating costs, which in turn leads to a decrease in TFP due to the reduction of technological innovation capabilities. By the above reasons, rising house prices will result in the unreasonable allocation of labor factors and lead to the misallocation of labor.

For the distortion of overall TFP, model two shows that correlation coefficient of real estate prices is 6.003 that is significant at the significance level of 10%. Due to the unbalanced development among China’s regionals, the rapid increase in housing prices in hot-spot cities will not result in the flow of essential resources from the cities with rising house prices to the surrounding areas. On the contrary, excessively high prices of real estate will cause obviously increased distortions of factors among industries or companies within industries in these cities; meanwhile, these hot-spot cities have concentrated various high-quality resources due to a number of factors, but other cities with tepid prices are facing relatively inconvenient traffic conditions, backward infrastructures, and single industrial structures, although the land has increased significantly, the gap between regions has made it impossible for resources to flow effectively. Therefore, cities with rising housing prices will accumulate more essential resources while surrounding cities will face the dilemma of continuous loss of essential resources. Usually, there is a continence to increase the distortions of resources in the region, which is not conducive to the improvement of overall TFP.

Discussion

In recent years, housing prices in China’s hot cities have risen so quickly, and many investment activities in financial market have also been closely linked with the real estate market. Along with the irrational prosperity of the real estate market, raw material prices have also risen greatly in recent years. On the contrary, the various costs of manufacturing companies have risen rapidly, and the channels of investment and financing have also been squeezed along with the fluctuations of stock market and bond market as well as over-investment in the real estate market. As a result, there is a phenomenon in which factor allocations have been removed from real economy and not conducive to the healthy development of the Chinese economy. The results of this paper also verify that there are serious misallocations of resources among different regions or industries. Meanwhile, there are also significant misallocations of resources between the different ownership systems within the manufacturing sector.

The development of China’s economy needs to achieve a balance between virtual economy and real economy, and it’s vital to attract innovative elements at domestic and abroad to serve the real economy through rational flow and effective allocation. China’s economy needs to increase total factor productivity through the transformation of new and old kinetic energy and innovation-driven, which applies to other countries that face the same issues as China, so this paper has a strong practical significance.

Conclusion

By constructing theoretical transmission mechanism and empirical model, this paper measures and analyzes the degree of distortion of capital, labor and overall TFP from the national, regions and
ownership systems, and also the impact of real estate price fluctuations on the distortions of factor and overall productivity of manufacturing enterprises. The distinct conclusions can be drawn.

In the country as a whole, the difference of distortions of capital, labor, and overall TFP respectively reach 7.55, 9.63, and 6.5 before and after 2012. And the degree of distortion of the factors increases significantly after 2012, and if the distortions in the allocation of factors are eliminated, the TFP of manufacturing enterprises can get a growth space of 20%-30%.

In terms of sub-regions, the degree of distortion of capital in the east and west areas are higher than that in central regions. The regional distributions with higher distortion of labor are scattered and mainly are those provinces with large labor inflows or outflows which have higher distortion of labor. Meanwhile, the higher level of distortion of overall TFP are mainly in the regions of west and northeast. And if the distortions of factors allocation are eliminated, the TFP of manufacturing enterprises will have greatly growth space in the west, northeast, and several provinces along the eastern coast with an average of more than 20%.

In terms of sub-ownership, the degree of distortion of the capital in state-owned enterprises is significantly strengthened in 2015 and 2016 with distortion indexes of 30-50. And the distortion of the factor of non-state-owned enterprises increases year by year; and the distortion of labor reaches 54.5 in 2016. Importantly, if misallocation of resources is eliminated, the growth spaces of TFP of state-owned and non-state-owned enterprises would reach about 20% and 30%-50% respectively.

Finally, real estate prices have a significant inhibitory effect on total factor productivity of manufacturing enterprises, and a positive effect on distortions of capital, labor and overall TFP. The rising price of real estate will affect the efficiency of resource allocation among industries to result into misallocation of resource and reduce the growth rate of TFP in manufacturing enterprises.

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