The Effect of Industrial Diversity on Unemployment Rate: Evidence from the Japanese City Level

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Keywords: Industrial diversity, Industrial specialization, Unemployment rate.

Abstract. This paper uses the city-level panel data from 1990 to 2010 to test the impact of industrial diversity on unemployment rate. First, the results show that industrial diversity in the whole country is declining. Second, there is a negative correlation between diversity and urban unemployment rate. Third, the degree of specialization in different industries has different effects on unemployment.

Introduction

Employment has always been an important issue to consider in economic development. In the late 1980s, Japan, which faced a bubble economy, has been exploring industrial upgrading and transformation. In 1980, the unemployment rate in Sapporo was 3.3%, compared to 7.7% in 2010. Therefore, how the industrial structure affects unemployment during the transition period is worthy of attention.

The impact of industrial structure on unemployment is mainly manifested in two aspects: First, changes in industrial structure affect unemployment. The second is the impact of industrial structure characteristics on unemployment. The characteristics of industrial structure are generally reflected by the degree of industrial diversity and the degree of industrial specialization. Industrial diversity seeks to achieve regional economic growth by enriching the industrial base [1]. The industry specialization seeks to achieve economic growth by promoting specific mature industries with competitive advantages in the region [2]. This paper mainly discusses the impact of industrial structure characteristics on unemployment.

With regard to the discussion of the relationship between industrial diversity and unemployment, existing theoretical and empirical studies have drawn very different conclusions. Wahner and Deller [3] argue that diversity not only improves economic stability, but is also more beneficial to economic growth and lower unemployment.

The idea that the increase in industrial diversity can reduce unemployment is supported by many scholars [4,5]. Simon [4] conducted empirical research using employment data from 91 cities in the United States, which found that the lower the unemployment rate in cities with high industrial diversity. Malizia [5] found that the cities with higher industrial diversity have lower unemployment rates and higher employment stability through the 1972-1988 US urban quarterly data study. Izraeli et al. [6] found a negative correlation between industrial diversity and unemployment in the US states. Tarzwell [7] also found that industry diversity was negatively correlated with unemployment rate through annual data from the Canadian provinces from 1989 to 1994.

There is also a contrary view that industrial diversification will increase unemployment [8]. This paper shows that urban unemployment is positively related to industry diversification, as cities with high levels of diversification will have greater wage differentials, and job searchers have incentives to extend search time. Industrial specialization is based on the assumptions of classical economics. The theory of comparative advantage reveals the benefits of specialized division of labor and trade [6]. Specialization helps to form a shared labor market. Manufacturers are easy to hire professional workers, and laborers rely on a shared labor market to reduce unemployment risks. Specialized production enables manufacturers to obtain a wide range of low-cost intermediate products. Simon [4] found that frictional unemployment is related to industrial specialization, and industrial specialization reduces unemployment.
Methodology, Variable and Data

Methodology and Variable Interpretation

This paper focuses on the impact of industrial diversification on unemployment, and empirical research uses panel data models to better control time-fixed effects and regional fixed effects. The model is as in eq (1).

\[ UR_{it} = \alpha_0 + \alpha_1 \text{div}_{it} + \alpha_2 \text{S}_{it} + \alpha_3 X_{it} + \eta_i + \eta_t + \mu_{it} \]

\( UR_{it} \) is the explained variable, which indicates the unemployment rate of city \( i \) in year \( t \).

\( \text{div} \) reflects the degree of industrial diversification. There are many measures for the industrial diversification index. This paper uses the reciprocal of the Herfindahl-Hirschman Index which is an indicator that reflects the concentration of the industry. It can usually be used to indicate the degree of industrial diversification. The calculation formula is as in (2).

\[ \text{div}_{i} = \frac{1}{\sum_j y_{ij}^2} \]  

\( y_{ij} \) is the proportion of employment in the industry \( j \) to the total number of employed people in the city \( i \).

\( S \) are variables that used to control the impact of industrial specialization on the unemployment. This paper uses industrial location quotients (LQ) to measure the level of industrial specialization. In regional economics, location quotients (LQ) are often used to distinguish whether an industry is a specialized sector in the region. This paper selects the 7 industries of manufacturing, construction, electric gas heating and water supply, transportation, retail and wholesale, finance & insurance and service respectively, using \( s_{mn}, s_{co}, s_{el}, s_{tr}, s_{it}, s_{se}, s_{se} \) representatives respectively.

\[ s_i = \frac{p_{ij}}{\sum_i p_{ij}} \]

Where \( p_{ij} \) is employed people in the industry \( j \) in the city \( i \), \( p_i \) is the total number of people employed in the city \( i \); \( p_j \) is the national employment in the industry \( j \), and \( \sum_i p_i \) is the total number of employed people in the country.

\( X \) is a control variable that is used to reflect the economic level of each city and the situation of the labor market. Three control variables are mainly added: In \( \text{inc} \) is the logarithm of the taxpayer's per capital income. We use the taxpayer's per capital income rather than the per capital income of the entire family to better reflect the income level of the labor force. In \( \text{fis} \) is the logarithm of fiscal expenditure. The government's fiscal expenditure, such as granting water conservancy and investment infrastructure, can directly increase employment and ease the pressure of unemployment. In \( \text{sch} \) is the logarithm of the number of local schools (secondary and university) to indicate the level of education in the city.

Data

The data used in this paper is the panel data from 573 cities in Japan, and the selection time is from 1995 to 2010 every five years. The data comes from the Japan Statistics Bureau. Due to the many changes in the municipal administrative divisions in Japan, and the lack of data in some cities, we deleted the cities with more missing data. In the end, only 573 cities were retained in 790 cities for regression analysis.

Regarding the industry classification, we use the data from the standard industry classification released by the Japan Bureau of Statistics. There are 11 industries, namely manufacturing, construction, electric gas heating, water supply, transportation, retail and wholesale, finance & insurance industry, service
industry, agriculture, forestry & fishery, mining quarrying & gravel collection industry, real estate industry, and public service industry. Table 1 shows descriptive statistics for each variable.

Table 1. Summary statistics.

| Variable | Mean | Std. Dev. | Min | Max |
|----------|------|-----------|-----|-----|
| UR       | 4.250| 1.988     | 0.600| 16.900|
| div      | 4.337| 0.525     | 1.755| 6.408|
| S_mm     | 1.142| 0.379     | 0.269| 3.412|
| S_co     | 1.246| 0.627     | 0.088| 3.438|
| S_el     | 1.103| 2.440     | 0    | 13.504|
| S_s      | 0.886| 0.442     | 0.044| 5.422|
| S_se     | 0.960| 0.437     | 0.001| 2.190|
| S_f      | 0.887| 0.573     | 0.051| 10.970|
| S_se     | 1.038| 0.301     | 0.217| 2.424|
| ln inc   | 7.956| 0.245     | 7.212| 8.856|
| ln fis   | 17.199| 0.883     | 15.299| 21.367|
| ln sch   | 2.561| 0.758     | 0    | 5.631|

Results and Discussion

Descriptive Statistics of Diversity Index

Table 2. Descriptive statistics of diversity index.

| Year | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 |
|------|------|------|------|------|------|------|------|
| Mean | 4.433| 4.380| 4.375| 4.392| 4.290| 4.189| 4.287|
| Median | 4.505| 4.433| 4.433| 4.427| 4.320| 4.22 | 4.307|
| Min  | 1.910| 1.754| 1.758| 1.991| 2.114| 2.168| 2.185|
| Max  | 6.408| 6.370| 6.107| 6.053| 5.679| 5.470| 5.499|
| Std.Dev | 0.662| 0.627| 0.556| 0.470| 0.427| 0.407| 0.407|

The above table is about the descriptive statistics of the diversity index from 1980 to 2010. In terms of the average, the diversification index in 1980 was 4.433, and in 2006 this figure fell to 4.189. In 2010, it rebounded slightly and rose to 4.287. On the whole, we can see that the overall industrial diversification is gradually decreasing, and industrial specialization and centralization are becoming more and more obvious.

Analysis of Regression Results

The regression results are shown in Table 3. Model 1 is OLS regression, since OLS is based on the assumption that there is no observed heterogeneity between the cross-sectional units and different times. So this assumption is too strict and obviously does not match the data type of this article. Model 2 is only fixed for the region. However, due to the different levels of development in each city, there may be missing variables that do not change over time. So in model 3 and model 4 we add time-fixed effects. The variables of model 3 include diversity, as well as control variables: education level, fiscal expenditure, and per capital income. Model 4 adds seven industry specialization variables based on model 3.

Both Model 3 and Model 4 reflect a strong negative correlation between industrial diversification and unemployment. Model 3 shows that when the degree of industrial diversification increases by 1%, the unemployment rate will fall by 0.32 %. When the industry specialization variable is added, the diversified regression coefficient becomes -0.308 and is significant at the 1% level. This still shows that diversification can reduce unemployment. This is consistent with the results of Simom (1998) and Malizia et al (1993).
From the perspective of industrial specialization variables, the specialization of manufacturing and construction industry can help improve unemployment. For every 1 unit increase in the construction industry, the unemployment rate can be reduced by 0.29%; the regression coefficient of the electricity, gas, water, retail and service industries is positive, indicating that the specialization of these three industries will significantly increase the unemployment rate. For every additional unit of retail and service business, the unemployment rate will increase by 0.73% and 0.44% respectively.

From the perspective of control variables, the regression coefficient of education level is negative, which indicates that the increase of labor human capital level will reduce unemployment rate. There is also a significant negative correlation between government fiscal expenditure and per capita income, which is consistent with theoretical predictions. The government's fiscal expenditure can directly increase employment and reduce unemployment. An increase in per capita income will also increase people’s confidence in their work, thereby reducing the structural unemployment caused by leaving a job to find a new job.

Table 3. The impact of industrial diversity on unemployment rate.

| UR | OLS (1) | FE (2) | FE (3) | FE (4) |
|----|---------|--------|--------|--------|
| div | 0.476(0.112) | 0.491*** (0.086) | -0.323*** (0.039) | -0.308*** (0.069) |
| $S_{ma}$ | -0.863*** (0.099) | -1.664* (0.094) | -0.318*** (0.0817) |  |
| $S_{co}$ | 0.647* (0.223) | 0.042 (0.175) | -0.294** (0.138) |  |
| $S_{el}$ | 0.170*** (0.039) | 0.372*** (0.022) | 0.042** (0.022) |  |
| $S_{tr}$ | 0.426* (0.086) | 0.024 (0.075) | -0.001 (0.058) |  |
| $S_{se}$ | 2.014 (0.191) | 2.980*** (0.136) | 0.730*** (0.119) |  |
| $S_{fi}$ | -0.802 (0.133) | -0.196* (0.050) | 0.003 (0.039) |  |
| $S_{sc}$ | 3.103 (0.146) | 3.74*** (0.111) | 0.442*** (0.115) |  |
| ln sco | -0.591* (0.225) | -0.701** (0.189) | -0.162** (0.062) | -0.421*** (0.149) |
| ln fis | 0.282 (0.036) | 1.804* (0.110) | -0.374*** (0.102) | -0.358*** (0.102) |
| ln inc | -2.202** (0.152) | -2.644** (0.165) | -2.361*** (0.280) | -2.273*** (0.285) |
| City-FE | N | Y | Y | Y |
| Year-FE | N | N | Y | Y |
| Obs | 4009 | 4009 | 4009 | 4009 |
| R-square | 0.478 | 0.782 | 0.870 | 0.873 |

Notes: Numbers in parentheses are standard errors. Superscripts *** and ** indicate significant at the 1%, 5% and 10% levels

Conclusion

This paper uses the city-level panel data from 1980 to 2010 to study the impact of industrial diversity on unemployment rate by using the dual fixed effect model. The main conclusions are as follows: (1) During the research period, the national industrial diversity index is generally decreasing year by year, and the industry specialization and concentration trend are obvious; (2) industrial diversity and unemployment rate are significantly negatively correlated, construction industry, manufacturing The specialization of the industry has improved the unemployment rate and the concentration of the retail and service industries will increase the unemployment rate. (3) The educational level of controlled variables, per capita income, and increased government spending will all reduce unemployment.

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