The Impact of Urban Economic Agglomeration on Urban Unemployment from Spatial Econometric Model

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Abstract. Whether in developed or developing countries, the aggregation of economic enterprises within cities or regions is becoming more and more common. While this aggregation brings benefits to cities and people, there are also problems, such as urban unemployment. Rate. This paper studies the impact of three elements of urban agglomeration-induced changes in urban GDP, urban population mobility, and urban inflation on urban unemployment. In this paper, the method of spatial econometric analysis is used to build a forecasting model to perform linear regression analysis on the data of fifty states in the United States, and to test the built forecasting model. According to the study, there is a positive correlation between changes in urban GDP, urban population mobility, and urban inflatio and urban unemployment.

Keywords: Economic Agglomeration, Unemployment, Forecasting Model

1. Introdiuction

With the globalization of the pandemic, urban agglomeration or industry agglomeration in cities is increasingly occurring in cities around the world. Perhaps the industrial agglomeration of a city will provide various benefits to the city or the region where the city is located, such as higher city visibility, greater talent attraction, or a better-known city label. For example, when it comes to automobiles people think of Detroit, the internet thinks of Seattle, or the tech hub thinks of Silicon Valley. These advantages for cities will lead to more cities willing to join the urban agglomeration. Industry agglomeration in cities brings benefits to cities, but also has certain disadvantages. According to the Core-Periphery theory, urban agglomeration makes people in relatively underdeveloped areas around developed cities more willing to immigrate to developed areas. However, cities in developed areas are more willing to immigrate to developed areas. There are not enough jobs and housing, leaving many unemployed and living in slums, deepening the urban unemployment problem.

Unemployment has always been an important topic of widespread concern to social economists and the government. Solving urban unemployment has always been an important area of socioeconomics, because controlling stable and acceptable unemployment is the basis for ensuring social and economic stability. The increase of urban unemployment may lead to intensified contradictions among urban classes, and social security issues are more seriously threatened or even exacerbated social unrest. Mohamad, Amjad and Marc (2019) [1] used Johansen cointegration method to study the relationship between urban unemployment rate and urban crime rate. The research showed that the number of remittances, industrialization and social infrastructure had a negative and significant impact on the crime rate in the Punjab region. The author concludes in the article that unemployment is the mother of crime. Karin (2005) [2] studied a crime economics theory through a fixed effect model - an increase in unemployment will lead to an increase in the rate of property crime. The author's model model includes time- and location-specific effects as well as some economic and social demographic data as study basic variables to control for unobservable variables and covariates. The authors say the study's findings suggest that an increase in unemployment can lead to an increase in some property crimes. Although these two studies have different research areas and research methods, they both clearly express that the increase of urban unemployment has a huge impact on social stability. Therefore, effective understanding of the reasons for the unemployment rate has always been one of the important topics of economists. Zenou (1999) [3] proposed three

reasons for urban unemployment, he believed that urban unemployment was caused by excessive urban efficiency wages, urban search friction and spatial mismatch. In addition, Zenou (2000) [4] put forward the premise of combining the two theories of urban unemployment and endogenous city formation, through variable control methods (such as the choice of optimal efficiency and efficiency wages) to study fully mobile enterprises and internal Unemployment in cities in the context of employment centers.

This article will combine the background premise of urban economic agglomeration to predict how urban unemployment is affected by urban economic agglomeration through a spatial econometric model. The article will analyze and study the unemployment problem through two parts, namely the review of previous related research, the introduction of prediction models and data, the diagnosis of prediction models (spatial diagnosis and non-spatial diagnosis), and conclusions and prospects. The purpose of this paper is to provide a model that can effectively predict the future unemployment rate in the case of urban agglomeration, help to understand the factors that cause unemployment more comprehensively and effectively seek solutions to urban unemployment.

2. Literature Review

As mentioned in the introduction, the unemployment rate has always received the attention of society and economists, and many scholars are constantly studying the problem of unemployment rate.

2.1 Causes of unemployment

Pan (2018) [5] investigating and analyzing the impact of the stock market on the unemployment rate in countries with different development states (such as developed and developing countries and emerging countries), the correlation between the financial market and the national unemployment rate is analyzed. This survey method fully understands the differences between countries in different states. The authors stated that the results presented a unidirectional causal direction, and the state was strong. In contrast, the relationship between financial securities prices and unemployment in other developed countries is a bilateral causal, albeit strong, relationship. However, in developing and emerging countries, causality tests show that strong Granger causality still exists between unemployment and financial security prices. Robert and Jens (1998) [6] analyzed that the high unemployment rate in Europe led many economists and government officials to praise the rapid job creation and low unemployment rate in the United States, and many economists attributed this achievement in the United States to its relative lack of Regulated labor market. However, data from the US and E-4 (France, Germany, Italy, and the UK) found at the time of the authors' survey suggest that unemployment rates for "golden-age" men are largely consistent with no significant differences, but within and between countries across all countries Unemployment rates for other demographic groups vary widely. The authors say that the control of unemployment in the U.S. (an unregulated labor market) has had a mixed effect on European unemployment, although it has helped some.

2.2 Effects of Unemployment

As introduced in the first part of the article, unemployment can cause some serious social problems. F J Van (2005) [7] analyzed the impact of unemployment on higher mortality in the community through data samples from six countries (United States, Netherlands, United Kingdom, Finland, Italy, and Spain). For different styles of research data, the authors used Cox proportional hazards model to analyze and study the possible correlation of outcomes among people in the same community, and to evaluate the relationship between unemployment and mortality in the community. Through a series of analyses, the authors found that there was a corresponding relationship between living in poorer neighborhoods and all-cause mortality in the United States and five European countries, but not with individual socioeconomic characteristics. Lin (2007) [8] stated that since the OLs model is a research method often used to analyze the impact of unemployment, however, due to endogenous problems,

the author believes that OLS may not fully show the serious impact of unemployment on crime. In the article, the authors use a 2SLS model to estimate the relationship between unemployment and crime. The authors address endogeneity in the model by using instrumental variables of real exchange rates, state manufacturing percentages, and state union membership rates. The authors show that a 1-percentage-point increase in the unemployment rate increases property crime by 1.8% under the OLS method, but the elasticity rises to 4% when using the 2SLS analysis of the relationship between unemployment and crime.

In recent years, research scholars have paid more and more attention to the use of interdisciplinary and information, and more and more economists have paid attention to the unemployment rate under different conditions. Arup and Hajime (2008) [9] studied how the agglomeration economy affects the production technology efficiency of the industry, whether it will affect the unemployment rate of the industry, such as whether the agglomeration economy produces faster economic growth and higher (lower) Employment (unemployment) level. In the study, the authors estimate the technical efficiency index for a specific region based on the stochastic frontier production function framework. Research shows that in most industry groups, efficiency is positively correlated with the external scale variable, that is, efficiency increases as the external model variable increases, or decreases as the external model variable decreases. For some textile industries or manufacturing industries, it has a stronger aggregation effect and aggregation effect. Economic growth is positively related to external size variables, and unemployment declines with growth and concentration. Ali and Zulfiqar (2018) [10] studied the impact of natural resource agglomeration in Pakistan on unemployment in Pakistan from 1980 to 2016. The authors constructed a natural resource index total land area based on non-stop resource types, where natural resources include coal resources, tree resources, agricultural resources, and monk forest resources. The purpose of the authors is to measure the aggregation of natural resources within Pakistan and to study the effect of resource aggregation on the unemployment rate in Pakistan through a cointegration approach. The authors say the study found that the concentration of natural resources was an important factor in reducing unemployment in Pakistan. The authors also acknowledge that there are other factors in agglomeration economies, such as local economic policies and natural resource availability. However, these studies still have some limitations. For example, these studies did not deeply explore the influence of urban factors caused by agglomeration effect on unemployment. This paper will use a spatial econometric model to study the impact of a series of results caused by urban agglomeration on future urban unemployment, find a model suitable for predicting future unemployment, and conduct spatial and non-spatial diagnosis of the model.

3. Method

This paper explores a model that can predict how urban economic agglomeration affects future unemployment. As mentioned in the article, urban economic agglomeration is important for the development of the city and the development of enterprises in the city (for example, agglomeration of enterprises can help companies share effective market information, supply chains, save money, and more easily find what enterprises need employees), and the living welfare of citizens (for example, citizens can more easily obtain a variety of goods or services from agglomeration companies, and citizens can change jobs frequently without changing their place of residence). However, the agglomeration economy leads to the rapid urban expansion will also make the city reach a maximum capacity, resulting in a mismatch between population and resources, leading to a series of social problems such as unemployment. The purpose of this paper is to explore the linear relationship between the unemployment rate and the impact of urban agglomeration, and to help provide more effective forecasts and solutions to urban unemployment.

3.1 Data

3.1.1 Explanatory variables

The purpose of this paper is to find the linear relationship between explanatory variables and dependent variables to build a stable and reliable unemployment rate forecasting model. The first step of the research is to find suitable explanatory variables that are related to urban agglomeration and have the ability to affect future urban unemployment. The first explanatory variable used in this paper is the change in gdp by city. Economic agglomeration within a city will undoubtedly change the city's gdp. As mentioned in the article, economic agglomeration within a city will bring a lot of benefits to businesses and make it easier for citizens in the city to get what they need. All kinds of commodities, these will change the city's economic expenditure and income, and thus change the city's GDP. According to Okun's Law "There is an inverse relationship between changes in unemployment and real gross domestic product (GDP)." It can be determined that changes in urban GDP can be helpful in predicting urban unemployment. Leopold (2001) [11] studied the link between Austrian GDP and unemployment through Okun's law. Preliminary empirical estimates based on U.S. data suggest that 2 to 3 percent above natural or average GDP growth leads to a 1 percentage point drop in unemployment, and vice versa. The authors estimated the regression model through the Markov Chain Monte Carlo method, and by analyzing the Austrian study data, the results showed that a GDP growth rate of more than 4.16% reduces the unemployment rate by 1 percentage point. By analyzing the data, the authors point out that the relationship between unemployment and GDP growth shows a stable relationship in the Austrian economy.

The second explanatory variable used in this paper is the population flow data of the city. Similar to the change data of GDP, the population flow data will also be affected by the economic agglomeration within the city. Good development and opportunities, the rapid development of the city will attract more immigrants to the city than the city with a slower development rate, at the same time, according to the first explanatory variable used in the article, the population is more willing to join the GDP A city or region with positive growth is compared to a city or region with stagnant or negative GDP growth. Damba (2010) [12] analyzed the linear relationship between high mobility across states and unemployment across states by using a multi-sector equilibrium model to study the impact relationship between population relocation and overall unemployment and welfare. The authors state that the model can explicitly handle both net and total mobility data for the population (labor) in the study area and job friction in the market within the study area. By presenting a U-shaped function between the unemployment rate and the cost of population mobility within the study area. In addition, Marusca and Guido (2015) [13] indicated that urban net population change data can provide an analytical index to measure the external pressure on the regional labor market in the study of urban unemployment rate and help the data to better run in predict model of the unemployment rate.

Inflation is the third explanatory variable used in this paper. Economic agglomeration within a city will lead to changes in the city's economic and financial structure, resulting in changes in the regional currency market. This can prove that inflation is also the result of economic agglomeration within a city. At the same time inflationt also has an impact on urban or regional unemployment. Fumitaka and Qaiser (2014) [14] supported the validity of the Phillips curve hypothesis through data research and analysis on the Malaysian region. The Phillips curve is a trade-off relationship for the negative correlation between two variables, unemployment, and inflation, proposed by William Phillips in 1958. Focusing on the Malaysian region, the author said the study found a balanced relationship between unemployment and inflation in Malaysia.

3.1.2 Data Resources

Table 1 shows the data types, data sizes, and data sources of the explanatory variables in this paper. Include the forecast employment for each observation, which includes financial insurance, educational services, agriculture, forestry, fishing and hunting, mining, etc.); Table 1 includes GDP change data for fifty states in the United States, and the unit of the data set is US dollars; the United

States five Changes in population data for ten states, and inflation data for U.S. The dependent variable studied in this paper is the projected future unemployment rate in the United States. The research purpose of this article is to hope to find the spatial linear relationship between the dependent variable and the explanatory variable. Find the most suitable research method and more suitable model structure through different linear equations.

Table 1. explanatory variable

Table credit: Original

Variable	Description	Data Type
GDP change	Annual changes in Gross Domestic Product in 50 States	CSV file
Population	Annual population movements in 50 States	CSV file
Inflation percentage	Inflation rate	CSV file

3.2 Model

In order to study the linear relationship between the unemployment rate and urban agglomeration, the article adopts the analysis method of ols regression. Equation 1 [15] shows the linear analysis method adopted in the study. In this formula, each symbol has its meaning. Y is the dependent variable (representing the analytical value of the predicted unemployment rate studied in the article), β0 is the intercept of the model (shows a linear relationship between the dependent variable and the explanatory variable, such as a positive or negative correlation), and X j corresponds to the model's The jth explanatory variable (j=1 to p), e is a random error with an expectation of 0 and a variance of σ^2. Equation 1: $Y = \beta 0 + \Sigma j=1..p\ \beta jXj + \varepsilon$

3.3 Research steps

This article mainly uses three methods to model the future unemployment rate in the United States and test the predictive power of the forecasting model. First, I use Exploratory Data Analysis (EDA) to perform basic data analysis on explanatory variable data (such as the distribution of the data, the correlations that exist within the data), which helps to understand whether the research data is useful for analyzing and predicting the data and the research data is enough. Next, I will perform a standard linear regression (OLS regression) on the explanatory and dependent variables to see the research value of the data in the analytical model. Finally, I will perform diagnostics on standard linear regression to ensure the accessibility of the research model and the accuracy of the predicted results. Based on literature reading and research, this paper predicts that there is a correlation between explanatory variables and dependent variables, that is, urban economic agglomeration will lead to or affect changes in Brunei's urban unemployment rate.

4. Results

Table 2 shows the results of data Exploratory Data Analysis (EDA) for explanatory variable data. Through Exploratory Data Analysis, the distribution of research data can be more clearly and intuitively understood. For example, the minimum value of the population mobility ratio for the study data is -0.053 and the maximum value is 0,211. This represents the research data of 50 states, some of which have negative population growth, and the state with the most negative growth has a population loss rate of 0.053. Some states have positive population growth, and the state with the largest population inflow has a population inflow rate of 0.211. In addition, the table also shows that, for example, the median of population flow is 0.048, and the mean is 0.07. Research data distribution is an important method to test whether the data is sufficient and representative for the research question.

Table 2. The results of data Exploratory Data Analysis (EDA)

Table credit: Original

Variable/analysis	*Population moving rate*	*GDP change rate*	*Inflation rate*	*Unemployment rate*
Min.	-0.053	-0.300	-0.356	0.019
1 st Qu	0.017	1.400	2.405	0.028
Median	0.048	2.050	3.429	0.034
Mean	0.070	2.148	4.114	0.035
3 rd Qu	0.122	2.775	5.255	0.042
Max	0.211	5.700	13.55	0.053

The second finishing step of the article for explanatory variables is Test for Multicollinearity with a Correlation Matrix. Table 3 shows the Correlation relationship between the three explanatory variables. According to the Correlation Matrix, the larger the value, the stronger the correlation between the two data, that is, the more likely there is multicollinearity between the variables. Figure 1 shows that the maximum Correlation value between the three variables is 0.28 and the smallest is 0.05, which indicates that there is no multicollinearity among the three explanatory variables used in this paper, which can prove that the research data used in this paper are sufficient and have sufficient Feasible enough and doesn't create an overfitting problem.

Table 3. Correlation Matrix

Table credit: Original

Variables/Variables	*Population moving rate*	*GDP change rate*	*Inflation rate*
Population moving rate	1.00		
GDP change rate	0.05	1.00	
Inflation rate	0.25	0.28	1.00

The article uses R studio to analyze the OLS regression data between the explanatory variables (the ratio of population mobility variables, GDP change rate and inflation) and the dependent variable (future urban unemployment rate) to build a predictive model. The analysis results preliminarily confirmed the previous conjecture of the article, that the consequences of urban spatial economic agglomeration will aggravate urban unemployment in the future. The ols results show that there is a positive correlation between population mobility, changes in GDP, and inflation and unemployment. That is to say, when the population in a city or region increases, the rate of change in GDP is small or inflation increases, the future unemployment rate in the city or region will increase. According to the coefficient of the explanatory variable, the population flow data has the greatest impact on the future urban unemployment rate, and the inflation data has the least impact on the future urban unemployment rate. OLS regression analysis can provide a clear influence relationship between explanatory variables and dependent variables and the availability of explanatory variables. For example, the correlation between the population mobility change ratio data and the future unemployment rate is 0.009, which means that when the population mobility change ratio increases by 1%, the urban or regional unemployment rate will increase by 0.009% accordingly. Table 4 shows the relationship between explanatory variables and dependent variable.

Table 4. Relationship between explanatory variables and the dependent variable

Table credit: Original

Variable/Coefficient	*Estimate*	*Std. Error*
(Intercept)	0.2533	0.0026
Pop	0.0099	0.0159
GDP	0.0037	0.0009
Inflation	0.0002	0.0004

Next, the article uses three research methods (AIC test, stationarity test and heteroscedasticity test) to diagnose the prediction model and ensure the accuracy and reliability of the model. First, the article chooses to use the AIC value to determine whether the model is the most effective, that is, whether the explanatory variables of the model can analyze the results of the dependent variable most accurately and comprehensively, and whether the explanatory variables in the model are necessary. and sufficient. The article uses the R code: m2=step (standard linear regression) to detect the AIC value for each linear model. According to the usual situation, when the value of AIC is smaller, it proves that the linear model has better research effect. In this study, we will compare the AIC values of the three linear analysis models for urban unemployment forecast and find a more suitable analysis method. In my predictions, the AIC value of the original analytical model of the three study variables should be the largest. Through research, the original AIC value was -475.82. When one explanatory variable was dropped, the AIC value increased to -477.48. When there was only one explanatory variable, the AIC value was -478.83. The research results show that when the article drops the explanatory variable, in other words, the research model composed of three explanatory variables (the ratio of population mobility variables, the rate of change in GDP, and inflation) is the current model in predicting the relationship between urban unemployment. optimal.

The article uses the Augmented Dickey–Fuller (ADF) t-statistic test to test the stationarity of the time series of explanatory variables. The stability of the time series can avoid the research results because the time series of explanatory variables causes unpredictable results due to unstable factors and ensures the credibility and rationality of the research results. The article uses r studio to test the stationarity of the prediction model. The results show that the Test statistic is -2.1048 and the P-value is 0.0293. Because the p-value is less than 0.05, the hypothesis can be rejected. In other words, the time series of the explanatory variables of the article are stationary, and the data of the explanatory variables have constant changes over time. Table 5 shows the result of Augmented Dickey–Fuller (ADF) t-statistic test.

Table 5. result of Augmented Dickey–Fuller (ADF) t-statistic test

Table credit: Original

Test summary	*Dickey- Fuller*	*Lag order*	*p-value*
Test result	-2.1048	2	0.0293

Finally, the article uses the Breusch-Pagan test to test the performance of the predictive model. The article uses the R code: bptest (standard linear regression) to detect the value for the model. The heteroscedasticity test is an important check in the ols model or a criterion for measuring the reliability of the model. If the prediction model violates the homoscedasticity assumption, the results of the regression model of the research question may be unreliable. Especially the significance of regression coefficients. The article uses the Breusch-Pagan test method to test the prediction reliability of the unemployment rate prediction model. The results were shown to have a BP value of 3.8957, df = 3, p-value = 0.1426, because the value of the test statistic (BP) was small and a p-value greater than 0.05 indicated that the p-value was not significant. Therefore, the null hypothesis is not rejected, and the residuals are homoscedastic. Table 6 shows the result of Breusch-Pagan test.

Table 6. The result of Breusch-Pagan test

Table credit: Original

Test summary	*BP*	*df*	*p-value*
Test result	3.375	3	0.185

5. Conclusion

By measuring the impact of the three potential consequences (population mobility variable ratio, GDP change rate and inflation) caused by urban economic agglomeration on the future unemployment rate of the city, the ols regression model is used to predict the relationship between

the explanatory variables and the dependent variables. establishment. During the research process, the article found that there is a positive correlation between the variable ratio of population mobility, the rate of change of GDP and inflation and the future unemployment rate of the city, which means that the urban economic agglomeration will lead to further aggravation of the future unemployment rate of the city. This confirms the previous point of the article. While urban economic agglomeration brings benefits to the city and its residents, it also brings some disadvantages (such as increasing urban unemployment, increasing social unrest, etc.). In order to test the rationality, accuracy and reliability of the forecasting model, the paper carried out AIC test, stationarity test and heteroscedasticity test for the forecasting model. The research results show that the time series of the forecasting model of the article is stationary, and the residuals are homoscedastic. It is valid and necessary for poor and three explanatory variables. The purpose of this paper is to provide a new way of thinking to understand and predict the urban unemployment rate in the future, to provide a solution to the urban unemployment rate and to alleviate the social problems caused by the urban unemployment rate.

6. Future Outlook

After completing the research of this project, the research methods and data of this paper still have some problems or limitations. First, the interaction between variables has not been studied. The variables of socioeconomics are not completely independent variables, in other words, they are spatially dependent on each other. For example, changes in population may change with changes in GDP. To solve this limitation, the article can perform spatial data analysis on the dependencies between variables in the future, such as neighbor data or standard linear regression. Understanding the dependencies between variables is more helpful for us to understand the impact of research variables on urban unemployment. Another limitation is that the number of research variables in the article is not sufficient. Urban unemployment is a complex socioeconomic issue, and the three research variables (GDP change, population, and inflation) do not fully explain changes in urban unemployment. For example, in Figure, it can be found that the unemployment rate in the United States has a sharp rise and fall between April 2020 and June 2021, but this is not perfect in the research variables (GDP change, population and inflation) 's explanation. The solution to this limitation is to find more research variables related to urban unemployment in future articles to help better understand and predict the impact of urban agglomeration-induced economic agglomeration on urban unemployment.

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