Urban Resilience and Export Resilience: 38 Customs Cities Based on the Epidemic

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Abstract: Under the impact of a new round of epidemic, my country's exports have been affected again, and how to maintain the stability of exports has become the top priority. Taking the epidemic in 2020 as the external shock, this paper studies the role of urban resilience of 38 customs cities in maintaining the stability of the city's exports. At the same time, it specifically analyzes the role of the four dimensions of urban resilience on export resilience, and discusses the impact of first-tier cities and new first-tier cities on the export resilience. The impact of this role, and finally provide credibility recommendations for the government based on the conclusions.

1. Introduction

In 2022, the mutant strain of Omicron will make a comeback, sweeping the world again, causing huge economic losses. Especially for the Shanghai area of China, strict epidemic prevention measures have restricted roads in many places, and it is difficult for trucks to enter the wharf to unload goods, which brings great challenges to exports and arouses widespread concern in the society. Due to the characteristics of the new crown epidemic that is easy to mutate and spread easily, it cannot be ruled out that the possibility of the epidemic invading our country again or even repeatedly. In this context, how to maintain normal export activities under the impact of the external environment of the epidemic has become the focus of domestic and foreign scholars. .

As early as 2002, in order to cope with the challenges of the external environment, the International Council for Regional Sustainable Development (ICLEI) first proposed to bring the concept of “resilience” into urban disaster prevention and control at the United Nations General Assembly, and defined urban resilience as urban resistance. Disaster capacity and ability to recover from disasters. (Hu Zhichao, Wang Xinxi, Zhang Jian, Huang Shengxiong. Urban Resilience Evaluation System and Improvement Strategies) In my country, this research is relatively late. In the National Earthquake Science and Technology Innovation Project published by the China Earthquake Administration in 2017, it was first proposed at the national level. 's urban resilience building plan. However, with the external shock brought by the epidemic, my country has gradually strengthened its emphasis on urban resilience construction. At the Fifth Plenary Session of the 19th Central Committee in December 2020, the document on urban resilience construction was once again passed. Urban resilience is becoming a hot topic of discussion among scholars at home and abroad. Especially in the context of the normalization of epidemic prevention and control, the role of urban resilience in epidemic prevention and control has extremely high research value and practical significance.

Although a large number of literatures at home and abroad have studied urban resilience, most of the literatures focus on the measurement method of urban resilience and the spatial distribution of urban resilience. There are relatively few studies on the resumption of economic activity in China.

In order to make up for the lack of such research literature, this paper will take the outbreak of the new crown epidemic in December 2019 as the background, take one year as the research period, and use the ratio of the actual export value in 2020 to the estimated annual export value in 2020 as the export value An indicator of resilience, which explores the impact of urban resilience in China's

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38 customs cities on the degree of export recovery. The advantages of using China as the research object are as follows: first, in China, the prevention and control policy of home isolation was almost uniformly adopted in the initial stage, and the impact of the epidemic on each city was relatively uniform; second, due to the strict control and road closure measures by the Chinese government, the It is more difficult for cities to maintain normal export activities, which can clearly distinguish the role that different levels of urban resilience play in export resistance and resilience, and avoid the difficulty of maintaining normal exports. The status of exports; the last outbreak of the epidemic in China was at the end of 2019, so it can be considered that the annual export value before 2019 was the export value that was not affected by the epidemic, and the annual export value in 2020 was the export value that was hit by the epidemic. The annual export value in 2020 without the impact of the epidemic is predicted and compared with the actual export value as an indicator of export resilience.

The study shows that higher urban resilience leads to a higher degree of export recovery within a 1-year period. Under the robustness test, this conclusion is still valid and significant. Afterwards, this paper conducts heterogeneity and mechanism analysis to find the impact mechanism of urban resilience on export recovery. This paper mainly studies the following questions: First, can a city with high urban resilience significantly improve the export resilience of the city? Second, which of the four dimensions of urban resilience play a significant role in urban export resilience? Third, does urban resilience play an equal and qualitative role in the export resilience of first-tier cities, new first-tier cities, and other cities? Fourth, what policy recommendations should be put forward in response to the above analysis?

2. Literature Review

The discussion on the definition of urban resilience has not stopped. In traditional literature, urban resilience is often associated with engineering resilience, focusing on the ability of roads, buildings and other entities to withstand disasters and their ability to restore to their original state after being hit by disasters. On the basis of this concept, the existing literature has paid more attention to non-entities such as economy and ecology, and defined urban resilience as a highly complex adaptive system. For example, the American Rockefeller Foundation believes that urban resilience is a A system of people, communities, institutions and industries that can demonstrate the ability to recover, adapt and continue to develop when subjected to various external shocks. This paper considers urban resilience as a system that can maintain the normal operation of a city's physical equipment and non-physical activities when it is hit by a disaster.

The research on the measurement method of urban resilience has been in-depth, but at present, there is still no unified measurement method. When urban resilience is considered as a process, it generally adopts the method of constructing performance and production function to show the change of urban resilience over time. For example, Simmie (Simmie) proposed to use the change of GDP or employment rate after disasters to reflect the economic resilience of cities; Cimellaro et al. (Cimellaro et al.) constructed a performance function, which is surrounded by the abscissa and ordinate. The area of is used as a specific value of urban resilience. When urban resilience is regarded as a state, it is generally measured in two ways: one is the post-disaster recovery time or the degree of post-disaster recovery as a measure. The power outages and re-power supply in the regions hit by typhoons are used as indicators; the second is to build an indicator system for measurement. For example, when Liu Yanping (2021) measured urban resilience with a sample of 288 cities in China, he proposed that the urban resilience development index is determined by cultural resilience. , economic resilience, social resilience, environmental resilience, image resilience 5 first-level indicators and more than 20 second-level indicators and more than 70 third-level indicators.

On the whole, domestic scholars are more and more inclined to build an indicator system to measure urban resilience, but there are still some differences in the selection of first-, second-, and third-level indicators among scholars. For example, Rongzhi (2021) chose spatial resilience, governance resilience, social resilience, institutional resilience, and digital resilience as primary

indicators when building urban health security resilience; Zhang Mingshun (2018) used economic resilience, social resilience, Community capacity resilience, infrastructure resilience, ecological environment resilience, and institutional resilience are used as primary indicators; Bai Shuai (2022) and many other scholars use economic resilience, social resilience, ecological resilience, and infrastructure resilience as primary indicators.

Scholars at home and abroad have begun to explore the relationship between urban resilience and disasters, but most of the research is on disasters that cause physical damage to cities. For example: Du Jinying (2020) built a tropical cyclone disaster risk assessment system and an urban resilience assessment system based on the tropical cyclone disasters that occurred in the Pearl River Delta region from 1989 to 2018, and concluded that due to the high disaster risk, the existing Urban resilience is not enough to resist disasters, so it is imminent to improve urban resilience; Zang Xinyu (2021) established an urban disaster resilience evaluation system applicable to the three types of disasters by analyzing the disturbance mechanism of earthquakes, fires, and rainstorms. And determined the weight of each indicator; Luo Ziyuan (2021) concluded that cities with high urban resilience significantly reduced the risk of typhoon storm disasters by analyzing the typhoon storm disasters in 7 southeastern coastal provinces and cities. With the outbreak of the epidemic, the research on urban resilience against the background of the epidemic has gradually been carried out. For example, Liu Chengkun (2021) took the SARS epidemic as the background and took 11 cities in the Guangdong-Hong Kong-Macao Greater Bay Area as samples to analyze the economic recovery status of each city under the impact of the epidemic, and found that areas with a diversified industrial structure had higher rates after suffering from the epidemic. economic resilience. However, in general, the literature on urban resilience in the context of the epidemic is relatively small.

Exports are an important part of cities, and domestic scholars have also tried to link the concept of resilience with exports. At present, scholars have a relatively unified understanding of export resilience, that is, it is necessary to examine both the ability of exports to avoid decline after disasters (resistance) and the ability to recover exports after disasters (resilience). However, there are still major differences in the measurement of export resilience. For example, Wang Wenyu (2021) used the annual export growth rate as an indicator of export resilience to explore the impact of market-related diversification on export resilience; Liu Hui (2021) used annual export growth rate as an indicator of export resistance, and export growth rate The time to recover from a negative value to a positive value is used as an indicator of export resilience, and resistance and resilience together constitute export resilience. Other scholars have also tried to explore the relationship between urban resilience and exports. For example, Wang Shiping (2016) took 286 cities at the prefecture level and above in China as the research object, and found that urban resilience significantly promoted the growth of exports.

To sum up, there has been some research on urban resilience and export resilience. There are many studies on urban resilience, but most of them tend to focus on the construction of its index system and the resilience of urban resilience to disasters such as floods and earthquakes. Few literatures study urban resilience in the context of the epidemic. The research on export resilience is generally unified, but there are differences in specific measurement methods, and the number of literatures is relatively small. There is little literature linking urban resilience to export resilience. The main innovations of this paper are: (1) to study the relationship between urban resilience and export resilience in the context of the epidemic, to supplement the gaps in the existing literature; (2) this paper innovates on the existing export resilience, and proposes to use the actual export volume The ratio with the predicted export value is used as a measure of export resilience; (3) Analysis of the role of urban resilience on export resilience is also conducive to providing solutions for China to maintain export stability under the epidemic. Therefore, this paper not only supplements the existing literature and innovates the measurement method, but also has high practical significance and provides a theoretical basis for policy formulation.

3. Data

3.1 Data Sources and Processing

The data of this article comes from the China Economic Net database and the EPS database, of which the data of the China Economic Net database comes from the monthly customs database published by the General Administration of Customs of China, which has monthly import and export data of each customs city; Urban Statistical Yearbook, which has annual data such as urban GDP, emissions and disposal of various pollutants. Since the indicators in the statistical yearbooks of various cities in China are not uniform and are prone to problems such as missing data, this paper selects the indicators that are available in all cities as much as possible. The data predicts 2019 figures.

3.2 Construction of the Measurement Model

This paper draws on the model of scholar Wang Shiping, takes the logarithm of the explanatory variable, the explained variable and the control variable, and obtains the following model:

$$LnResexport=\beta_0+\beta_1 LnRescity+LnX+\gamma$$

Among them, Resexport represents the export resilience of a city, Rescity represents the urban resilience of a city, and its coefficient β1 represents the effect of urban resilience on export resilience. If β1 is greater than 0, it means that cities with higher urban resilience are in In the event of a disaster, export activities can be maintained to a greater extent. X represents the control variable and γ represents the random error term.

3.3 Variable Description

1) Export toughness. Domestic scholars believe that export resilience refers to the ability of export volume to return to its original level. Usually, the growth rate of export volume is used as a measure of export resilience. However, foreign scholars have proposed that export volume should not only return to its original state. , but also to return to the expected state without external shocks. This article adopts the viewpoints of foreign scholars, calculates the annual average growth rate of export value based on the annual export value data from 2015 to 2019, and predicts the annual export value value in 2020 without the impact of the epidemic. If it is measured in terms of growth rate, there will be many sample cities with negative growth rates, which cannot be logarithmic. Therefore, this paper compares the annual export value actually affected by the epidemic in 2020 with the predicted annual export value in 2020, as An indicator of export resilience.

2) Urban resilience. This paper adopts the index system commonly used by domestic scholars and divides urban resilience into four dimensions: economic resilience, social resilience, ecological resilience and infrastructure resilience. In the selection of specific index layers, the literature of domestic scholars was consulted, and the number of beds in medical and health institutions per unit of population, the proportion of total retail sales of social consumer goods in GDP, per capita GDP, the comprehensive utilization rate of general solid waste, and the per capita urban consumption electricity consumption, etc. 20 indicators as secondary indicators. In order to avoid the bias caused by subjective weighting, this paper adopts the entropy method to objectively weight the secondary indicators according to the degree of dispersion of the data. The specific indicators and weights are shown in the following table 1.

3) Control variables. When studying exports or export resilience, urban labor productivity, urban human capital, urban infrastructure construction level, urban GDP, etc. are usually used as control variables. However, since the above variables have been included in the measurement of urban resilience in this paper, it is decided to use urban agglomeration. size as a control variable. Referring to the measurement method of Qian Xuefeng (2012), the density of non-agricultural population is used as an indicator of urban agglomeration scale.

Table 1 Index System of Comprehensive Measurement of Urban Resilience

	first-level indicator	Secondary indicators	Weights
urban resilience	social resilience (0.2212068)	Number of beds in medical and health institutions per population	0.0286325
		Basic medical insurance coverage	0.0665022
		Total retail sales of social consumer goods as a percentage of GDP	0.0553768
		population growth rate	0.0285148
		The proportion of the unemployed	0.0421805
	infrastructure resilience (0.3130708)	Number of Internet users per 10,000 people	0.0412805
		Electricity consumption per capita in urban life	0.0392915
		Industrial electricity consumption per capita	0.1035371
		library collection	0.1289617
	economic resilience (0.4013682)	GDP per capita	0.0486079
		The added value of the tertiary industry as a percentage of GDP	0.0429444
		Total fixed assets	0.0712913
		Expenditures within the general budget of local finance	0.1457956
		Year-end balance of savings of urban and rural residents	0.092729
		Harmless treatment rate of domestic waste	0.0071736
		Comprehensive utilization rate of general solid waste	0.020498
		Centralized treatment rate of sewage treatment plant	0.0082735
		Industrial wastewater discharge	0.0128219
		Industrial SO2 Emissions	0.0071407
		Industrial soot emissions	0.0084466

4. Empirical Analysis

4.1 Basic Results

The basic regression results of urban resilience and export resilience are shown in the figure below. The coefficient of the core explanatory variable urban resilience is significantly positive at the level of 1%, indicating that urban resilience can significantly improve export resilience. %, the export resilience will increase by 0.226%.

Table 2 Basis Regression

	(1)
VARIABLES	LnResexport
LnRescity	0.226***
	(3.557)
LnX	0.0750**
	(2.042)
Constant	-3.462***
	(-3.303)
Observations	38
R-squared	0.390

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Robustness Check

1) Measure export resilience in terms of annual growth rates. This paper proposes its own method on the measurement of export resilience, and now uses the methods of other domestic scholars to measure export resilience, and conducts regression again. The results are as follows: the coefficient of the core explanatory variable urban resilience is still positive and significant at the 5% level, so this paper believes that the conclusion is still valid.

Table 2 Robustness Test 1

	(1)
VARIABLES	Increaserate
LnRescity	0.126**
	(2.690)
LnX	0.0594**
	(2.177)
Constant	-1.781**
	(-2.227)
Observations	38
R-squared	0.282

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2) Use recovery time as an indicator of export resilience. Export resilience generally includes two capabilities: resistance and resilience. Liu Hui (2021) uses the annual export growth rate as the resistance indicator, and the recovery time as the resilience indicator. This article will take 1 as the limit, from when the ratio of the actual export value to the expected export value is less than 1 for the first time as the start time, and when the ratio is greater than 1 for three consecutive months as the end time. That is, if the ratio of the actual export value to the estimated export value in the Mth month is less than 1 for the first time, the ratio is greater than 1 in the M+N month, and is still greater than 1 in the following two months, the recovery time is considered to be N months.

Table 3 Robustness Test 2

	(1)
VARIABLES	Restime
LnRescity	-2.470***
	(-3.026)
LnX	-0.963
	(-1.620)
Constant	44.96***
	(3.178)
Observations	37
R-squared	0.293

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3 Heterogeneity Test

This paper divides 38 customs cities into first-tier cities, new first-tier cities and other cities, and sets up dummy variables to build a new model for regression.

$$LnResexport=\beta_0+\beta_1 LnRescity+\beta_2 LnX+\beta_3 LnRescity*Dum1+\beta_4 LnRescity*Dum2+\gamma$$

Among them, if it is a first-tier city, β3 is assigned a value of 1, and β4 is assigned a value of 0; if it is a new first-tier city, β3 is assigned a value of 0, and β4 is assigned a value of 1; if it is another city, both are 0. The test results are shown in the table below. The coefficients of β3 and β4 are both negative, which means that first-tier cities and new first-tier cities play a smaller role in promoting urban resilience to export resilience than other cities. Considering the significance and the magnitude of the coefficient, this paper argues that the urban resilience of first-tier cities plays a smaller role in promoting export resilience.

Table 4 Heterogeneity Tests

	(1)
VARIABLES	LnResexport
LnRescity	0.327***
	(3.931)
LnX	0.121***
	(3.030)
Dummy variable for first-tier cities *LnRescity	-0.0305***
	(-2.841)
Dummy variable for new first-tier cities *LnRescity	-0.00381
	(-0.772)
Constant	-4.790***
	(-3.714)
Observations	38
R-squared	0.464

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.4 Mechanism Analysis

Urban resilience is composed of multiple systems of economy, ecology, society and infrastructure. This paper replaces urban resilience with economic resilience, ecological resilience, social resilience, and infrastructure resilience in turn, and examines the role of each system in export resilience.

Table 5 Mechanism Analysis 1

	(1)
VARIABLES	LnResexport
LnReseconomy	0.226***
	(3.556)
LnX	0.0750**
	(2.042)
Constant	-3.462***
	(-3.303)
Observations	38
R-squared	0.390

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

It can be seen from the above table that economic resilience plays a role in promoting export resilience. For every 1% increase in economic resilience, export resilience increases by 0.226%. Wang Yonggui (2020) defines economic resilience. He believes that economic resilience is the ability of cities to make adjustments in the face of shocks to maintain high-quality and healthy economic development. According to this definition, it is not difficult to see the impact of economic resilience on export stability. Under the influence of the epidemic, it is difficult for cities with low economic resilience to resume work and production normally due to the lack of workers, which will lead to the transfer of foreign orders to other countries, which will lead to a significant decline in exports and a longer recovery time, which will lead to lower Export resilience. This is similar to the views of other scholars. For example, Zhao Chunyan (2021) analyzed the relationship between urban economic resilience and exports and found that in the context of external shocks, urban economic resilience can reduce its adverse impact on exports.

Table 6 Mechanism Analysis 2

	(1)
VARIABLES	LnResexport
LnResecology	0.124***
	(3.349)
LnX	0.177***
	(4.084)
Constant	-0.110
	(-0.549)
Observations	37
R-squared	0.347

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ecological resilience also plays a significant role in promoting export resilience, but the promotion effect is smaller than that of economic resilience. For every 1% increase in ecological resilience, export resilience increases by 0.124%. Yuan Xiaoling (2019) found that environmental regulation not only improves the ecological environment, but also promotes the upgrading of the local industrial structure and the development of high-end industries. Therefore, this paper believes that the higher the ecological resilience, the more high-end industries in the city and the more competitive the industrial structure. Therefore, in the early stage of the epidemic, it was difficult for foreign consumers to find suitable substitutes in other countries, which affected exports. of a smaller magnitude.

Table 7 Mechanism Analysis 3

	(1)
VARIABLES	LnResexport
LnResinfrastructure	-0.0699
	(-0.567)
LnX	0.199**
	(2.244)
Constant	1.220
	(0.962)
Observations	38
R-squared	0.270

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Infrastructure resilience has a negative impact on export resilience, but the results are not significant. Similar to engineering resilience, infrastructure resilience refers to a city's ability to absorb external shocks and adapt to adapt and transform them to sustain the recovery of urban infrastructure. Infrastructure is the material basis for urban operation, but since the epidemic has not caused great damage to urban infrastructure, this paper believes that infrastructure resilience will not have an impact on export resilience in disaster shocks that are not physically damaged.

Table 8 Mechanism Analysis 4

	(1)
VARIABLES	LnResexport
LnRessociety	-0.325
	(-1.537)
LnX	0.195***
	(3.352)
Constant	0.954**
	(2.564)
Observations	38
R-squared	0.309

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Social resilience also had a negative impact on export resilience, again with insignificant results. Zhao Fangdu (2018) incorporates social resilience into the scope of social mechanisms, arguing that in the face of external shocks, the social system has the ability to maintain the stability of the social structure. Wang Sibin (2016) believes that social resilience will have an impact on the economy, but no scholars have studied the impact of social resilience on exports. This paper believes that social resilience will not affect export resilience.

5. Conclusions and Recommendations

This paper measures urban resilience from the four dimensions of economy, society, infrastructure and ecology, and innovatively defines export resilience as the ratio of actual export value to projected export value, explores the relationship between urban resilience and export resilience, and finally obtains The following conclusions are drawn: First, urban resilience has a significant role in promoting export resilience, that is, the stronger the city's ability to cope with disasters, the easier it is for exports to maintain a stable state. This conclusion is still significantly established after changing the measurement method of export resilience; Secondly, economic resilience and ecological resilience in urban resilience play a significant role in promoting export resilience, but the role of economic resilience is greater than that of ecological resilience, while infrastructure resilience and social resilience play an insignificant role in export resilience. This paper believes that it will not have an impact on export resilience. Finally, in the heterogeneity test, it is found that compared with other cities, first-tier cities and new first-tier cities have a negative impact on the promotion of urban resilience on export resilience. The impact of first-tier cities is significant, and the impact of new first-tier cities is small and insignificant.

In response to the above conclusions, this paper puts forward the following suggestions: First, the government is in the right direction to vigorously develop the construction of resilient cities, and should continue to increase construction efforts, which is conducive to maintaining export stability under the normalization of epidemic prevention and control; second, compared with The construction of infrastructure resilience and social resilience should pay more attention to the construction of economic resilience and ecological resilience, especially the construction of economic resilience, which will significantly promote the improvement of export resilience; finally, the government should focus on the construction of resilient cities on the front line and In cities after the new first-tier cities, increasing investment in these cities will have a greater effect on maintaining export stability than investing in first-tier and new first-tier cities.

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