



Article Cross-Border E-Commerce and Urban Entrepreneurial Vitality—A Quasi-Natural Experiment Evidence from China

Qigang Yuan¹, Yongsheng Ji^{1,*}, Wei Zhang² and Ting Lei¹

- ¹ School of International Trade and Economics, Shandong University of Finance and Economics, Jinan 250014, China; yuanqigang107@foxmail.com (Q.Y.); tinglei0629@126.com (T.L.)
- ² School of Business, Shandong Yingcai University, Jinan 250104, China; xf237@163.com
- * Correspondence: yongshengj310@163.com; Tel.: +86-182-5418-0815

Abstract: Cross-border e-commerce, as a new form of trade driven by digital technology, provides an opportunity to enhance the entrepreneurial vitality of cities. With the help of the comprehensive pilot area for cross-border e-commerce, also called a "quasi-natural" experiment, and using 2010–2020 panel data and Chinese business enterprise registration data for 278 cities in China, this paper examined the impact of cross-border e-commerce on enterprise vitality. The study found that the pilot policy in the comprehensive pilot area promoted the entrepreneurial vitality to increase by about 13.3%, and it remained stable after a series of tests. The heterogeneity analysis shows that the pilot policies in the comprehensive pilot areas have a stronger effect on the promotion of enterprise vitality in the eastern and western regions. At the same time, the pilot policy has expanded the scope of enterprise subjects and plays a more prominent enterprise incentive effect in small and medium-sized cities, cities with low innovation, and small and medium-sized registered enterprises. In addition, the pilot policy stimulates the entrepreneurial vitality of the service industry, but has no significant impact on agriculture and manufacturing. In terms of the influence mechanism, the comprehensive pilot area mainly affects the entrepreneurial vitality by means of optimizing the business environment, reducing the entry cost, promoting the synergistic agglomeration of manufacturing and producer services, and stimulating market demand. The further spatial spillover effect found that the comprehensive pilot area not only improves the entrepreneurial vitality of the pilot cities, but also radiates the enterprise development of neighboring and surrounding cities with similar economic development.

Keywords: sustainable business models; cross-border e-commerce comprehensive pilot area; entrepreneurial vitality; business environment; spatial spillover effects

1. Introduction

In the era of the digital economy, the deep integration of digital technologies such as artificial intelligence, big data, and blockchain with international trade has given rise to a new trade format known as cross-border e-commerce, fostering innovation in production methods and business models. According to China Customs data, China's cross-border e-commerce trade volume increased from USD 0.36 trillion in 2015 to USD 2.11 trillion in 2022, with an average growth rate of 34.55% [1]. Additionally, the number of entities engaged in cross-border e-commerce has exceeded 100,000, accompanied by the emergence of various listed companies and unicorn enterprises. According to the Digital Economy Unicorn Development Report of 2023 [2], there are a total of 273 unicorn enterprises focused on the digital economy fields such as big data, cloud computing, artificial intelligence, and the Internet of Things. It is evident that the disruptive innovation of trade patterns has stimulated entrepreneurship and provided new opportunities for promoting sustainable development.

Currently, sustainable development has become a basic guiding principle for economic activities due to severe environmental pollution and resource scarcity. As an environmentally-friendly trade format, cross-border e-commerce contains elements of



Citation: Yuan, Q.; Ji, Y.; Zhang, W.; Lei, T. Cross-Border E-Commerce and Urban Entrepreneurial Vitality—A Quasi-Natural Experiment Evidence from China. *Sustainability* **2024**, *16*, 1802. https://doi.org/10.3390/ su16051802

Academic Editors: Peng Zhou and Bo Zhang

Received: 5 January 2024 Revised: 17 February 2024 Accepted: 19 February 2024 Published: 22 February 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). sustainable business models and has unique advantages in promoting entrepreneurship and sustainable development [3]. On the one hand, cross-border e-commerce connects buyers and sellers from different countries, expands market scale, and attracts entrepreneurs. Moreover, cross-border e-commerce platforms break down barriers in traditional markets, enabling small and start-up companies to compete with large enterprises on an equal footing, and promoting the sustainability of entrepreneurship. On the other hand, crossborder e-commerce promotes the digital transformation of operational models, allowing entrepreneurs to reduce energy consumption and pollution while obtaining economic benefits through paperless offices, online delivery, smart warehousing, intelligent logistics, green packaging, and other means.

Based on the above background, the purpose of this study is to analyze whether the pilot policies of the CECPA can stimulate entrepreneurial vitality in cities. If there are positive effects, what are the underlying theories and mechanisms? In addition, does the pilot policy of the comprehensive testing zone have spatial spillover effects that can drive the development of surrounding areas? Analyzing these issues is of great significance for utilizing new trade formats to stimulate entrepreneurial vitality and promote sustainable economic development.

Therefore, this paper utilizes panel data of 278 cities in China from 2010 to 2020 and takes the pilot policies of the CECPA in China as a "natural experiment" to conduct an in-depth analysis of how the sustainable business model of cross-border e-commerce affects entrepreneurial vitality in cities. The results indicate that the development of cross-border e-commerce significantly stimulates entrepreneurial vitality. The primary mechanisms through which the cross-border e-commerce comprehensive testing zones stimulate entrepreneurial vitality are the business environment, industrial synergy and agglomeration, and market size. Additionally, the pilot policies of CECPA also drive the development of entrepreneurship in surrounding cities and contribute to regional coordinated development.

The possible marginal contributions of this paper are as follows: Firstly, it evaluates the entrepreneurial effect of cross-border e-commerce for the first time, which not only enriches the implementation effect of cross-border e-commerce policies, but also effectively supplements the empirical evidence of the impact of digital technology on entrepreneurship. Secondly, it examines the underlying mechanisms through optimizing the business environment, promoting industrial synergy and agglomeration, and expanding market consumer demand. Thirdly, it also discusses the spatial spillover effect of the pilot policies in the comprehensive pilot area of cross-border e-commerce.

The structure of the remaining paper is as follows: Section 2 includes the literature review; Section 3 describes theoretical analysis and research hypotheses; Section 4 introduces research methods, variable description, and data declaration; Section 5 provides empirical results analysis; Section 6 explores the different impact mechanisms and the spatial spillover effect of the pilot policies; and Section 7 outlines conclusions and recommendations.

2. Literature Review

2.1. Research on the Effect of Cross-Border E-Commerce

Cross-border e-commerce, as a product of the development of international trade enabled by digital technology, has become a focus of extensive attention among scholars on its trade effects. It is generally believed in existing research that cross-border e-commerce promotes the scale of enterprises' export, reduces their market portfolio risk, and improves their quality of products [4–6] by reducing trade costs, especially reducing information search and matching costs [7]. The policy of CECPA pilot is a new thing. Since its implementation, as for whether it can enhance the cross-border e-commerce, scholars conducted heated discussions on its policy effects. For example, Liu and Yang and Zhang et al., respectively, studied the promotion effects of the pilot policies of the comprehensive pilot area for cross-border e-commerce on economic growth, industrial agglomeration, and regional coordinated development [8,9]. Hu and Song and Yuan and Ji delved into the microenterprise perspective and explored the positive effects of the pilot policies of the comprehensive pilot area on workers' wages and employment [10,11]. Therefore, it is evident that cross-border e-commerce has played an important role in stabilizing foreign trade, employment, and promoting economic growth. However, there is little research on how cross-border e-commerce policies affect entrepreneurship.

2.2. Research on the Influencing Factors of Entrepreneurship

Regarding the discussion of factors influencing entrepreneurship, domestic and foreign scholars have mainly conducted research from the perspectives of microcharacteristics such as individuals and families, as well as macroenvironmental aspects such as policy systems. From a microindividual perspective, it is believed that entrepreneurial characteristics [12], human capital, social capital [13], and degree of risk preference [14] significantly influence individual entrepreneurial behavior. Furthermore, existing research has extensively analyzed the impact of institutional environments, business environments, and financial development, as well as other related policies and systems such as free trade areas and smart city pilot projects on entrepreneurial vitality [15–18].

2.3. Research on the Intersection between Cross-Border E-Commerce and Entrepreneurship

In the intersection between cross-border e-commerce and entrepreneurship, considering the dual characteristics of cross-border e-commerce involving advancements in digital technology and an upgrade in trade models, we find valuable insights from two relevant studies. Firstly, the impact of digitization on entrepreneurship is crucial. The widespread integration and evolution of digital technology are driving significant shifts in business models, offering entrepreneurs new opportunities [19,20]. Digitization enables entrepreneurs to swiftly discern market changes and enhances their responsiveness [21]. It also reduces the costs and barriers associated with entrepreneurship [22], expands market boundaries [23], and motivates entrepreneurs to embark on new ventures [24,25]. As representatives of digital technology, Qin and Xie conducted a family data analysis of the impact of e-commerce development on family entrepreneurship [26]. They argue that the development of e-commerce significantly promotes entrepreneurship by addressing resource deficiencies and stimulating market demand. Secondly, from the perspective of an open economy, trade liberalization strengthens connections with foreign markets, creating more opportunities and space for potential entrepreneurs, thereby elevating entrepreneurial inclinations [27]. Pan and Fu's research suggests that cross-border e-commerce, due to its lower entry costs, propels small and medium-sized enterprises into international markets through innovation [28]. However, it is important to note that the discussed paper focuses on enterprise innovation performance (technological, process, and market innovation) rather than the establishment of new enterprises within the regional context.

Through a review of the literature, it is found that the influencing factors of entrepreneurship are centered on the internal influence of microcharacteristics and related promotion policies. In the context of open economies, the focus has been on the influence of trade liberalization and opening up on entrepreneurship, while overlooking how the new trade mode of cross-border e-commerce affects entrepreneurship in the era of the digital economy. However, cross-border e-commerce as a new trade model differs from traditional e-commerce, facing significant changes in market scope, entry barriers, and competitive environments, and its impact on entrepreneurs is more complex and challenging. Therefore, further exploration of the impact of cross-border e-commerce on entrepreneurship is highly necessary.

3. Theoretical Analysis and Research Hypothesis

3.1. The Impact of CECPA on Entrepreneurial Vitality in Chinese Cities

The concept of entrepreneurial vitality refers to the level of growth and prosperity of emerging enterprises and startups within a specific industry or region during a certain period [29]. It represents the degree of entrepreneurial activity within a country or city. In simple terms, the main issue we address is: Does the implementation of policies in the CECPA contribute to an increase in entrepreneurial levels?

According to the trade heterogeneity theory, as proposed by Melitz [30], it suggests that enterprises entering the international market need to pay additional fixed costs. The reduction in these fixed costs significantly impacts entrepreneurship by influencing the export decisions of enterprises. The pilot policy of CECPA, through the construction of digital platforms, has reduced the costs associated with information searches and the development of overseas marketing networks, thus facilitating enterprise entry into the international market. Simultaneously, preferential policies within CECPA, such as export tax exemptions, alleviate financing constraints for enterprises and reduce the uncertainty of exports, leading to the entry of low-productivity enterprises that were previously only selling in the domestic participate in the international market. The reduction in fixed costs not only drives highly productive nonexporting enterprises to enter the international market but also increases the possibility of low-productivity enterprises entering the international market, thereby lowering the "productivity" threshold for entrepreneurship and expanding the scope of entrepreneurial entities, thus enhancing entrepreneurial vitality. Furthermore, the construction of CECPA has reduced the risks of entrepreneurship, effectively overcoming information asymmetry. It improves the operational efficiency of new entrepreneurial enterprises in the region by sharing institutional innovation achievements and the digital ecological environment infrastructure, thereby ensuring the success of entrepreneurship [31,32]. In addition, the construction of the comprehensive pilot area requires support from digital technology, which will drive the development of advanced service industries such as data services, software applications, artificial intelligence, and information technology, substantially increasing the value added of products and providing market opportunities for new enterprises [33].

Hypothesis 1. The policies of CECPA are conducive to stimulating urban entrepreneurial vitality.

3.2. The Mechanism of CECPA Affecting Urban Entrepreneurial Vitality

Next, this paper further analyzes the mechanisms of how the CECPA policies impact urban entrepreneurial vitality. The specific analyses are as follows:

The quality of the business environment directly affects the level of entrepreneurial activity [34–36]. The pilot policy of CECPA can provide a favorable business environment for entrepreneurs by improving the quality of institutions. Firstly, in the construction of the CECPA, there has been a continuous and proactive effort to deepen the "streamlining administration, delegating powers, and improving regulation" reform. This includes actively promoting facilitation of customs clearance procedures, and exploring the formulation of rules for cross-border e-commerce and policies for intellectual property protection. These efforts are aimed at promoting fair competition in the market and, in turn, stimulating entrepreneurial vitality. Secondly, the pilot areas have promoted the integration of crossborder e-commerce transactions by establishing an online "single window" service model. This has significantly improved the efficiency of customs clearance for goods and reduced the institutional barriers and trade costs for enterprises entering the market. Thirdly, digital infrastructure is an important requirement for promoting entrepreneurial development in the digital economy era. One of the main tasks of the pilot area is to build an intelligent service system, which involves constructing a smart logistics system through digital technology, effectively connecting warehousing and operational services, and achieving the digital transformation of the logistics supply chain. Fourthly, the pilot areas have also been innovated in the financial services sector. By encouraging various financial institutions to carry out business innovation and provide financial products such as export credit insurance and policy financing, they have alleviated the financing difficulties of small and medium-sized enterprises. This provides financial support for entrepreneurs and alleviates their financing constraints [37].

Industrial agglomeration in a specific geographical space will produce a resourcesharing effect and will promote entrepreneurship through positive externality effects generated by knowledge spillover and economies of scale [38,39]. The construction of the pilot area promoted the spread and application of new technologies, driving manufacturing enterprises to accelerate the digital transformation of the supply chain, improving production efficiency, which reduces inventory costs and increases expected returns for enterprises [40]. In this process, the manufacturing industry depends on the support of productive service industries within the park. In particular, the CECPA provides a comprehensive set of supporting services for enterprises, including financial services, consulting services, platform services, data analysis services, and logistics services. This has driven the agglomeration of productive service industries such as finance, information technology, and warehousing, accelerated the flow of factors and resources to the service industry, enabled factors to be better integrated into the manufacturing supply chain and industrial chain, and formed a spatial co-agglomeration of the manufacturing industry and its related service industries. Industrial co-agglomeration reduces transaction costs and increases the specialization of division of labor and the degree of upstream and downstream correlation, thereby promoting the sharing and spillover of knowledge, technology, and human capital [41]. Furthermore, co-agglomeration accelerates the aggregation and sharing of resources such as funds, high-skilled talents, and information required for entrepreneurship, thereby enhancing entrepreneurial vitality.

The pilot policy of CECPA improves urban entrepreneurial vitality by promoting market consumer demand. On the one hand, through the cross-border e-commerce platform, the pilot area links foreign consumers with domestic producers, breaks the time and geographical restrictions, expands the market boundary, increases the variety and quantity of product markets, achieves returns to scale through platform agglomeration effect and network effect, forming economies of scale and the long-tail effect, and further expands the scale of entrepreneurial vitality [42]; On the other hand, the diversified and personalized needs of consumers drive manufacturers to upgrade product design and develop new products, enhancing the proactivity of enterprises in engaging in new production activities [43]. The comprehensive supporting measures of the pilot area provide possibilities and convenience for enterprises to cater to the broad international market, bridging the industrial chain between the production and consumption ends of cross-border e-commerce. Market expansion leads to the emergence of new business opportunities, thereby increasing the probability of entrepreneurial market.

Based on this, this paper proposes the following hypothesis:

Hypothesis 2. The pilot policy of CECPA improves entrepreneurial vitality by optimizing the business environment.

Hypothesis 3. The pilot policy of CECPA improves entrepreneurial vitality by promoting the co-agglomeration of manufacturing and productive service industries.

Hypothesis 4. The pilot policy of CECPA improves entrepreneurial vitality by broadening the boundaries of market scale.

4. Methods, Variable and Data

4.1. Methods Selection

4.1.1. Benchmark Regression Model

The purpose of this paper is to examine the causal effect between cross-border ecommerce and the entrepreneurial vitality of cities. We consider the CECPA pilot policy, implemented since 2015, as an exogenous policy shock. This exogenous event serves as a "natural experiment" to evaluate how cross-border e-commerce affects entrepreneurial vitality, employing a differences-in-differences (DID) approach—a widely used method to assess policy effectiveness. It identifies the "net effect" of a policy by capturing relative differences between pilot cities (treatment group) and nonpilot cities (control group) before and after policy impacts. During the sample period, 98 cities were approved as CECPA cities, because the CECPA is set up in different batches, and the policy shock year is inconsistent. Therefore, this paper uses a multistage DID method to test whether CECPA is conducive to stimulating entrepreneurial enthusiasm. In terms of model construction, following the approach of Bertrand et al. [44] and Wang et al. [45], the specific model is as follows:

$$Enterp_{it} = \beta_0 + \beta_1 DID_{it} + \gamma Z_C + year_t + city_i + \varepsilon_{it}$$
(1)

where *Enterp*_{*it*} represents the urban entrepreneurial activity level of city *i* in year *t*, and DID_{it} represents a dummy variable of the interaction term between group and policy time to identify cities where CECPA is approved in *year*_{*t*}. *Z*_{*c*} is the set of control variables, *year*_{*t*} represents time fixed effects, *city*_{*i*} represents individual fixed effects, and ε_{it} is the random error term (ε_{it} is an independent and identically distributed error).

4.1.2. Dynamic Model

The key premise of multiperiod DID is that before the policy implementation, the change of urban entrepreneurial vitality in the treatment group and the control group has the same trend, that is, the common trend hypothesis is met. In order to prove the changes in urban entrepreneurial vitality caused by exogenous policies and to support the accuracy and effectiveness of the benchmark regression results in this paper, the model is extended to Equation (2) for parallel trend test.

$$Enterp_{it} =_{0} + \sum_{k=-9}^{5} \delta_{k} DID_{it} + \gamma Z_{C} + year_{t} + city_{i} + \varepsilon_{it}$$
(2)

Among them, *DID* is still the policy dummy variable, and the meanings of the remaining variables are consistent with the above Equation (1). The estimated coefficient δ_k is focused on, which is reflected in the difference in the change of entrepreneurial vitality between pilot and nonpilot regions in the K^{th} year of the policy implementation.

4.1.3. Mediation Mechanism Test Model

In order to facilitate theoretical mechanism analysis, this paper further explores the internal mechanism of cross-border e-commerce influencing entrepreneurship vitality from the three main paths of business environment, co-agglomeration of manufacturing and productive service industries, and market consumer demand. In accordance with Baron and Kenny [46], this paper uses the two-step method of intermediary effects to test the above mechanisms, and the model is constructed as follows:

$$M_{it} = \beta_0 + \beta_1 DID_{it} + \gamma Z_C + year_t + city_i + \varepsilon_{it}$$
(3)

$$Enterp_{it} = \beta_2 + \beta_3 DID_{it} + \tau M_{it} + \gamma Z_C + year_t + city_i + \varepsilon_{it}$$
(4)

where M_{it} is the mechanism variable, and the other control variables are the same as in Equation (1).

4.1.4. Spatial Spillover Effects Test Model

Theoretical analysis in the previous section indicates that cross-border e-commerce has strong knowledge spillover effects and resource sharing effects. The pilot policies of CECPA may not only enhance local entrepreneurial vitality but also potentially drive the improvement of entrepreneurial levels in surrounding cities. To explore the spatial spillover effects of the establishment of the CECPA on urban entrepreneurial vitality, we draw on the method of Diao et al., and construct a spatial differences-in-differences (SDID) model to analyze the entrepreneurial spillover effects of this pilot policy [47]. The model is set up as follows:

$$Enterp_{it} = \alpha_0 + \rho W \times Enterp_{it} + \alpha_1 DID_{it} + \alpha_2 W \times DID_{it} + \alpha_3 Z_C + \alpha_4 W \times Z_C + year_t + city_i + \varepsilon_{it}$$
(5)

W represents the spatial weight matrix, with three specific settings: the first is the economic distance matrix (*W1*), which measures the reciprocal of the absolute difference in per capita GDP between two cities; the second is the spatial adjacency matrix (*W2*), with a value of 1 if the cities are adjacent and 0 otherwise; the third is the spatial geographic distance matrix (*W3*), which represents the reciprocal of the square of the geographical distance between two cities. ρ is the spatial lag coefficient of the dependent variable, and the other variables are the same as in Equation (1). The spatial Durbin model with double fixed effects (*SDM-DID*) is ultimately selected to estimate the entrepreneurial spillover effects of the pilot policy of CECPA.

4.2. Variable Selection

4.2.1. Explained Variable

The explained variable in Equation (1) is entrepreneurial vitality, which is measured by the number of new enterprises in the region. These data mainly come from the China Industrial and Commercial Enterprise Registration Database. Based on the registration information of enterprises, the number of newly registered enterprises of different scales and industries is compiled based on the city dimension, aiming to comprehensively investigate the impact of cross-border e-commerce pilot area on urban entrepreneurial vitality.

4.2.2. Core Explanatory Variable

The core explanatory variable of the study is the virtual variable of the cross-border e-commerce pilot area. If the city is approved as a cross-border e-commerce pilot area in the current year, it takes the value of 1; otherwise, it is 0. The estimated coefficient β_1 implies the average entrepreneurial effect before and after the implementation of the pilot policy in the cities with and without the pilot areas. If this coefficient is greater than 0 and statistically significant, it indicates that the pilot policy of CECPA can enhance entrepreneurial vitality. Considering the continuity of the sample interval data and data missing issues, the study selects the first five batches (98 cities in total) of the CECPAs between 2015 and 2020.

4.2.3. Mechanism Variables

(1) Business Environment

In quantifying the business environment, in addition to considering the marketization, legalization, and internationalization of the business environment based on the research of Zhang et al., we also introduced digital measurement indicators based on the actual development of cross-border e-commerce [17]. Specifically, we selected six dimensions: government efficiency, nonstate ownership, opening degree, digital financial development, digitization, and legal environment. Among these, government efficiency is measured using per capita public service expenditure; nonstate ownership is measured by the proportion of the output value of nonstate-owned industrial enterprises above a certain scale to the total output value of industrial enterprises above a certain scale; openness to the outside world is represented by the total volume of import and export trade; digital finance is represented by the Digital Inclusive Finance Index; the level of digitization is represented by the data of digital patent applications in the region; and the legal environment is measured by the number of law firms in the city.

(2) Industrial Synergy Agglomeration

The locational entropy is used to construct the agglomeration index of manufacturing and productive service industries [48]. At the same time, in order to eliminate the deviation caused by the different sizes of industries in different regions, correction coefficients α and

 β are introduced, represented by the proportion of value added of the secondary industry and the tertiary industry to GDP. The specific calculation method is as follows:

$$Agg_{itm} = (e_{itm}/E_{it})/(e_{tm}/E_t), \ Agg_{its} = (e_{its}/E_{it})/(e_{ts}/E_t)$$
 (6)

$$Coagg = \left(1 - \frac{|Agg_{itm} - Agg_{its}|}{Agg_{itm} + Agg_{its}}\right) + (\alpha Agg_{itm} + \beta Agg_{its})$$
(7)

where e_{itm} and e_{its} represent the number of employees in the manufacturing industry and productive service industry in city *I* in year *t*, E_{tm} and E_{ts} represent the total number of employees in the manufacturing industry and productive service industry in all cities in year *t*, E_{it} represents the number of employees in all industries in city *i* in year *t*, and E_t represents the number of employees in all industries in year *t*.

(3) Market Consumer Demand

Changes in market consumer demand will also influence entrepreneurial behavior. The total retail sales of social consumer goods in cities are used as a measure of market consumer demand. Building on this, Harris used measured market potential as a substitute variable for market consumption scale [49]. The specific calculation method is as follows:

$$MPS_{it} = \sum_{i \neq j} \frac{retail_{jt}}{d_{ij}}$$
(8)

*retail*_{*jt*} is the per capita retail sales of social consumer goods in city *j* in year *t*, and d_{ij} is the geographical distance between city *i* and *j*.

4.2.4. Control Variable

In order to control for potential interfering factors, the model includes relevant variables that may influence entrepreneurship. Firstly, the higher the economic development level of a region, the more conducive it is to attracting capital, technology, and talent aggregation, providing a better entrepreneurial foundation. Therefore, the per capita GDP of each prefecture-level city is selected to measure the regional economic development level. Secondly, the introduction of foreign capital not only provides financial support for entrepreneurship, but the spillover effects of advanced technology and management knowledge also affect the level of entrepreneurship. Upgrading of the industrial structure implies new entrepreneurial opportunities, which also affects the growth of the number of new enterprises in the region. Additionally, the government's level of expenditure on technology and the level of urban human capital are important factors influencing entrepreneurship. Finally, financial development, informatization, and urbanization are resources that promote the sustainable development of entrepreneurial activities, all of which are included in the analysis.

4.3. Data Declaration

Balanced panel data from 278 prefecture-level cities in China from 2010 to 2020 are selected as the research sample. The data on entrepreneurial vitality come from the China Industrial and Commercial Enterprise Registration Database, and the list of cross-border e-commerce pilot area is obtained from the Chinese government website. Data on instrumental variables, control variables, and mechanism variables are from the "China City Statistical Yearbook" and the CEIC Chinese Economic Database from various years. In cases of missing data, linear interpolation is used for imputation. Descriptive statistics of each variable are shown in Table 1, and logarithmic transformation has been applied to control variables with relatively large values.

Variables	Meaning	Definition	Mean	Sd
Enterp	Entrepreneurial vitality	Number of new startups	9.14	1.06
DID	Cross-border E-commerce Comprehensive pilot area	Approved as a comprehensive test area is 1, otherwise it is 0	0.07	0.25
Rgdp	Economic development	Log of GDP per capita	10.67	0.59
FDI	Opening degree	Foreign investment/GDP	0.016	0.017
Tech	Technology expenditure	Technology expenditure / government expenditure	0.017	0.018
Finance	Financial development	Balance of RMB loans of financial institutions at the end of the year	0.83	0.63
Upgrade	Industrial structure	Index of industrial structure rationalization	2.29	0.15

Table 1. The descriptive statistics of major variables.

5. Empirical Results

5.1. Benchmark Regression Results

The benchmark regression results of this paper are shown in Table 2. In column (1), the regression result without controlling for individual fixed effects, time fixed effects, and control variables is presented. It is found that the estimated coefficient of DID is positive at the 1% level, indicating that the pilot policy of CECPA has significantly improved the entrepreneurial vitality in the city. Column (2) adds control variables based on column (1), while column (3) controls for individual and time fixed effects but does not include control variables. Column (4) adds control variables to column (3). From the regression results, it can be seen that even after controlling for other factors that may affect regional entrepreneurial vitality, the entrepreneurial effect of the pilot policy is still significant. The estimated results in column (4) show that cities with pilot areas have seen a 13.3% increase in the number of newly registered startups, indicating that cross-border e-commerce, as a new trade model and business format, has brought new entrepreneurial opportunities and significantly enhanced the entrepreneurial vitality of cities, thus validating Research Hypothesis 1. Among other control variables, the level of economic development, foreign investment, industrial structure upgrading, human capital, informatization, and urbanization construction all have a promoting effect on regional entrepreneurial vitality.

Table 2. Benchmark regression results.

X7 + 11	(1)	(2)	(3)	(4)
Variables	Enterp	Enterp	Enterp	Enterp
DID	1.851 ***	0.222 ***	0.099 ***	0.133 ***
	(0.117)	(0.051)	(0.037)	(0.031)
Rgdp		0.219 ***		0.496 ***
0 1		(0.073)		(0.068)
FDI		0.378		2.569 ***
		(1.586)		(0.926)
Tech		4.807 **		3.985 ***
		(2.356)		(1.168)
Finance		0.152 ***		-0.015
		(0.049)		(0.020)
Upgrade		0.325		0.215 *
		(0.209)		(0.128)

	(1)	(2)	(3)	(4)
Variables -	Enterp	Enterp	Enterp	Enterp
Stud		0.161 ***		0.093 **
		(0.034)		(0.041)
Intnet		0.614 ***		0.161 ***
		(0.048)		(0.041)
Urbanratio		-0.099		0.619 **
		(0.311)		(0.259)
_cons	9.008 ***	0.092	9.130 ***	0.808
	(0.048)	(0.715)	(0.003)	(0.979)
Fixed Effects	Ν	Ν	Y	Y
Ν	3058	3058	3058	3058
Adj-R ²	0.196	0.753	0.932	0.944

Table 2. Cont.

Note: ***, **, and * represent significance at the confidence levels of 1%, 5%, and 10%, respectively, with standard errors in parentheses. The standard errors are clustered at the city level.

5.2. Parallel Trend Test

The research samples in this paper are ten years before and five years after the implementation of the policy, and all the results in the sample period are reported under the 95% confidence interval.

As shown in Figure 1, when the policy time point k is less than 0, the estimated coefficient δ_k is close to 0 and does not reach the significance level. This illustrates that before the pilot policy in the CECPA, no significant difference exists in the entrepreneurial vitality between the pilot cities and the nonpilot cities, so the parallel trend test is met. At the same time, after the implementation of the policy, the entrepreneurial vitality effect of the pilot construction in the comprehensive area begins to appear in the first phase, and with the increase of the pilot cities in the comprehensive area, it shows an obvious trend of enhancement, indicating that the pilot policy has a long-term and stable effect on the improvement of the urban entrepreneurial vitality.



Figure 1. Parallel trend test.

5.3. Robustness Test

5.3.1. Placebo Test

In order to further exclude the changes in entrepreneurial vitality caused by other exogenous shocks such as missing variables and random factors, this paper adopts the method proposed by Cao and Deng [50]. By randomly selecting the same number of cities as the real pilot in the cross-border e-commerce comprehensive pilot area as the treatment group, and the remaining cities as the control group, the policy implementation time is randomly generated, and the random experiment based on the two levels of time–city when policy is implemented is constructed accordingly. Regression is conducted according to Equation (1), and the accuracy and reliability of the benchmark regression conclusion are judged according to the estimation results obtained from the false experiment.

Generally speaking, if there is no interference from omitted variables and other random factors, the false DID-estimated coefficient should not be significantly different from 0, which means that the randomly established pilot cities in the CECPA will not affect entrepreneurial vitality. In order to prove the robustness and reliability of the estimated results, this paper repeats the above process 500 times, and the estimated coefficients and *p*-value distributions are shown in Figure 2. The results show that the spurious DIDestimated coefficients are all distributed around the value of 0, and their corresponding *p*-values are basically greater than 0.1. However, the real DID-estimated coefficient (0.133) in this paper is obviously different from the estimated value in the placebo test, which is an outlier. Therefore, it can be believed that there is no serious omission of variables or interference from other random factors in the model setting. This verifies the robustness of the core conclusions.





5.3.2. PSM-DID Test

The approved pilot cities may be better than nonpilot cities due to their geographical conditions, economic strength, resource endowment, and other conditions, and this will lead to sample selection bias. This paper further uses the propensity score matching (PSM-DID) method to test the impact of the pilot construction of CECPA on entrepreneurial vitality when other objective conditions are similar. Covariates are selected to construct a PSM dataset for the logit model of whether it is a pilot city. According to the propensity

score, the 1:1 nearest neighbor method is adopted to rematch the treatment group and the control group, and the regression is conducted again. The results are shown in column (1) of Table 3. The estimated coefficient of the core explanatory variable is still significantly positive at the level of 1%, and the coefficient size is not significantly different from that of the benchmark regression in this paper, which further verifies that entrepreneurial vitality indeed benefits from the new forms of trade.

T 7 + 11	(1)	(2)	(3)
Variables	PSM-DID	IV1	IV2
DID	0.1000 ***	0.3429 **	0.3815 ***
	(0.038)	(2.3048)	(3.3176)
_cons	0.7037	-	-
	(1.179)	-	-
Control Variables	Y	Y	Y
Fixed Effects	Y	Y	Y
Ν	2649	3058	2420
Adj-R ²	0.912	0.746	0.759
ĹM	-	30.17	37.61
F statistic	-	258.7	394.5

Table 3. PSM-DID and other robustness tests.

Note: *** and ** represent significance at the confidence levels of 1% and 5%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

5.3.3. Endogeneity Analysis

Considering that the construction of CECPA is not a completely exogenous event, it is affected by the basic conditions of urban economic and trade development, and these factors are closely related to entrepreneurial activity. In order to mitigate potential endogeneity issues, instrumental variables are used to conduct a robustness test, including the spherical distance between the city where the enterprise is registered in Hangzhou, as well as the per capita number of post offices in 1984. Firstly, Hangzhou is one of the first pilot cities for the CECPA, and it has a good digital infrastructure. Therefore, the closer a city is to Hangzhou, the higher its level of cross-border e-commerce development should be, and it is also more likely to be approved as a pilot city, which satisfies the relevance condition for instrumental variable selection. Secondly, the number of post offices, as an early national postal transportation system, has a certain correlation with modern cross-border logistics and transportation. Areas with a large number of post offices in the early stage mean that the local logistics conditions are developed, which will be more easy to select as the CECPA. Therefore, there is a correlation between the number of post offices and the CECPA, which meets the correlation conditions for the selection of instrumental variables. Finally, the spherical distance from Hangzhou does not have a significant impact on the entrepreneurial level of other cities, and the number of post offices in history are unchanged factors, which will not have an impact on the current entrepreneurial vitality. Both further satisfy the exogenous nature of the selection of instrumental variables. In addition, in order to satisfy the empirical analysis of panel data, both variables are multiplied with the total number of internet users over the years. The 2SLS method is further used for testing, and the results of the second step of instrumental variable method are reported in columns (2) and (3) of Table 3. The estimated coefficients of *IV1* and *IV2* are significantly positive. Moreover, LM and F tests show that there is no overidentified and weak instrumental variable.

5.3.4. Recalculation of Key Variables

Replacement of the entrepreneurial measurement indicators: Firstly, in order to overcome the impact of urban scale heterogeneity, this paper uses the number of new entrepreneurial enterprises per 100 people in a city as an indicator to measure entrepreneurial vitality. Secondly, considering that the level of self-employment is also an important measure of urban entrepreneurial vitality, the ratio of private enterprises and self-employed individuals to the total employment in each city is selected as a measure. Finally, the "China Regional Innovation and Entrepreneurship Index" compiled by the Peking University Enterprise Big Data Research Center constructs a comprehensive index reflecting different dimensions of entrepreneurship. It is also a commonly used indicator of entrepreneurial vitality in existing research. The regression results are shown in columns (1)–(3) of Table 4. Regardless of the method used to measure urban entrepreneurial activity, the estimated coefficient of DID is always significantly positive. This indicates that the policy of CACPE significantly increased the number of new entrepreneurial enterprises and the level of self-employment of the employed population in cities. It had a positive effect on regional innovation and entrepreneurship development, further confirming the robustness of the basic conclusions of this paper.

	(1)	(2)	(3)	
Variables	Number of New Entrepreneurial Enterprises per 100 People	Self-Employment Rate	Entrepreneurship Index	
DID	0.3499 ***	0.0465 **	0.1492 ***	
	(0.0931)	(0.0235)	(0.0165)	
_cons	-1.4031	0.1538	2.4126 ***	
	(1.0021)	(0.1726)	(0.2792)	
Control Variables	Y	Y	Y	
Fixed Effects	Y	Y	Y	
Ν	3053	3047	3058	
Adj-R ²	0.827	0.741	0.910	

Table 4. Robustness test of recalculated key variables.

Note: *** and ** represent significance at the confidence levels of 1% and 5%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

5.3.5. Eliminating the Interference of Other Policies

During the sample period (2010–2020), many pilot policies related to the CECPA and other policies related to the development of urban entrepreneurial vitality were implemented. These policies will interfere with the benchmark regression results to a certain extent. Therefore, this paper further focuses on the impact of representative policies, such as the "Mass Entrepreneurship and Innovation" policy in 2015, the "Smart city" pilot policy, the "Broadband China" pilot strategy, and the "Innovation City" pilot policy, on entrepreneurial vitality, so as to accurately identify the "net effect" of the pilot policy of CECPA on the development of entrepreneurial vitality. The estimation results are shown in columns (1)–(4) of Table 5. After controlling the influence of the four kinds of policies, the pilot policy of CECPA still has a relatively stable effect on improving the urban entrepreneurial vitality, which further verifies that the improvement of urban entrepreneurial vitality is indeed brought about by the development of cross-border e-commerce.

Table 5. Eliminating the interference of other policies.

	(1)	(2)	(3)	(4)	
Variables	Enterp	Enterp	Enterp	Enterp	
DID	0.1335 ***	0.1331 ***	0.1146 ***	0.1303 ***	
	(0.0314)	(0.0316)	(0.0306)	(0.0313)	
d2015	0.2930 ***	. ,	, , , , , , , , , , , , , , , , , , ,	. ,	
	(0.1023)				
did_smart		0.0319			
		(0.0451)			
did_bbc		× ,	0.1148 ***		
			(0.0362)		

X7 · 11	(1)	(2)	(3)	(4)
Variables –	Enterp	Enterp	Enterp	Enterp
did_inno				0.1641 ***
				(0.0489)
_cons	0.7240	0.8444	0.8523	0.9095
	(0.9385)	(0.9754)	(0.9610)	(0.9767)
Control Variables	Y	Y	Y	Y
Fixed Effects	Y	Y	Y	Y
Ν	3058	3058	3058	3058
Adj-R ²	0.751	0.944	0.945	0.945

Table 5. Cont.

Note: *** represent significance at the confidence levels of 1%. Standard errors are in parentheses, and they are clustered at the city level.

5.4. Heterogeneity Analysis

5.4.1. Regional Heterogeneity

The pilot of the CECPA may have different effects on urban entrepreneurial vitality due to regional economic development levels and resource endowment. Therefore, the research sample was divided into eastern, central, and western regions to examine whether the construction of CECPA would promote regional coordinated development of entrepreneurship. The results, as shown in Table 6, indicate that the pilot policy has increased entrepreneurial vitality in both the eastern and western regions, with no significant promotional effect on entrepreneurial vitality in the central region. During the sample period, the distribution of cross-border e-commerce comprehensive pilot zones included 57 pilot areas in the eastern region, 22 pilot areas in the central region, and 19 pilot areas in the western region. Although the western region has the fewest comprehensive pilot areas, its entrepreneurial effect demonstrates strong vitality. To some extent, it can be considered that the development of cross-border e-commerce has effectively bridged the "digital divide" between the eastern and western regions, promoting the regional balanced development of entrepreneurship.

X7 + 11	(1)	(2)	(3)
Variables	Eastern Region	Central Region	Western Region
DID	0.0933 **	0.0568	0.1173 *
	(0.0451)	(0.0481)	(0.0684)
_cons	0.5134	-3.6106 **	0.5570
	(1.5746)	(1.4946)	(1.8845)
Control variables	Y	Y	Y
Fixed effects	Y	Y	Y
Ν	1099	1100	858
Adj-R ²	0.957	0.922	0.931

 Table 6. Heterogeneous analysis of regional.

Note: ** and * represent significance at the confidence levels of 5% and 10%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

5.4.2. Urban Scale Heterogeneity

It is different for the entrepreneurial vitality of cross-border e-commerce in cities with different scales. It is generally believed that larger cities would receive more policy support and resource preference, and possess higher levels of industrial agglomeration and resource allocation efficiency. Therefore, this paper divides the sample cities into large cities and small and medium-sized cities to further explore the heterogeneity of entrepreneurial vitality by the development of cross-border e-commerce in cities at different scales.

The regression results are shown in columns (1) and (2) of Table 7. It can be found that in large cities, the entrepreneurial effect of the CECPA policy is negative but not significant,

while in small and medium-sized cities, the pilot policy of CECPA can significantly promote the entrepreneurial vitality at the 1% level in this place. The reason for this phenomenon may be that large cities have well-established infrastructure services and institutional environments, indicating intense market competition and relatively high labor costs, which can lower entrepreneurs' entry expectations into the market. Additionally, due to the advanced development of cross-border e-commerce in large cities and the relatively complete digital ecological construction, their entrepreneurial vitality is at a higher level. Therefore, in large cities, the continuous promotion of the pilot construction of CECPA has a decreasing marginal effect on entrepreneurial vitality.

-					
	(1)	(2)	(3)	(4)	
Variables	Large Cities	Small and Medium-Sized Cities	High Level of Innovation	Low Level of Innovation	
DID	-0.0250	0.1072 ***	-0.0160	0.0917 **	
	(0.0484)	(0.0371)	(0.0410)	(0.0454)	
_cons	6.9611 ***	-0.9002	5.1690 **	-0.7760	
	(2.0513)	(1.0897)	(2.3763)	(1.1309)	
Control Variables	Y	Y	Y	Y	
Fixed Effects	Y	Y	Y	Y	
Ν	462	2596	626	2424	
Adj-R ²	0.976	0.916	0.964	0.893	

Table 7. Heterogeneous analysis of city size and innovation level.

Note: *** and ** represent significance at the confidence levels of 1% and 5%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

However, in small and medium-sized cities, the development of cross-border ecommerce is relatively backward because digital infrastructure construction and information technology lags behind. Moreover, the innovation economy of small and mediumsized cities is still in its infancy, and the urban entrepreneurial vitality still has great space and potential. Thus, the pilot policy of CECPA just makes up for the slow trade digitalization in small and medium-sized cities, and with the continuous impact of cross-border e-commerce, it can fully stimulate the entrepreneurial vitality of this type of city.

5.4.3. Urban Innovation Level Heterogeneity

The innovation environment of a city directly affects its entrepreneurial vitality. In accordance with the quantity of authorized invention patents, the sample was divided into two groups in order to examine the impact of cross-border e-commerce on entrepreneurial vitality at different innovation levels. The regression results are shown in columns (3) and (4) of Table 7. The pilot policy of the CECPA significantly promoted an increase in the number of new startups in cities with lower innovation levels, with no significant impact on cities with higher innovation capabilities. This may be because cross-border e-commerce has lower market entry costs, and entrepreneurs do not need to invest a large amount of capital and resources in innovation, greatly reducing the entrepreneurial costs of cities with lower innovation levels to participate in the international market. At the same time, the CECPA promotes the regional agglomeration of entrepreneurial resources and, combined with the institutional dividends released, can compensate for the lack of innovation levels, thereby increasing the entrepreneurial initiative of cities.

5.4.4. Heterogeneity in the Scale of Registered New Enterprises

In order to examine the relationship between enterprise scale and entrepreneurial vitality, the sample was divided into three groups using the classification criteria of Wang et al., with registered capital of 100,000 and 10 million as dividing points [51]. Since it is not possible to obtain the actual operational situation of the enterprises, registered capital can, to some extent, represent the expected operational scale of the enterprises. Therefore, the three

groups above were considered as small and microenterprises, small and medium-sized enterprises, and large enterprises. Regression results in Table 8 show that the pilot policy of CECPA has stimulated the entrepreneurial vitality of small and microenterprises, small and medium-sized enterprises, and large enterprises. However, in terms of the coefficient size, the entrepreneurial effect of cross-border e-commerce on small and microenterprises is greater compared to large enterprises. This is because cross-border e-commerce has the characteristics of inclusive trade, reducing the cost for small and medium-sized enterprises to enter the international market and increasing the entrepreneurial initiative of small and microenterprises.

(2) (3) (1)Variables $X \leq 100000$ 10 < X \leq 1000 X > 1000DID 0.1552 ** 0.3146 ** 0.0695 * (0.0718)(0.1444)(0.0369)12.1567 *** 2.5492 *** -0.6738cons (1.7155)(3.9597)(0.7551)**Control Variables** γ Υ Υ **Fixed Effects** Υ Υ γ 3058 3058 3058 Ν Adi-R² 0.774 0.965 0.957

Table 8. Heterogeneity in the registration scale of new startups.

Note: ***, **, and * represent significance at the confidence levels of 1%, 5%, and 10%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

5.4.5. Heterogeneity in Industry Types

Considering the different requirements for entrepreneurship and the varying sensitivity to the emergence of new business models in different industries, it is necessary to examine the industry heterogeneity of the entrepreneurial effect of the CECPA's pilot policy. Generally, manufacturing enterprises have higher requirements for location, resource endowment, and factor flow, while service enterprises are relatively flexible and adaptable, with lower market entry barriers, making them better able to adapt to changes in new business models and modes. The "Number One Central Document" issued in 2022 proposed the implementation of the "Nurturing Businesses in Rural Areas with Digital Technologies" project to promote the standardized and healthy development of e-commerce in rural areas. It can be seen that the innovative integration of cross-border e-commerce with agriculture and rural areas over the years will, to some extent, promote entrepreneurial vitality in the agricultural sector. Therefore, this paper separates the sample industries into three groups: agriculture, manufacturing, and services, and examines whether there is heterogeneity in the pilot policy among these three types of industries.

The regression results are shown in Table 9. The results show that the pilot policy of CECPA significantly promotes the entrepreneurial activity in service industries, but has no significant impact on agricultural and manufacturing industries. Furthermore, when the service industries are divided into productive service and nonproductive service, the results in columns (4) and (5) of Table 9 show that the pilot policy of CECPA has a significant positive effect on the entrepreneurial vitality of both types of enterprises. This, to some extent, indicates that the pilot policy of CECPA more effectively promotes entrepreneurial vitality in the service sector, including both productive and nonproductive services, while the entrepreneurial effect on the real economy of agriculture and manufacturing has not been fully demonstrated.

On one hand, cross-border e-commerce, as an integrated industry, drives the agglomeration of productive service industries such as finance, information technology, logistics, and warehousing. The establishment of the comprehensive pilot area attracts a large number of enterprises in the productive service industry, providing more entrepreneurial opportunities. On the other hand, cross-border e-commerce promotes the development of the platform economy, providing online markets for nonproductive service industries such as wholesale and retail, accommodation and catering, and resident services, expanding their market share. The digital platform accelerates the aggregation and flow of entrepreneurial resources, reduces entrepreneurial costs, and significantly enhances entrepreneurial vitality. In addition, manufacturing enterprises have high technological barriers, complex supply chains, and logistics, as well as high capital requirements. The CECPA may currently focus more on trade facilitation and service system construction. The policy formulation for the real economy of manufacturing and agricultural product trade is not yet perfect, providing a direction for policy formulation on how to vigorously develop B2B business and integrate with agriculture in the future, fully driving the entrepreneurial vitality of the manufacturing and agriculture industries.

X7 · 11	(1)	(2)	(3)	(4)	(5)
variables	Agriculture	Manufc	Service	Prodservice	Nonproduserv
DID	-0.0277	0.0069	0.2398 ***	0.1079 ***	0.1340 ***
	(0.0596)	(0.0350)	(0.0374)	(0.0412)	(0.0392)
_cons	4.7335 ***	5.9809 ***	7.5856 ***	3.6725 ***	7.4525 ***
	(1.1476)	(0.6609)	(0.6766)	(1.0063)	(0.6950)
Control Variables	Y	Y	Y	Y	Y
Fixed Effects	Y	Y	Y	Y	Y
Ν	3058	3058	3058	3058	3058
$Adi-R^2$	0.820	0.925	0.935	0.935	0.925

Table 9. Heterogeneity across industry types.

Note: *** represent significance at the confidence levels of 1%. Standard errors are in parentheses, and they are clustered at the city level.

6. Further Discussion: Impact Mechanism and Spatial Spillover Effects

6.1. Mechanism: Optimizing the Business Environment

The regression results are shown in Table 10, columns (1) and (2). Column (1) represents the impact of the CECPA policies on the business environment, while column (2) indicates whether the improvement in the business environment will promote urban entrepreneurial vitality. The results indicate that the pilot policy of CECPA has significantly optimized the business environment, and the better the business environment, the higher the city's entrepreneurial activity, thus validating Hypothesis 2.

Table 10. Mechanism analysis I.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Business	Enterp	Government Efficiency	Nonstate- Owned Economy	Opening Degree	Digital Finance	Digitalization	Legal Envi- ronment
DID	0.005 **	0.095 ***	0.007 *	-0.016	0.005 ***	0.015 ***	0.010 ***	0.010 *
	(0.003)	(0.028)	(0.004)	(0.010)	(0.002)	(0.006)	(0.003)	(0.005)
Business		3.572 *** (0.513)						
_cons	-0.190 ***	2.123 **	-0.426 ***	-0.091	0.022	-0.647 ***	0.001	0.003
	(0.055)	(0.891)	(0.072)	(0.241)	(0.023)	(0.139)	(0.043)	(0.064)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Ν	2780	2780	2780	2780	2780	2780	2780	2780
Adj-R ²	0.975	0.955	0.888	0.930	0.990	0.946	0.970	0.882

Note: ***, **, and * represent significance at the confidence levels of 1%, 5%, and 10%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

Columns (3) to (5) of Table 10 show the empirical test results for different dimensions of the business environment. This shows that the pilot policy of CECPA has significantly promoted the government governance efficiency and the degree of openness to the outside

world, while the proportion of nonstate-owned economy has not changed significantly. This indicates that the pilot policies in the comprehensive area effectively improve government governance, reduce excessive government intervention in the market, unleash the entrepreneurial vitality of the market, and, at the same time, promote domestic and foreign exchanges and cooperation as well as resource mobility through expanding opening up, which helps to enhance urban entrepreneurial vitality.

Column (6) of Table 10 shows that the pilot policies in the comprehensive area have promoted the development of digital finance by establishing cross-border e-commerce financial service platforms and providing financial products, alleviating financing difficulties and high risks for cross-border e-commerce enterprises, and attracting a large number of small and medium-sized enterprises to participate in entrepreneurship.

The regression results in column (7) demonstrate that the comprehensive experimental area, through the use of artificial intelligence, big data, cloud computing, and digital technologies, has focused on constructing smart industrial parks and promoting the digitization of trade applications, thereby driving the city's digital construction and facilitating entrepreneurial development.

Finally, column (8) shows that the comprehensive area construction has significantly improved the level of legalization in the city, providing legal guarantees for business startups.

6.2. Mechanism: Industrial Synergy Agglomeration Effect

In the regression results shown in Table 11, column (1) demonstrates that the pilot policy of CECPA has promoted the synergy agglomeration of the manufacturing and productive service industries. The estimated coefficient of *DID* is 0.0713, and it is significant at the 1% level. Column (2) confirms that the synergistic agglomeration of industries has had a positive impact on urban entrepreneurial vitality. To some extent, this implies that cross-border e-commerce has played a role in stimulating entrepreneurship through the promotion of deep integration between manufacturing and service industries, thereby harnessing agglomeration effects through the sharing of specialized talents, knowledge spillover, and specialized division of labor, thus validating Hypothesis 3.

Variables	(1)	(2)	(3)	(4)
variables	Coagg_New	Enterp	МСР	Enterp
DID	0.0713 ***	0.1292 ***	0.0620 ***	0.1262 ***
	(0.0196)	(0.0379)	(0.0235)	(0.0314)
Coagg_new		0.1235 **		
00		(0.0586)		
MCP				0.1183 ***
				(0.0439)
_cons	1.0738 **	-0.1498	8.2069 ***	-0.1624
	(0.4888)	(1.1349)	(0.6109)	(1.1055)
Control Variables	Y	Y	Y	Y
Fixed Effects	Y	Y	Y	Y
Ν	2647	2647	3058	3058
Adj-R ²	0.835	0.944	0.979	0.944

Table 11. Mechanism analysis II.

Note: *** and ** represent significance at the confidence levels of 1% and 5%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

6.3. Mechanism: The Expansion of Market Consumer Demand

The regression results in Table 11, column (3) reveal that the establishment of the CECPA significantly enhances the consumption potential of the market, promoting the expansion of the e-commerce product market scale. Meanwhile, column (4) demonstrates that market expansion will generate new entrepreneurial opportunities, significantly enhancing the entrepreneurial vitality of cities, thus validating Research Hypothesis 4.

6.4. Spatial Spillover Effects

The regression results for the spatial spillover effects are shown in Table 12. The results indicate that regardless of whether the economic distance matrix, spatial adjacency matrix, or geographic distance matrix is used, the estimated coefficients of the DID and its spatial lag term are all significantly positive. Additionally, the coefficient of the spatial lag term ρ for urban entrepreneurial vitality is also significantly positive, indicating a positive spatial spillover effect of the pilot policy of CECPA on entrepreneurial vitality. Furthermore, the impact of the pilot policy on entrepreneurial vitality is decomposed into direct effects, indirect effects, and total effects. The analysis shows that the coefficient of the direct effect reflects the impact of the pilot policy of the comprehensive experimental area on local entrepreneurial vitality, while the estimated coefficient of the indirect effect represents the spillover effect of the pilot policy on the entrepreneurial vitality of surrounding cities.

Variables	(1) Economic Distance Matrix	(2) Spatial Adjacency Matrix	(3) Geographical Distance Matrix
	Enterp	Enterp	Enterp
DID	0.0654 ***	0.0909 ***	0.0858 ***
	(0.0238)	(0.0209)	(0.0188)
W imes DID	0.1274 **	1.1214 ***	0.2318 ***
	(0.0593)	(0.3153)	(0.0780)
ρ	0.0674 *	0.3879 ***	0.8434 ***
	(0.0375)	(0.0923)	(0.0260)
Direct	0.0674 ***	0.0964 ***	0.1127 ***
	(0.0243)	(0.0215)	(0.0208)
Indirect	0.1429 **	1.9318 ***	1.9743 ***
	(0.0640)	(0.5794)	(0.5961)
Total	0.2103 ***	2.0282 ***	2.0870 ***
	(0.0635)	(0.5817)	(0.6034)
Control Variables	Y	Y	Y
Fixed Effects	Y	Y	Y
Ν	3058	3058	3058
Adj-R ²	0.4223	0.4223	0.4223

Table 12. Analysis of the spillover effects of entrepreneurship.

Note: ***, **, and * represent significance at the confidence levels of 1%, 5%, and 10%, respectively. Standard errors are in parentheses, and they are clustered at the city level.

The total effect represents the average impact of the pilot policy on the overall entrepreneurial vitality of the region. The results in Table 12 show that the three types of effects for the three weight matrices in columns (1) to (3) are all significantly positive at the 1% level, indicating that considering spatial spillover effects, the pilot policy of CECPA not only enhances local entrepreneurial vitality but also stimulates the entrepreneurial vitality of economically similar cities, neighboring cities, and surrounding cities. This demonstrates the functional role of the comprehensive area in promoting the coordinated regional development of entrepreneurial levels.

7. Conclusions and Recommendations

7.1. Conclusions

This paper, in the context of sustainable business models, utilizes panel data from 278 cities in China between 2010 and 2020 to analyze the crucial role of cross-border e-commerce in stimulating entrepreneurial vitality and promoting sustainable development. Furthermore, this paper also discusses the transmission mechanism of the cross-border e-commerce affecting the entrepreneurial vitality. The results are as follows:

 The pilot policies of CECPA significantly stimulate entrepreneurial vitality of cities. Compared to nonpilot cities, the number of newly registered enterprises in pilot areas increased by approximately 13.3%. This conclusion is still valid after conducting robustness tests such as parallel trends analysis, placebo tests, and endogeneity tests, thereby validating Hypothesis 1. Furthermore, cross-border e-commerce has also facilitated sustainable entrepreneurship, primarily by promoting entrepreneurial development in underdeveloped regions such as Western China, small and medium-sized cities, and cities with lower levels of innovation. It also promotes entrepreneurial activities among small and microenterprises, providing them with equal opportunities to compete with large enterprises. Additionally, cross-border e-commerce exhibits strong entrepreneurial vitality in the service industry.

- (2)The mechanisms used to promote the entrepreneurial vitality of the city can be categorized into three aspects: optimizing the business environment, promoting industrial agglomeration and synergy, and expanding the market scale. Firstly, the sustainable development of entrepreneurial cannot be achieved without a sound business environment. The pilot policy of CECPA can enhance the urban business environment by improving government efficiency, promoting privatization, opening up to the outside world, digitization, digital financial development, and legal institutionalization. This, in turn, reduces transaction costs associated with entrepreneurship and enhances entrepreneurial vitality, thus validating Hypothesis 2. Secondly, the CECPA promotes industrial agglomeration, particularly in manufacturing and productive service industries. By increasing the linkages between upstream and downstream industries and leveraging the agglomeration, sharing, and spillover effects of entrepreneurial resources, the zones have an impact on entrepreneurial activities, which supports Hypothesis 3. Lastly, the CECPA expands market boundaries through digital platforms, providing potential entrepreneurs with more opportunities, which validates Hypothesis 4.
- (3) Through the analysis of spatial spillover effects, it is found that the CECPA not only enhances local entrepreneurial vitality but also has a positive impact on the entrepreneurial vitality of geographically proximate or economically similar cities, demonstrating significant radiation effects. This conclusion indicates that the CECPA can promote regional coordinated development and is of great significance to sustainable development. It also represents a further extension of the research conducted by Qin and Xie [26].

7.2. Recommendations

To leverage this impact for sustained economic growth and development, the following policy recommendations are proposed:

Firstly, there is a need to accelerate the construction and upgrading of comprehensive experimental areas for cross-border e-commerce, in line with the standardization of international rules for digital trade. Encouraging the upgrading of trade models and leveraging digital technologies such as cloud computing, big data, the Internet of Things, and artificial intelligence can drive the transition of cross-border e-commerce to digital trade, thereby unleashing entrepreneurial vitality.

Secondly, local governments should seize the opportunity presented by the construction of comprehensive experimental areas for cross-border e-commerce to address institutional barriers affecting its development. This can be achieved by strengthening the business environment, focusing on the development of digital technology industries, and leveraging the spillover effects of collaborative agglomeration between manufacturing and service industries to provide a favorable institutional environment and resource sharing for entrepreneurship.

In addition, tailored policies should be explored to promote the development of cross-border e-commerce, continuously increasing financial and policy support for the central and western regions, cities with lower innovation levels, and small and mediumsized registered enterprises. Moreover, promoting the development model of "crossborder e-commerce + industrial belts" can facilitate the deep integration of cross-border e-commerce with manufacturing and agriculture, stimulating entrepreneurial vitality across various sectors.

Finally, efforts should be made to strengthen the spatial spillover effects of comprehensive experimental areas for cross-border e-commerce, enhancing their radiation capacity and reducing regional "digital divides". This will promote the coordinated development of entrepreneurship and contribute to overall economic growth.

Limitations and future research: Firstly, due to data availability, real cross-border e-commerce import and export data were not utilized in this study. In the future, with China's customs statistics work improving, the data can be supplemented and enhanced. Secondly, the research on the impact of cross-border e-commerce on entrepreneurship can be further refined. For example, future studies could examine its influence on digital or green entrepreneurship.

Author Contributions: Conceptualization, Q.Y. and Y.J.; Resources, W.Z.; Data curation, T.L.; Writing—original draft, Y.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Natural Science Foundation of Shandong Province, grant number ZR2023MG047.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the research data subjects.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Available online: http://dzsws.mofcom.gov.cn/article/ztxx/ndbg/202306/20230603415404.shtml (accessed on 28 September 2023).
- 2. Available online: http://www.cnipr.com/sj/zx/202312/t20231227_253493.html (accessed on 1 February 2024).
- Duan, C.; Kotey, B.; Sandhu, K. The Effects of Cross-Border E-Commerce Platforms on Transnational Digital Entrepreneurship: Case Studies in the Chinese Immigrant Community. J. Glob. Inf. Manag. 2011, 30, 1–19. [CrossRef]
- Wang, Y.; Wang, Y.; Lee, S. The Effect of Cross-Border E-Commerce on China's International Trade: An Empirical Study Based on Transaction Cost Analysis. Sustainability 2017, 9, 2028. [CrossRef]
- 5. Ma, Z.; Hu, Z. The effect of cross-border E-commerce on the portfolio of export risks facing Chinese firms. *Fin. Trade Econ.* **2022**, 43, 149–164. [CrossRef]
- Liu, B.; Gu, C. The Impact of Cross-border E-commerce on Enterprise Participation in Global Value Chains: Empirical Evidence Based on Micro Data. *Stat. Res.* 2022, 39, 72–87. [CrossRef]
- 7. Carballo, J.; Rodriguez Chatruc, M.; Salas Santa, C.; Volpe Martincus, C. Online business platforms and international trade. *J. Int. Econ.* **2022**, *137*, 103599. [CrossRef]
- 8. Liu, Y.; Yang, L.; Liu, Z. Cross-border E-commerce and producer services agglomeration. J. World Econ. 2023, 46, 63–93. [CrossRef]
- Zhang, B.; Chen, Y.; Zhu, J.; Yan, Z. Cross-border E-commerce Comprehensive Pilot Areas and Regional Coordinated Development: Window Radiation or Siphon Effect. J. Financ. Econ. 2023, 49, 34–47. [CrossRef]
- Hu, H.; Song, Y. Cross-border E-commerce Reform and Wage Income: A New Open Perspective. J. Financ. Econ. 2022, 48, 49–63. [CrossRef]
- 11. Yuan, Q.; Ji, Y. How does Cross-border E-commerce affect Enterprise Labor Employment: Based on the Quasi-natural Experiment of Cross-border E-commerce Comprehensive Pilot Area. *Ind. Econ. Res.* **2023**, *1*, 101–114. [CrossRef]
- 12. Djankov, S.; Qian, Y.; Roland, G.; Zhuravskaya, E. Who Are China's Entrepreneurs? Am Econ. Rev. 2006, 96, 348–352. [CrossRef]
- LaFave, D.; Thomas, D. Farms, Families, and Markets: New Evidence on Completeness of Markets in Agricultural Settings. Econometrica 2016, 84, 1917–1960. [CrossRef]
- 14. Bianchi, M.; Bobba, M. Liquidity, Risk, and Occupational Choices. Rev. Econ. Stud. 2013, 80, 491–511. [CrossRef]
- 15. Lu, J.; Tao, Z. Determinants of entrepreneurial activities in China. J. Bus. Ventur. 2010, 25, 261–273. [CrossRef]
- 16. Peng, B.; Zhao, Y.; Elahi, E.; Wan, A. Does the business environment improve the competitiveness of start-ups? The moderating effect of cross-border ability and the mediating effect of entrepreneurship. *Corp. Soc. Responsib. Environ. Manag.* **2022**, *29*, 1173–1185. [CrossRef]
- 17. Zhang, L.; Li, J.; Sun, W. Institutional Innovation, Business Environment and Entrepreneurial Vitality: Evidence from the China Pilot Free Trade Zone. J. Quant. Tech Econ. 2023, 40, 93–114. [CrossRef]

- 18. Li, C.; Zhang, X.; Dong, X.; Yan, Q.; Zeng, L.; Wang, Z. The impact of smart cities on entrepreneurial activity: Evidence from a quasi-natural experiment in China. *Resour. Policy* **2023**, *81*, 103333. [CrossRef]
- 19. Kraus, S.; Mcdowell, W.; Ribeiro-Soriano, D.E.; Rodríguez-García, M. The role of innovation and knowledge for entrepreneurship and regional development. *Entrep. Reg. Dev.* 2021, *33*, 175–184. [CrossRef]
- Afawubo, K.; Noglo, Y.A. ICT and entrepreneurship: A comparative analysis of developing, emerging and developed countries. *Technol. Forecast. Soc. Chang.* 2022, 175, 121312. [CrossRef]
- 21. Troise, C.; Ben-Hafaïedh, C.; Tani, M.; Yablonsky, S.A. Guest editorial: New technologies and entrepreneurship: Exploring entrepreneurial behavior in the digital transformation era. *Int. J. Entrep. Behav. Res.* **2022**, *28*, 1129–1137. [CrossRef]
- 22. Niebel, T. ICT and economic growth—Comparing developing, emerging and developed countries. *World Dev.* **2018**, *104*, 197–211. [CrossRef]
- 23. Hong, Y.; Sawang, S.; Yang, H.S. How is entrepreneurial marketing shaped by E-commerce technology: A case study of Chinese pure-play e-retailers. *Int. J. Entrep. Behav. Res.* **2023**. ahead of print. [CrossRef]
- 24. Elia, G.; Margherita, A.; Passiante, G. Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technol. Forecast. Soc. Chang.* **2020**, *150*, 119791. [CrossRef]
- 25. Dabbous, A.; Barakat, K.A.; Kraus, S. The impact of digitalization on entrepreneurial activity and sustainable competitiveness: A panel data analysis. *Technol. Soc.* 2023, 73, 102224. [CrossRef]
- 26. Qin, F.; Xie, K.; Wang, J. Effects of E-commerce Development on Entrepreneurship: Evidence from Microdata of Households. *Financ. Trade Econ.* **2023**, *44*, 154–168. [CrossRef]
- 27. Sun, C.; Wang, S.; Jiang, H. Would Trade Liberalization Promote Entrepreneurship? *Financ. Trade Econ.* **2020**, *41*, 111–127. [CrossRef]
- 28. Pan, L.; Fu, X.; Li, Y. SME participation in cross-border e-commerce as an entry mode to foreign markets: A driver of innovation or not? *Electron. Commer. Res.* 2023, 23, 2327–2356. [CrossRef]
- 29. Barreneche García, A. Analyzing the determinants of entrepreneurship in European cities. *Small Bus. Econ. Group* 2014, 42, 77–98. [CrossRef]
- 30. Melitz, M.J. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica* 2003, 71, 1695–1725. [CrossRef]
- 31. Manjon, M.; Aouni, Z.; Crutzen, N. Green and digital entrepreneurship in smart cities. Ann. Reg. Sci. 2022, 68, 429–462. [CrossRef]
- Zhang, J.; van Gorp, D.; Kievit, H. Digital technology and national entrepreneurship: An ecosystem perspective. J. Technol. Transf. 2023, 48, 1077–1105. [CrossRef]
- 33. Lamine, W.; Fayolle, A.; Jack, S.; Audretsch, D. Impact of digital technologies on entrepreneurship: Taking stock and looking forward. *Technovation* **2023**, *126*, 102823. [CrossRef]
- 34. Bah, E.H.; Fang, L. Impact of the business environment on output and productivity in Africa. *J. Dev. Econ.* **2015**, *114*, 159–171. [CrossRef]
- 35. Urbano, D.; Audretsch, D.; Aparicio, S.; Noguera, M. Does entrepreneurial activity matter for economic growth in developing countries? The role of the institutional environment. *Int. Entrep. Manag. J.* **2020**, *16*, 1065–1099. [CrossRef]
- Stevens, M. The response of small ONTARIO businesses to a changing business environment. J. Small Bus. Entrep. 1995, 12, 50–57. [CrossRef]
- 37. Ali, A.; Kelley, D.J.; Levie, J. Market-driven entrepreneurship and institutions. J. Bus. Res. 2020, 113, 117–128. [CrossRef]
- Glaeser, E.L.; Kerr, W.R. Local Industrial Conditions and Entrepreneurship: How Much of the Spatial Distribution Can We Explain? J. Econ. Manag. Strategy 2009, 18, 623–663. [CrossRef]
- 39. Delgado, M.; Porter, M.E.; Stern, S. Clusters and entrepreneurship. J. Econ. Geogr. 2010, 10, 495–518. [CrossRef]
- 40. Ciriello, R.F.; Richter, A.; Schwabe, G. Digital Innovation. Bus. Inf. Syst. Eng. 2018, 60, 563–569. [CrossRef]
- 41. Yuan, F.; Gao, J.; Wang, L.; Cai, Y. Co-location of manufacturing and producer services in Nanjing, China. *Cities* **2017**, *63*, 81–91. [CrossRef]
- 42. Audretsch, D.B.; Heger, D.; Veith, T. Infrastructure and entrepreneurship. Small Bus. Econ. Group 2015, 44, 219–230. [CrossRef]
- 43. Zhao, T.; Zhang, Z.; Liang, S. Digital Economy, Entrepreneurship, and High-Quality Economic Development: Empirical Evidence from Urban China. *J. Manag.* 2020, *36*, 65–76. [CrossRef]
- 44. Bertrand, M.; Mullainathan, D.S. How Much Should We Trust Differences-in-Differences Estimates? *Q. J. Econ.* **2004**, *119*, 249–275. [CrossRef]
- 45. Wang, H.; Li, Y.; Lin, W.; Wei, W. How does digital technology promote carbon emission reduction? Empirical evidence based on e-commerce pilot city policy in China. *J. Environ. Manag.* **2023**, *325*, 116524. [CrossRef] [PubMed]
- 46. Baron, R.M.; Kenny, D.A. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* **1986**, *51*, 1173–1182. [CrossRef]
- 47. Diao, M.; Leonard, D.; Sing, T.F. Spatial-difference-in-differences models for impact of new mass rapid transit line on private housing values. *Reg. Sci. Urban Econ.* **2017**, *67*, 64–77. [CrossRef]
- 48. Xu, H.; Liu, W.; Zhang, D. Exploring the role of co-agglomeration of manufacturing and producer services on carbon productivity: An empirical study of 282 cities in China. *J. Clean. Prod.* **2023**, *399*, 136674. [CrossRef]
- Harris, C.D. The, Market as a Factor in the Localization of Industry in the United States. Ann. Assoc. Am. Geogr. 1954, 44, 315–348. [CrossRef]

- 50. Cao, X.; Deng, M.; Li, H. How does e-commerce city pilot improve green total factor productivity? Evidence from 230 cities in China. *J. Environ. Manag.* 2021, 289, 112520. [CrossRef]
- Wang, Z.; Li, M.; Liao, L.; Shi, Y. Aging Populations and Regional Entrepreneurship: A Study Using Entrepreneurship Data from Qixinbao. *J. Financ. Res.* 2022, 2, 80–97. Available online: www.jryj.org.cn/CN/Y2022/V500/I2/80 (accessed on 28 September 2023).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.