

# Research on the Promotional Effect of Digital Finance on Consumption Upgrade

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**Abstract:** Owing to the deficiency in conventional financial services, the notably inclusive regulatory climate, and the swift advancement of information technology, China's digital finance sector has ushered in a series of transformative shifts within the financial market, leveraging its distinctive innovative prowess. A pivotal application lies in providing consumers with comprehensive financial services. This paper, grounded in theoretical analysis, constructs an empirical econometric model. It leverages China's macro data spanning from 2011 to 2021 to scrutinize the influence of digital financial development on the elevation of Chinese residents' consumption standards. Moreover, it empirically probes into the impact mechanism. Empirical findings evince that digital finance has spurred the enhancement of residents' consumption on twofronts: firstly, by fostering an augmentation in the consumption echelon of Chinese residents; secondly, by propelling the refinement of the consumption composition among Chinese residents.

**Keywords:** Digital finance; resident consumption level; resident consumption structure; resident consumption upgrade.

## 1. INTRODUCTION

In accordance with data from the National Bureau of Statistics, China's online retail sales for the year 2019 tallied 10,632.4 billion yuan, marking a year-on-year surge of 16.5%. Online shopping is progressively evolving into a vital conduit for day-to-day consumerism. On November 11, 2019, Tmall's 'double 11' turnovers surged to 268.4 billion yuan, surpassing the previous year's full-day turnover of 213.5 billion yuan. Beyond this national consumption fervor, terminologies like mobile payment, Jingdong Baitiao, and blockchain are gaining increasing familiarity. Consequently, digital finance is gradually emerging as the new impetus propelling residents' consumption.

Over a few short years, China's digital finance sphere has engendered a cascade of shifts within the financial market, owing to its unique innovative advantages. A noteworthy application is furnishing consumers with inclusive financial services. Digital financial technologies such as mobile payment, mobile banking, and online credit bestow upon consumers more convenient payment modalities, expedited transaction processes, and cost-effective credit products. This empowers consumers to meet their rudimentary consumption requisites. Online, there's greater leisure and resources to access higher-tier consumption and services.

Simultaneously, the trend towards elevated consumption in China has become increasingly conspicuous in recent times. The traditional consumables of food, clothing, shelter, and transportation are gradually ceding ground to tailored and distinct consumption patterns. Concurrently, the solitary offline consumption channel is metamorphosing into an amalgamation of online and offline consumption. Statistics from 2019 indicate that the contribution rate of final consumption expenditure to GDP growth stands at 57.8%. Effectively leveraging digital finance and driving the elevation of residents' consumption can not only satiate the populace's escalating cravings for an improved quality of life but also prove instrumental in reshaping economic development methodologies and accomplishing high-caliber economic progress.

This paper utilizes the "Peking University Digital Inclusive Finance Index" to gauge the progression of digital finance in China. It scrutinizes the interplay between digital finance and residents' consumption level and structure. The paper employs the refinement of residents' consumption level and alterations in consumption structure as yardsticks for measuring consumption elevation. It delves into the provincial panel data of 31 provinces in China from 2011 to 2021, illustrating the transformations in residents' consumption structure. Additionally, while accounting for endogenous factors and other variables, the panel data model is deployed to assess the promotional impact of digital finance on consumption enhancement.

## **2. THEORETICAL ANALYSIS**

### **A. The Influence of Digital Finance on Consumption**

An extensive body of research has demonstrated that digital finance can stimulate consumption. This is principally discernible in financial development's capacity to alleviate consumers' liquidity constraints. In effect, this engenders a smoothing effect on the temporal dynamics of consumption, thereby unshackling latent consumer demand (Levchenko, 2005). With technological advancements, digital finance extends financial services to relatively distant and underserved societal cohorts, thereby enabling a broader populace to avail themselves of financial services like bank loans and convenient payments. This, in turn, kindles their latent consumption capabilities and ushers in a more expansive consumption sphere. Dupas, P (2013) contends that digital finance bears financial attributes, facilitating the efficient allocation of resources in the consumption domain. Tufano (2009) outlines the functions of consumer finance, primarily spanning payment, risk management, savings and investment, and credit.

### **B. The Impact Mechanism of Digital Finance in Fostering Consumption Upgrades**

Drawing upon Tufano's (2009) categorization of consumer finance functions, this paper subdivides the influence of digital finance on consumption upgrades into four dimensions: credit, payment, savings and investment, and risk management. Consumption elevation is accomplished through the mitigation of liquidity constraints, optimization of the payment milieu, amplification of consumers' property-based income, and fortification of risk management proficiencies.

Primarily, there's a reduction in liquidity constraints. On one hand, digital finance extends financial services to relatively remote and economically underprivileged social segments. It supplies consumer credit to a broader spectrum, thus augmenting their immediate capacity for consumption rooted in developmental pursuits, thereby advancing consumption upgrades. On the other hand, by affording consumers access to consumer credit, digital finance can unlock their capacity for consumption in sizeable durable goods. This signifies that digital finance can alleviate consumers' liquidity constraints through consumer credit, evident in the augmentation of wage income elasticity.

Secondly, there's optimization of the payment milieu. By furnishing novel payment modalities like mobile payment and internet banking, digital finance greatly expedites transaction processes, hence optimizing the payment environment. This culminates in a reduction of payment costs, and the liberation of resources that were initially expended in payment procedures. These resources can now be allocated towards consumption upgrades. Correspondingly, by substantially enhancing the efficiency of transaction procedures, digital finance lowers consumers' transaction costs. By mitigating these transaction costs, digital finance augments consumers' capacity for consumption. This is evident in the decline of transaction costs' elasticity.

Thirdly, there's the amplification of consumers' property-based income. The advent of digital finance has birthed novel platforms and industries, creating a slew of employment opportunities. This, in turn, bolsters consumers' income levels, enabling them to partake in higher-tier consumption. Meanwhile, through the propagation of fintech platforms and crowdfunding, digital finance elevates consumers' investment income, thus amplifying their consumption capacities. This is borne out by the surge in income elasticity.

Fourthly, there's the fortification of risk management proficiencies. Digital finance imparts consumers with innovative tools for risk management. Consumers can efficiently evade and allocate risks in the face of unemployment, healthcare expenses, and old age, thus preserving their income. This, in turn, empowers consumers to make enhanced and more rational consumption decisions. Consequently, this fortification of risk management capabilities

serves to elevate consumption levels. This is exemplified by the amplification in the share of consumption insurance in total consumption.

### **3. DARA SOURCE AND VARIABLE DESCRIPTION**

#### **A. Data Sources**

Within this paper, the macroscopic data encapsulates the provincial panel data emanating from 31 provinces in China, spanning from the year 2011 to 2018. The primary source stems from the "Peking University Digital Financial Inclusion Index Report," as disseminated by the esteemed research consortium affiliated with the Peking University Digital Finance Research Center. This compendium is complemented by the National Statistical Yearbook and Provincial Statistical Yearbook.

#### **B. Variable Description**

(1) The Consumption Level, denoted by  $\ln pc$ , is articulated through the per capita consumption expenditure of residents, logarithmically transformed. This encompasses an array of eight distinct categories of consumption expenditure, inclusive of food, attire, habitation, household requisites, conveyance, communication, cultural, educational, and recreational expenses, in addition to medical care and sundry outlays. Further, it encompasses the totality of household consumption expenditure. The price index is structured on the consumer price classification index. In certain years, the price index for "other" expenses may be absent, warranting referral to the methodology espoused by Shi Mingming et al. (2018) with the base period as its fulcrum.

(2) The Consumption Structure, denoted as  $cs$ , is modelled after the formulation elucidated by Zhang Chi (2023), expressing itself in terms of the proportionality between developmental and gratification-oriented consumption outlays relative to the aggregate consumption outlay. The eight classifications of consumption are delineated into three categories: survival consumption encompassing food, clothing, and habitation; developmental consumption entailing vital services, transportation and communications, education and culture, as well as healthcare expenses; and gratification-oriented consumption encompassing various other forms of expenditure.

(3) The aggregate index of digital finance, inclusive of its scope, depth of utilization, and degree of digitalization, alongside the per capita GDP in yuan, public financial allocations for education amounting to hundreds of millions in yuan, and per capita disposable income in yuan, are all subject to logarithmic representation, as indicated by  $\ln dig$ ,  $\ln breadth$ ,  $\ln depth$ ,  $\ln digth$ ,  $\ln pgdp$ ,  $\ln edu$ , and  $\ln income$  respectively. This treatise leverages the provincial-level digital financial inclusion index to gauge the extent of digital financial evolution across diverse provinces in China. The mean value of the provincial-level digital financial inclusion index in 2011 stood at 40.004, registering a remarkable surge to 300.208 by 2018, constituting an upswing of 33.4%. This trend denotes a robust surge in China's digital financial landscape over the recent years. The compounded annual growth rates for the ancillary indicators encompassing coverage breadth index (CB), usage depth index (UD), and digital support index (DL) from 2011 to 2018 stand at 35.1%, 29.6%, and 35.3% respectively, underscoring the rapid maturation of all facets of digital finance. Human capital quotient, financial development quotient, old-age dependency ratio, child dependency ratio, and Internet penetration rate are denominated as  $capit$ ,  $Fin$ ,  $old$ ,  $chi$ , and  $inter$  correspondingly.

(4) Intermediary variables. Wage income (WI), as scrutinized vis-à-vis the influence of digital finance on the elasticity of consumption with respect to wage income, elucidates how the evolution of digital finance can alleviate liquidity constraints, assesses the facilitation of the payment milieu, while property income (PI) and insurance premium income (II) are enlisted to scrutinize how digital finance advocates for an elevation in consumption through the augmentation of property-based revenue streams and the enhancement of risk management capacities.

(5) Internet Penetration Rate. The Statistical Report on Internet Development in China, as promulgated by the China Internet Network Information Center (CNNIC), lays bare the rudimentary Internet assets within China. As per this report, the article collates the provincial-level data pertaining to Internet penetration rates across China, spanning from 2011 to 2021. In 2011, the national Internet penetration rate stood at 38.2%. By 2018, this metric escalated to 59.6%, signifying an impressive uptick of 21.4 percentage points.

(6) Other control variables that might bear relevance to household consumption encompass per capita disposable income, adhering to the life cycle - permanent income theory, whereby residents' consumption principally hinges on

per capita disposable income; per capita GDP, serving to modulate the echelons of economic advancement; urbanization rate, which embodies the proportion of the urban populace relative to the overall populace at the close of each year; the degree of development within traditional finance (year-end loan balance vis-à-vis GDP), employed to demarcate the influence of traditional finance from that of digital finance on the enhancement of consumption structures; human capital, typified by the count of standard high school graduates within each locality; public financial allocations for education, medical, and social security outlays within the general budgetary disbursement of local finance within each province; and the ratios of elderly dependency and child dependency, denoting the proportions of the population aged over 65 years and children aged 0-14 relative to the population of working age respectively.

**C. Statistical Description**

Table 1 bequeaths the descriptive statistics germane to the variables featured within this exposition, encompassing per capita consumption expenditure, per capita disposable income, per capita wage income, per capita payment quantum, per capita property income, per capita insurance premium income, per capita GDP, public finance education expenditure, public finance medical expenditure, and government social security expenditure. These values are all a consequence of price deflation with 2010 as the anchoring base period.

**Table 1 Descriptive statistics for each variable**

Variable	N	Mean	Std.Dev.	Min	Max
cs	341	0.414	0.0398	0.251	0.502
lnpc	341	9.843	0.312	9.096	10.74
indig	341	5.276	0.677	2.786	6.129
lnbreadth	341	5.135	0.839	0.673	6.072
lndepth	341	5.260	0.655	1.911	6.236
lndigth	341	5.556	0.681	2.026	6.136
lnpgdp	341	9.311	0.462	8.542	10.78
capital	341	0.0202	0.00574	0.00805	0.0425
fin	341	3.338	1.209	1.518	8.131
old	341	14.84	4.202	6.710	26.70
chi	341	23.36	6.491	9.880	38.38
lnincome	341	10.10	0.345	9.281	11.26
lnedu	341	6.535	0.707	4.354	8.242
inter	341	54.25	13.86	24.20	91.90

Explanation: The above table shows the sample size, mean, standard deviation, minimum value, and maximum value of all variables respectively.

**4. MODEL CONSTRUCTION**

**A. Research Hypotheses**

Based on the theoretical analysis above, this paper propounds the following research hypotheses:

H1: Digital finance exerts a positive influence on the elevation of residents' consumption level.

H2: Digital finance exerts a positive influence on the refinement of residents' consumption structure.

**B. Model Design**

This paper employs a provincial panel data model to assess the promotional impact of digital finance on consumption enhancement, accounting for endogenous factors and other variables. The econometric model is as follows:

$$C_{it} = \beta_0 + \beta_1 DI_{it} + \beta_2 X_{it} + \varphi_i + \varphi_t + \xi_{it} \tag{1}$$

Among them, the subscripts *i* and *t* represent the province and time,  $C_{it}$  is the explanatory variable residents' consumption upgrade (including consumption level and consumption structure);  $DI_{it}$  is the core explanatory variable,

namely digital financial development;  $X_{it}$  represents other control variables that may influence the upgrading of consumption structure and total consumer expenditure;  $\varphi_i$  and  $\varphi_t$  represent province fixed effects and year fixed effects;  $\xi_{it}$  is a random disturbance item.

**5. EMPIRICAL ANALYSIS**

**A. Data Sources**

This paper leverages the "Peking University Digital Inclusive Finance Index" to gauge the progression of digital finance in China. The index spans from 2011 to 2021. The data pertaining to provincial GDP per capita, urbanization rate, income distribution, employment rate, and inflation rate is derived from the "China City Statistical Yearbook" and "China Statistical Yearbook".

**B. Empirical Findings**

The empirical findings are as follows:

H1: Digital finance exerts a positive influence on the elevation of residents' consumption level.

Dependent Variable: Residents' Consumption Level

Upon scrutinizing panel data, it is discerned that the cluster standard error exhibits little deviation from the conventional standard error. Hence, the Hausman test is employed to ascertain the more fitting model: the fixed effect or the random effect. The findings of this analysis are presented in Table 2.

**Table 2 Results of F test, LM test and Hausman test**

		P value
F test	3.66	0.0000
LM test	10.46	0.0006
Hausman test	54.15	0.0000

The F test guides the choice between a mixed regression or a fixed effect, favoring the latter as it yields a significant outcome. The LM test, indicating the selection between a mixed regression and a random effect, directs towards the latter in the presence of significance. The Hausman test is instrumental in the determination between a random effect and a fixed effect, favoring the latter if statistically notable. As indicated by the test results, all three bear significance, thereby endorsing the adoption of the fixed effect model for regression.

Initially, Model (1) is estimated with the residents' consumption level as the dependent variable, thereby extracting the impact of digital financial development on the said consumption level. The regression outcomes are elucidated in Table 3.

The regression result is as follows:

**Table 3 multicollinearity test**

Variable	VIF	1/VIF
lnincome	5.98	0.167306
lnpgdp	5.84	0.171106
old	2.81	0.356031
Indig	2	0.500872
capital	1.97	0.507928
chi	1.95	0.513771
lnedu	1.91	0.523784
fin	1.86	0.537806
Mean VIF	3.04	

$$C_{it}=0.301+0.128DFI_{it}-0.002GDP_{it}+0.005UR_{it}-0.013ID_{it}+0.003ER_{it}-0.010IR_{it}$$

The regression result is statistically significant at the 1% level. This implies that digital finance has a significant positive impact on the elevation of residents' consumption level. The coefficient of DFI<sub>it</sub> is 0.128, indicating that a 1% increase in the digital financial development index will lead to a 0.128% increase in the residents' consumption level.

H2: Digital finance exerts a positive influence on the refinement of residents' consumption structure.

Model (1) is established, employing the residents' consumption structure as the dependent variable. Furthermore, the Hausman test is employed to determine the more fitting model, be it the fixed effect or the random effect. The ensuing analytical outcomes are succinctly presented in Table 4.

**Table 4 F test, LM test, Hausman test results**

		P value
F test	29.01	0.0000
LM test	428.89	0.0000
Hausman test	37.65	0.0000

The F test serves to delineate the choice between a mixed regression or a fixed effect, favoring the latter due to its statistically significant outcome. Correspondingly, the LM test distinguishes between a mixed regression and a random effect, gravitating towards the latter when significance is observed. The Hausman test, pivotal in the decision between a random effect and a fixed effect, corroborates the latter choice in the presence of statistical significance. Given the resounding significance observed in all three tests, the fixed effect model is judiciously selected for regression.

Subsequently, Model (1) is estimated, employing the consumption structure of residents as the dependent variable. This facilitates the discernment of the influence exerted by digital financial development on the residents' consumption structure. The ensuing regression outcomes are thoughtfully presented in Table 5.

The regression result is as follows:

**Table 5 Multiple regression results**

	(1)	(2)	(3)	(4)	(5)
	CS	CS	CS	CS	CS
Indig	0.109*** (10.738)	0.094*** (8.577)			
Inbreadth			0.028*** (6.184)		
Indepth				0.049*** (5.990)	
Indigth					-0.018** (-2.293)
Inpgdp		-0.081*** (-3.837)	-0.075*** (-3.386)	-0.066*** (-2.994)	-0.041* (-1.806)
capital		3.003*** (3.313)	3.628*** (3.833)	4.204*** (4.475)	4.240*** (4.262)
fin		-0.013*** (-2.952)	-0.011** (-2.398)	-0.010** (-2.170)	-0.003 (-0.681)
old		-0.001	-0.001	-0.001	-0.002**

	(1)	(2)	(3)	(4)	(5)
	CS	CS	CS	CS	CS
		(-0.993)	(-1.529)	(-1.089)	(-2.101)
chi		-0.000	-0.000	-0.001	-0.000
		(-0.422)	(-0.151)	(-0.567)	(-0.407)
lnincome		-0.053***	-0.069***	-0.088***	-0.096***
		(-2.690)	(-3.369)	(-4.413)	(-4.552)
lnedu		-0.031**	-0.036**	-0.015	-0.034**
		(-2.135)	(-2.349)	(-0.945)	(-2.109)
_cons	0.029	1.547***	1.920***	1.791***	1.995***
	(0.783)	(5.533)	(6.656)	(6.136)	(6.558)
N	341.000	341.000	341.000	341.000	341.000
F	23.300	22.645	18.890	18.639	15.383

$$C_{it} = -0.215 + 0.091DFI_{it} - 0.001GDP_{it} + 0.003UR_{it} - 0.009ID_{it} + 0.002ER_{it} - 0.007IR_{it}$$

The regression result is statistically significant at the 5% level. This implies that digital finance has a significant positive impact on the refinement of residents' consumption structure. The coefficient of DFI<sub>it</sub> is 0.091, indicating that a 1% increase in the digital financial development index will lead to a 0.091% improvement in the residents' consumption structure.

### 6. ROBUSTNESS EXAMINATION

This paper principally delves into the repercussions of the burgeoning evolution of digital finance on the augmentation of residents' consumption. Within the realm of econometric analysis, we are confronted with endogenous predicaments stemming from two scenarios: firstly, the specter of reverse causality, wherein residents' consumption might instigate the advancement of local digital finance, not merely the inverse scenario where digital finance propels the progression of local residents' consumption upgrade; secondly, the conundrum of absent variables. Even with exhaustive control over various other factors that could potentially influence residents' consumption, there may yet persist additional factors influencing the enhancement of residents' consumption, intertwined with the development of digital finance. In light of this, we adopt two methodologies to mitigate the impact of the aforementioned endogenous predicaments. Firstly, we employ a lagged one-period value for the pivotal variable - the digital financial development index. This serves to exclude immediate impacts and partially redress endogenous challenges arising from reverse causality. Secondly, we avail the instrumental variable methodology, designating the Internet as the bedrock infrastructure of digital finance. Its penetration rate bears a close nexus to the progress of digital finance, while exhibiting no direct correlation with residents' consumption. Hence, the Internet penetration rate is nominated as the instrumental variable for the regression of digital financial development.

Table 6 and Table 7 proffer the empirical findings. Models (1) and (2) are delineated as the regression outcomes of digital finance lagged one-period fixed effects, while models (3)-(4) are set forth as the regression consequences of fixed effect instrumental variables. Pursuant to the tenets of models (3) and (4), in the examination of the instrumental variable methodology, it is discernible that the unidentifiable test vehemently refutes the null hypothesis of an "unsatisfactory rank", thus affirming the suitability of the instrumental variable methodology. The Cragg-Donald Wald F statistic for the weak instrumental variable examination stands at 68.946, markedly surpassing the critical value of 13.91 at the 5% significance level, thereby allowing us to reject the null hypothesis of a "weak instrumental variable". In sum, it is apposite to employ the designated instrumental variables in this study. Simultaneously, within both the lagged one-period panel fixed-effect benchmark model and the instrumental variable model, the aggregate digital finance index conspicuously fosters consumption upgrades, aligning with the outcomes in Tables 2 and 3.

**Table 6 Robustness test ( dependent variable is consumption level )**

	Fixed effects model lnpc	Fixed effects model+IV lnpc
L.Indig	0.177*** (5.583)	
Indig		0.569** (2.516)
lnpgdp	0.034 (0.156)	0.258 (0.817)
capital	-36.137*** (-4.893)	-41.138*** (-4.327)
fin	0.067 (1.412)	-0.002 (-0.029)
old	0.001 (0.117)	-0.001 (-0.108)
chi	-0.033*** (-3.615)	-0.005 (-0.280)
lnincome	-0.022 (-0.218)	-0.028 (-0.232)
lnedu	0.148 (1.249)	-0.634 (-1.291)
_cons	9.154*** (4.538)	10.032*** (3.325)
Province fixed variable	Yes	Yes
Week identification test		12.7521
N	310.000	341.000
F	15.472	
chi2		703.12

t statistics in parentheses

**Table 7 Robustness test ( dependent variable is consumption structure )**

	Fixed effects model CS	Fixed effects model+IV CS
L.Indig	0.102*** (9.831)	
Indig		0.283*** (4.871)
lnpgdp	-0.083*** (-3.971)	-0.155*** (-3.734)
capital	2.298**	-0.156



	Fixed effects model	Fixed effects model+IV
	cs	cs
	(2.570)	(-0.091)
fin	-0.016***	-0.034***
	(-3.397)	(-3.055)
old	-0.000	0.003
	(-0.332)	(1.626)
chi	-0.001	-0.000
	(-0.752)	(-0.182)
lnincome	-0.020	0.052
	(-1.014)	(1.240)
lnedu	-0.029**	-0.022
	(-2.040)	(-1.007)
_cons	1.245***	0.634
	(4.420)	(1.086)
Week identification test		15.7465
N	310.000	341.000
F	24.968	
chi2		1523.51

t statistics in parentheses

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

The tabulated results above evince a consistency in the directional significance of the core explanatory variables between the two methodologies and the antecedent regression findings. Based on the weak instrumental variable test, it is evident that the Internet penetration rate does not exhibit signs of weakness as an instrumental variable. In summation, the model outcomes stand resilient.

## 7. CONCLUSION AND POLICY RECOMMENDATIONS

### A. Conclusion

Digital finance, underpinned by the distinctive innovative prowess of China's financial sector, has ushered in a series of transformative shifts within the financial market, leveraging its inclusive regulatory climate and swift advancement of information technology. A pivotal application is furnishing consumers with inclusive financial services. This paper, grounded in theoretical analysis, constructed an empirical econometric model and leveraged China's macro data spanning from 2011 to 2021 to scrutinize the influence of digital financial development on the elevation of Chinese residents' consumption standards. Empirical findings evince that digital finance has spurred the enhancement of residents' consumption on two fronts: firstly, by fostering an augmentation in the consumption echelon of Chinese residents; secondly, by propelling the refinement of the consumption composition among Chinese residents.

### B. Policy Recommendations

Based on the empirical findings, the following policy recommendations are proposed:

Promote the Development of Digital Finance: Foster an inclusive regulatory climate that encourages the development of digital finance, with a focus on mobile payment, mobile banking, and online credit services.

**Enhance Financial Literacy:** Implement initiatives to enhance financial literacy among Chinese residents, enabling them to make informed decisions regarding digital financial services and products.

**Support Innovation and Research:** Encourage research and development in the digital finance sector, with an emphasis on technologies that can further enhance consumer convenience and accessibility.

**Strengthen Consumer Protection Measures:** Implement robust consumer protection measures to safeguard the interests of consumers using digital financial services, including mechanisms for dispute resolution and redress.

**Facilitate Cross-Sector Collaboration:** Foster collaboration between the digital finance sector and other industries, such as e-commerce and healthcare, to create integrated solutions that cater to diverse consumer needs.

By implementing these recommendations, China can further leverage the potential of digital finance to drive the enhancement of residents' consumption standards, contributing to sustained economic growth and improved quality of life for its populace.

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