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Nonlinear Effect of Digital Economy on Urban–Rural Consumption Gap: Evidence from a Dynamic Panel Threshold Analysis

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Abstract: Reducing the disparity in consumption between urban and rural areas, as a critical component in mitigating the economic imbalance between them, holds significant importance in enhancing people's sense of well-being and achieving collective prosperity. This research investigated the nonlinear impact of the digital economy and its sub-dimensions, including digital industrialization, industrial digitization, and the digital environment, on the urban–rural consumption disparity. We employed a systematic GMM and a dynamic panel threshold regression model and utilized dynamic panel data from 30 provinces in China. Our research reveals that the impact of digital economic development on the urban–rural consumption gap displays an inverted U-shaped nonlinear relationship of widening and then narrowing. This effect is primarily determined by the process of digital industrialization. The digital economy exerts a notable impact on the urban–rural consumption gap, with significant threshold effects identified for the income gap, the education gap, and financial expenditure for livelihoods; these threshold effects exhibit variation across the three sub-dimensions of the digital economy. Further analysis reveals that the digital economy plays a vital role in reducing the disparity between urban and rural hedonic and developmental consumption, while promoting the optimization and upgrading of consumption structure. Upon accounting for regional disparities in urbanization rates, it has been observed that the digital economy's dampening effect on the urban–rural consumption gap is notably more pronounced in areas with lower rates of urbanization. To more effectively leverage the positive impact of the digital economy on bridging the urban–rural consumption divide, it is recommended that the government accelerate the establishment of a digital environment in rural areas, encourage the integration of digital industries with traditional rural industries, and optimize the investment structure of livelihood-based finance. These measures would help to create a more conducive environment for the digital economy to thrive and could contribute to narrowing the consumption gap between urban and rural areas.

Keywords: digital economy; consumption gap; income gap; education gap; fiscal expenditure for people's livelihoods

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Citation: Zhang, Y.; Ma, G.; Tian, Y.; Dong, Q. Nonlinear Effect of Digital Economy on Urban–Rural Consumption Gap: Evidence from a Dynamic Panel Threshold Analysis. *Sustainability* **2023**, *15*, 6880. https://doi.org/10.3390/su15086880

Academic Editors: Isabel Novo-Corti, Diana-Mihaela Țîrcă and Laura Mariana Cismaș

Received: 18 March 2023
Revised: 12 April 2023
Accepted: 18 April 2023
Published: 19 April 2023

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1. Introduction

Consumption serves as both the start and end point of economic activity, and it exerts guiding and stimulating effects on a country's economic growth. Since the introduction of the reform and opening-up policy, China has experienced swift economic expansion, which has gradually given rise to a distinct urban–rural dual structure. This structure has resulted in a widening income disparity between urban and rural residents, eventually culminating in the emergence of a consumption gap [1]. In recent years, the consumption levels of both urban and rural residents in China have been rising. However, the consumption level and quality of life of rural residents remain generally lower than those of their urban counterparts [2]. In 2021, the per capita consumption level of urban residents in China was

2.04 times higher than that of rural residents, indicating a significant consumption gap between the two groups. The excessive consumption gap between urban and rural residents not only hinders inclusive economic growth but also exacerbates social inequality, ultimately impeding the harmonious development of society [3]. Furthermore, consumption status can reflect an individual's ability to withstand income shocks, and the consumption gap provides a more accurate measure of the differences in residents' true welfare levels [4]. Therefore, a wider consumption gap can have serious implications for the happiness of certain individuals. The "Opinions on Improving the System and Mechanisms to Stimulate Domestic Consumption and Unleash the Potential of Consumption Further", issued by the Central Committee of the Communist Party of China and the State Council in 2018, explicitly proposed promoting the upgrading of rural residents' consumption patterns and gradually reducing the consumption gap between urban and rural residents. It can be seen that narrowing the urban–rural consumption gap is crucial to addressing imbalanced and inadequate development in China. This effort could help promote more inclusive economic growth, reduce social inequality, and enhance the well-being of all residents. By achieving greater equity and common prosperity, China can continue to move toward a more sustainable and prosperous future.

To mitigate the disparity in consumption patterns between urban and rural areas, it is imperative to discern the factors that determine consumption for both urban and rural inhabitants. In recent years, the emergence of a new generation of information technology, such as the Internet, big data, and cloud computing, has facilitated the advent of novel business models in the digital economy. These models, including, but not limited to, digital technology-based e-commerce, online education, telemedicine, and online offices, have provided an impetus for the smooth progression of China's macro-economy, particularly in light of the increasingly intricate international scenario. However, the number of Internet users in China has displayed an "S"-shaped growth trajectory since 1998, whereas the ultimate consumption rate has demonstrated a "U"-shaped shift [5]. Hence, this paper seeks to determine the impact of the development of the Internet-based digital economy on the urban–rural consumption gap, as well as its underlying mechanism. By addressing the aforesaid inquiries, we expect to provide a reference for narrowing the urban–rural consumption gap and achieving common prosperity.

Several scholars have conducted measurements and comparisons of consumption gaps in China. They have found that the overall consumption inequality among Chinese residents is primarily attributed to the urban–rural consumption gap [6,7]. The consumption gap between urban and rural residents in China displayed a trend of "expansion followed by contraction" from 1992 to 2019, with the maximum consumption gap between urban and rural residents observed in 2003 [8]. Furthermore, several studies have confirmed that some factors can have a significant impact on the urban–rural consumption gap. These factors include urban–rural income inequality [9,10], urbanization development [11–13], industrial structure optimization [14], digital finance [15], and Internet usage [16,17]. Existing research has predominantly focused on the urban–rural income gap when examining inequality between urban and rural areas, with relatively less attention given to the urban–rural consumption gap. While some studies have reached a consensus on the measurement of the urban–rural consumption gap [3,18], and have explored a limited number of factors that influence this gap, there remains a dearth of research examining how the digital economy impacts the urban–rural consumption gap in the context of digital development. The main shortcomings of existing research are as follows. Firstly, while some studies acknowledge the significant impact of the digital economy on the urban–rural consumption gap, and some suggest that there may be a nonlinear relationship between the two, there is a lack of in-depth exploration regarding the reasons for this nonlinear relationship. Secondly, existing studies mainly focus on the level of digital economic development or the impacts of specific components of the digital economy, such as Internet usage, digital inclusive finance, and e-commerce, on residents' consumption. However, as the digital economy is a more macro-level concept, decomposing it into different dimensions may reveal a lack of research

on each dimension's impact on the urban–rural consumption gap. Thirdly, current studies overlook the heterogeneous impact of the digital economy on each type of consumption gap. By investigating different types of consumption gap, we can better discern whether the digital economy can alleviate the inequality in the upgrading of consumption structure, which is important in reducing the gap between urban and rural quality of life.

This paper aims to provide a more comprehensive understanding of the relationship between the digital economy and the urban–rural consumption gap by incorporating them into a unified framework and conducting a multi-dimensional empirical study. Specifically, we examine the impacts of digital industrialization, industrial digitization, and the digital environment on the urban–rural consumption gap. The contributions of this study are three-fold. Firstly, we apply the systematic generalized moment estimation method (GMM) to overcome the endogeneity problem and confirm the nonlinear impact of the digital economy on the urban–rural consumption gap. Secondly, we establish a dynamic panel threshold model to explore the reasons for the nonlinear relationship between the digital economy and the urban–rural consumption gap. Thirdly, we take a structural perspective and conduct an in-depth analysis of the effects of the digital economy on the subsistence, hedonic, and development consumption gaps. In doing so, we uncover the pathways through which the digital economy affects the urban–rural consumption gap.

The rest of this paper is organized as follows. Section 2 comprises a theoretical analysis and the formulation of hypotheses. In Section 3, we describe our empirical methods and data. Section 4 presents the empirical results. Finally, Section 5 provides the conclusion and offers policy implications.

2. Theoretical Mechanisms and Research Hypotheses

Amidst an increasingly intricate international landscape, the role of the digital economy in propelling China's economic growth has become increasingly prominent. As per the "2022 Report on the Development of China's Digital Economy" published by the China Academy of Information and Communications Technology, China's digital economy scale reached CNY 45.5 trillion in 2021, marking a year-on-year nominal growth rate of 16.2%, and accounting for 39.8% of GDP. As one of the three engines of economic development, household consumption is profoundly influenced by the integration of the digital economy with the real economy, including the Internet, big data, e-commerce, and other digital technologies. On the one hand, as the digital environment develops, the threshold for utilizing digital technology is gradually decreasing, enabling a wider populace to benefit from the dividends offered by the digital economy. Notably, digital payment services have enabled rural residents to conveniently procure goods and services through online platforms [19,20]. Driven by e-commerce platforms, the digital economy has effectively transcended temporal and spatial limitations, altering traditional consumption patterns and mitigating geographical barriers to consumption. In this way, it has facilitated the transformation of rural residents' consumption potential into tangible consumption [21].

The growth of the digital economy has also given rise to a digital divide, which has created new inequalities in opportunities and hindered equal access to the benefits of digital resources [22]. In the early stages of digital economic development, digital resources tend to be concentrated in cities due to rapid industrial digitization and digital industrialization. This unbalanced development has led to the emergence of the digital divide, which has widened the income and consumption gap between urban and rural residents [23]. Moreover, despite the development of digital finance increasing the income of rural residents, it has not significantly increased their consumption due to the existence of the digital divide [5]. Accordingly, this paper proposes research Hypothesis 1:

Hypothesis 1 (H1). *The influence of the digital economy on the existing urban–rural consumption gap exhibits nonlinear characteristics.*

Additionally, it is necessary to identify the factors that give rise to uncertainty regarding the degree to which the digital economy can close the urban–rural consumption gap. First, alterations in consumption are reliant on fluctuations in income. As per the relative income hypothesis, proposed by Duesenberry in 1949, modifications in an individual's consumption are affected by a "demonstration effect" [24]. In the case of rural residents, income inequality will engender a desire to elevate their social status, which will prompt them to increase their savings [25]. Conversely, for urban residents, income inequality will exacerbate their propensity to compare their standard of living with their peers, driving them to engage in conspicuous consumption, and thus augmenting their overall consumption [26]. Consequently, income inequality will further widen the existing disparity between urban and rural consumption patterns. Additionally, a wider income gap will not only alter people's consumption behavior, but it will also impede the adoption of digital technology in the region due to the low likelihood of lower-income individuals utilizing digital products [27]. However, some studies suggest that the current widening income gap does not significantly affect the necessity for adopting information technology [28].

Secondly, an upsurge in education levels can enhance the income and income expectations of individuals and households, consequently elevating the standard of household consumption [29]. Notably, with restricted household income, rural residents exhibit a higher inclination to augment their consumption levels and restructure their consumption patterns as their educational attainments continue to progress [30,31]. As rural information infrastructure construction continues to advance, the digital divide predicament is gradually evolving into a usability gap [32]. Additionally, improvements in the education levels of rural residents can significantly enhance their participation in the digital countryside, consequently promoting the digitization of rural industries [33]. However, unlike the positive impact of education levels, educational inequality can have adverse effects on digital technology utilization, and this negative impact is more pronounced in regions with lower levels of socioeconomic development [34]. Furthermore, the widening gap in education levels will impede the rapid and efficient transfer of information and technology diffusion, subsequently inhibiting the spread of digital technologies [35].

Thirdly, according to Keynesian theory, the expansion of government spending can generate a multiplier effect by multiplying demand and stimulating the economy. Public expenditure constitutes a crucial instrument for the government to enhance people's living standards and promote consumption, with the direction and structure of such expenditure playing a pivotal role in reducing the urban–rural consumption gap [36]. Among the various forms of public expenditure, fiscal expenditure on people's livelihoods provides a substantial amount of public goods and other public benefits or services with externalities that promote economic development. Furthermore, a conducive social environment can bolster the level of digital technology penetration and enhance the efficiency of digital economic development. Public service expenditure, such as that directed towards education, healthcare, and social security in fiscal expenditure for livelihoods, can significantly alleviate uncertainty and have a profound impact on residents' consumption. However, in the context of the prevailing urban–rural dualistic economic structure in China, the expenditure and revenue activities associated with the implementation of livelihood finance exhibit conspicuous dualistic characteristics [37]. This dualistic feature may engender discrepancies in its impact on the growth of the digital economy and residents' consumption. The following analysis demonstrates that the impact of the digital economy on the urban–rural income gap is contingent upon several factors, including the extent of the urban–rural income gap, the urban–rural education gap, and the level of livelihood-based fiscal expenditure. Thus, the following hypotheses are proposed:

Hypothesis 2 (H2). *There is a threshold effect of income gap on the impact of the digital economy on the urban–rural consumption gap.*

Hypothesis 3 (H3). *There is a threshold effect of education gap on the impact of the digital economy on the urban–rural consumption gap.*

Hypothesis 4 (H4). *There is a threshold effect of livelihood-based fiscal spending on the impact of the digital economy on the urban–rural consumption gap.*

3. Study Design

3.1. Econometric Models

In this paper, we commenced by scrutinizing the impact of the digital economy on the urban–rural consumption gap. In view of the fact that consumption inertia influences the current consumption expenditure of rural residents, we incorporated the lagged one-period variables of the urban–rural consumption gap into our model, leveraging existing research [30]. Specifically, we constructed the following dynamic panel model:

$$congap_{it} = \beta_0 + \beta_1 DIGE + \beta_3 congap_{it-1} + \gamma X_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Furthermore, in light of the potential nonlinear association between the digital economy and the urban–rural consumption gap, we introduced a quadratic term for the digital economy in our model. The resulting extended model is as follows:

$$congap_{it} = \beta_0 + \beta_1 DIGE + \beta_2 DIGE2_{it} + \beta_3 congap_{it-1} + \gamma X_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

In the model, i denotes the various provinces, autonomous regions, and municipalities directly under the central government, while t represents the year. $congap$ refers to the urban–rural consumption gap, $DIGE$ denotes the level of development of the digital economy, $DIGE2$ represents the squared term of the level of development of the digital economy, and X represents the control variables. μ_i reflects the unobserved regional differences that do not change over time, and ε_{it} denotes the random disturbance term.

This endogeneity problem causes the estimated coefficients obtained from ordinary least squares or fixed effects models to be biased and non-consistent due to the inclusion of the lagged terms of the explanatory variables in the above equations. In view of this, this paper used the Systematic Generalized Method of Moments Estimation (S-GMM) to estimate the dynamic panel model and effectively address the endogeneity problem.

To further investigate whether there exists a threshold effect in the nonlinear relationship between the digital economy and the urban–rural consumption gap, we constructed a dynamic panel single-threshold model. Drawing on the theoretical analysis in the previous section and following the approach used in [38], we used income disparity, educational disparity, and livelihood-based fiscal expenditure as threshold variables in the following model:

$$congap_{it} = X'_{it}\beta + (1, X'_{it})\delta 1\{q_{it} > \lambda\} + \mu_i + \varepsilon_{it} \quad (3)$$

In model (3), λ denotes the threshold value, q represents the threshold variable, and X'_{it} includes all explanatory variables with the first-order lagged dependent variable; this method eliminates the individual effect μ_i through first-order differencing. Then, the GMM method was used to estimate the threshold value "λ" and the coefficients β of X'_{it} before and after the threshold.

3.2. Variable Definition

(1) The explained variable is the urban–rural consumption gap (congap). This study draws on previous research that uses the Theil index to measure the urban–rural consumption gap [8]. The calculation method is as follows: $congap_t = \sum_{j=1}^{2} \left(\frac{c_{jt}}{c_t}\right) ln\left(\frac{c_{jt}}{c_t} / \frac{p_{jt}}{p_t}\right)$, $j = 1, 2$, which denotes urban and rural areas, respectively. p_t represents the population, and c_t represents consumption.

(2) The primary explanatory variable in this study is the level of digital economic development (DIGE). As per the "White Paper on China's Digital Economic Development in 2017", the digital economy is a novel form of economic activity that utilizes digital knowledge and information as key production factors, digital technology innovation as the primary driver, and modern information networks as a critical carrier, and enables the integration of digital technology with the real economy to enhance the digitization and intelligence of traditional industries. This, in turn, accelerates the restructuring of economic development and government governance models. The National Bureau of Statistics of China has recently classified the digital economy into two primary categories—digital industrialization and industrial digitization—as per the "Digital Economy and its Core Industries Statistical Classification (2021)". This article is based on the connotation of the digital economy, focusing on the conditions, applications, and environment of the digital economy. In addition, it refers to existing research and constructs a comprehensive system of digital economic indicators [39]. It is believed that the digital economy consists of three dimensions: digital industrialization (DIGIN), industrial digitalization (INDIG), and the digital environment (DIGEN). Digital industrialization represents the foundation of the digital economy, and its specific forms include electronic information manufacturing, the information and communication industry, the software service industry, and the Internet industry, among others. Industrial digitization, on the other hand, pertains to the integration of digital technology in traditional industries (e.g., agriculture, industry, and services) to enhance production quantity and efficiency. Moreover, the digital environment is an indispensable condition for the rapid development of digital industrialization and industrial digitalization, and the innovation environment and the digital literacy of residents can, to some extent, determine the level of development of the digital economy. Therefore, this article draws on existing research and selects the following: 12 third-level indicators that can be used to measure the telecommunications industry, software industry, and Internet industry, and thus, measure digital industrialization; 9 indicators that can be used to measure agricultural digitalization, industrial digitalization, and service digitalization, and thus, measure industrial digitalization; and 4 indicators that can represent the innovation environment and digital literacy of residents, and thus, measure the digital environment [39,40]. The specific variables comprising each dimension are outlined in detail in Table 1. To determine the digital economic development level for each province, the entropy value method is employed.

(3) Based on the previously conducted analysis, the impact of the digital economy on the urban–rural consumption gap is likely influenced by several factors. These may include the urban–rural income gap and the education gap, which could potentially weaken the benefits derived from the digital economy. Additionally, it is important to examine whether the level of livelihood-based fiscal expenditure, which is a crucial tool in government regulation, plays a significant role in the effect of the digital economy on the urban–rural consumption gap. Therefore, this paper selects three threshold variables, namely the urban–rural income gap (incogap), the urban–rural education gap (edugap), and the level of livelihood-based fiscal expenditure (finlive). Drawing on the existing literature [36,41–43], we utilize the urban–rural income Theil index, the ratio of per capita education level between urban and rural residents, and the sum of per capita fiscal expenditure on education, social security and employment, and healthcare as a percentage of total fiscal expenditure to measure these variables.

(4) Drawing on prior research, this study introduces control variables that may influence the urban–rural consumption gap in the model. These variables include the level of industrial structure upgrading (indup), the level of livelihood-based fiscal spending (finlive), the degree of openness to the outside world (open), the old-age dependency ratio (old), and the child dependency ratio (child). Industrial structure upgrading is an important variable that can facilitate the transfer of surplus rural labor to the

urban sector and can have a significant impact on the urban–rural income gap and consumption gap; the formula is as follows: $indup = \sum_1^3 q_i = q_1 \times 1 + q_2 \times 2 + q_3 \times 3$, where q_i represents the proportion of the output value of industry i [44]. Fiscal expenditure targeting people's livelihoods can significantly influence income redistribution and economic development policy. In particular, government-guaranteed expenditure plays a crucial role in reducing the consumption gap between urban and rural residents through income redistribution. The degree of openness of an economy can be gauged by measuring the proportion of total import and export to Gross Domestic Product (GDP). Demographic changes, as manifested by the elderly dependency ratio and child dependency ratio, can have a significant impact on residents' consumption. The aging of China's population has been a growing concern in recent years. Families with young children experience a different level of education and cultural expenditure to those without. The discrepancy in education costs between urban and rural areas further compounds the consumption gap between these regions. Based on prior research, the old-age dependency ratio and child dependency ratio can be measured by calculating the proportion of the population over 65 years old and the proportion of the population aged 0–14 years old, respectively, compared to that of the population aged 15–64 years old [45].

Table 1. Digital economic development indicator system.

First-Level Indicators	Second-Level Indicators	Third-Level Indicators
Digital industrialization	Telecommunications industry	The number of electronic information manufacturing enterprises above designated size Total telecommunications businesses Total profit of telecommunications industry Employment in information transmission and information technology services industry
	Software industry	Number of enterprises Revenue from information technology services Revenue from software services Employment in computer services and software industry
	Internet industry	Internet access ports Mobile phone users Broadband internet users Mobile internet users
Industrial digitalization	Digitalization of agriculture	Rural broadband access users Number of ecological and agricultural meteorological experimental stations Number of taobao villages
	Digitalization of industry	Number of enterprise websites Expenditure on technical transformation by large-scale industrial enterprises Full-time equivalent of R&D personnel in large-scale industrial enterprises
	Digitalization of services industry	E-commerce sales Digital inclusive finance index Express delivery volume
Digital environment	Innovation environment	Number of domestic patent applications R&D intensity
	Resident literacy	Expenditure on education Proportion of residents with college education or above

3.3. Data Sources and Descriptive Statistics

This article selects panel data from 30 provinces (municipalities and autonomous regions) in China from 2014 to 2019. Due to a lack of data availability, this article does not include data from regions such as the Tibet Autonomous Region, Taiwan, Macao, and Hong Kong. The data sources include the "*China Statistical Yearbook*", the "*China Electronic Information Industry Statistical Yearbook*", the "*China Science and Technology Yearbook*", the National Bureau of Statistics, and the Alibaba Research Institute.

Table 2 presents the descriptive statistics of the main variables. The minimum value of the urban–rural consumption gap in each province during the sample period is 0.018, the maximum value is 0.119, and the standard deviation is 0.022, indicating some variation in the urban–rural consumption gap across provinces. The variation range of digital economic development level, calculated using the entropy method, is 0.014 to 0.848, which highlights the significant disparity in the digital economic development level across different provinces in China. The VIF test for each explanatory variable reveals that the VIF values all meet the requisite threshold, indicating the absence of any significant multicollinearity among the explanatory variables.

Table 2. Descriptive statistics of the variables.

Variable		Obs	Mean	p50	Std	Min	Max
Urban–rural consumption gap	(congap)	180	0.056	0.054	0.022	0.018	0.119
Digital economy	(DIGE)	180	0.189	0.146	0.146	0.014	0.848
Digital industrialization	(DIGIN)	180	0.086	0.062	0.077	0	0.423
Industrial digitalization	(INDIG)	180	0.069	0.056	0.051	0.005	0.313
Digital environment	(DIGEN)	180	0.034	0.026	0.023	0.002	0.113
Urban–rural income gap	(incogap)	180	0.085	0.081	0.036	0.019	0.178
Urban–rural education gap	(edugap)	180	0.28	0.28	0.057	0.162	0.471
Livelihood-based fiscal expenditure	(finlive)	180	0.375	0.378	0.04	0.261	0.484
Industrial structure upgrading	(indup)	180	2.419	2.399	0.115	2.2	2.834
Openness to the outside world	(open)	180	0.254	0.135	0.254	0.013	1.134
Old-age dependency ratio	(old)	180	0.15	0.145	0.032	0.092	0.238
Child dependency ratio	(child)	180	0.228	0.232	0.061	0.12	0.356

4. Results and Discussion

4.1. Results of Dynamic Panel Regression

4.1.1. Benchmark Regression

Given the potential for the persistence of improvements in the consumption gap and the potential for omitted variables, endogeneity issues may arise. Consequently, in this paper, a dynamic panel model was employed for regression estimation in the baseline regression to address these issues. Table 3 presents the benchmark regression results of the digital economy on the urban–rural consumption gap. Columns (1) and (2) correspond to the fixed effect and random effect regression outcomes, respectively. Columns (3) to (6) display the results of S-GMM regression. The results of the Hansen test are not significant, which indicates that the original hypothesis of the over-identification of instrumental variables cannot be rejected, thus confirming the validity of the selection of instrumental variables. The significant *p*-value of AR(1) and insignificant *p*-value of AR(2) indicate that there is first-order autocorrelation, but no second-order autocorrelation, thereby verifying the validity of the GMM estimation. The regression results indicate that the effect of the urban–rural consumption gap in the previous period on the current period gap is significantly positive at the 1% level, and the coefficients are all greater than 0.76. This indicates that an increase of one unit in the urban–rural consumption gap in the previous period leads to an increase of 0.76 units at the current level of inequality. As a result, it can be verified that an individual's present consumption is influenced by their previous consumption habits, demonstrating the existence of a habitual consumption effect. Based on the results in columns (1) to (3), it is evident that the digital economy has a significant negative effect on the explanatory

variables, implying that it can effectively reduce the urban–rural consumption gap. The results from columns (4) to (6) indicate that digital industrialization, the digitalization of industry, and the digital environment all have a suppressive effect on the widening of the urban–rural consumption gap, and the narrowing effect of the digital environment is the most significant, followed by digital industrialization and the digitalization of industry, the latter of which has the smallest effect. The literacy of residents in the digital environment is a fundamental requirement for their active participation in the digital economy. Furthermore, an innovative environment acts as a driving force and is necessary for guaranteeing the growth of the digital economy. The development of the digital environment is essential for creating a social atmosphere, institutional arrangements, policy support, and resource allocation for innovative activities. Optimizing the digital environment can facilitate the widespread application and deep integration of digital technologies, thereby enhancing the level of intelligence in production, management, and services. These advancements can significantly improve the efficiency and quality of the digital economy, thereby having a more pronounced impact on urban and rural consumption. Despite these benefits, studies have demonstrated that the relationship between Internet development and residential consumption is not constant [5]. The digital divide and digital dividends generated by the digital economy differ between the stages of its development. Therefore, it is crucial to further explore whether there exists a nonlinear relationship between the digital economy and the urban–rural consumption gap.

Table 3. The benchmark regression results of the impact of the digital economy on the urban–rural consumption gap.

	(1)	(2)	(3)	(4)	(5)	(6)
	FE	**RE**	**GMM**	**GMM**	**GMM**	**GMM**
L.Theil			0.7609 ***	0.7658 ***	0.7769 ***	0.7951 ***
			(0.0125)	(0.0183)	(0.0231)	(0.0258)
DIGE	−0.0952 ***	−0.0785 ***	−0.0065 ***			
	(0.0223)	(0.0167)	(0.0018)			
DIGIN				−0.0157 ***		
				(0.0051)		
INDIG					−0.0140 **	
					(0.0058)	
DIGEN						−0.0877 ***
						(0.0204)
_cons	0.1578 ***	0.1408 ***	0.0036	0.0022	−0.0000	−0.0065
	(0.0321)	(0.0307)	(0.0067)	(0.0072)	(0.0080)	(0.0056)
Control	YES	YES	YES	YES	YES	YES
N	180	180	150	150	150	150
AR(1)			0.009	0.007	0.006	0.007
AR(2)			0.812	0.802	0.798	0.745
Hansen			0.648	0.797	0.811	0.661

Note: *** and **, respectively, indicate significance at the levels of 10% and 5%; numbers in brackets represent the standard deviation.

4.1.2. Nonlinear Regression

Building upon the previous analysis, it can be argued that the impact of the digital economy on the urban–rural consumption gap exhibits nonlinear characteristics. This assertion will be empirically examined in this section. We added the squared term of the digital economy to the regression model in columns (3) to (6) of Table 3, and the corresponding regression results are presented in columns (1) to (4) of Table 4. The coefficient corresponding to the level of digital economic development is shown to be significantly positive in column (1), while its squared term is significantly negative. This finding implies the presence of an inverted U-shaped relationship between the digital economy and the urban–rural consumption gap, thereby confirming hypothesis 1. Similarly, the outcomes reveal that both digital industrialization and industrial digitization exhibit a nonlinear

relationship with the urban–rural consumption gap, displaying an initial positive impact, followed by a negative impact. On the other hand, the digital environment consistently demonstrates a negative impact on the urban–rural consumption gap. This phenomenon may be attributed to the scale effect of the digital economy, which can influence the impact of the digital economy on the urban–rural consumption gap. During the early stages of digital economic development, the levels of digital industrialization and industrial digitization are typically low, making this period susceptible to the issue of the "digital divide". As a result of the existence of a technical threshold for digital applications and the limited digital literacy skills of rural residents, they may encounter challenges in accessing the benefits of the digital economy. This difficulty in sharing the dividends offered by the digital economy can negatively impact efforts to narrow the urban–rural consumption gap. As the level of advances in digital economic development continue to grow, the scale effect of the digital economy becomes more prominent. With the assistance of digital technology, the digitization level of the agricultural, industrial, and service sectors can be significantly enhanced, thereby further enhancing the inclusiveness of the digital economy. Consequently, this can facilitate the reduction in the urban–rural consumption gap. Based on column (4), it is evident that improving the digital environment can effectively alleviate the urban–rural consumption gap. This could be because optimizing the digital environment reduces the disparity in digital access and technology application between urban and rural areas, ultimately bridging the primary- and secondary-level digital divides and preventing the urban–rural consumption gap from widening further. To ensure the robustness of the test results, the Thiel index of the explanatory variable, the urban–rural consumption gap, is replaced by the ratio of urban–rural consumption, which is subjected to GMM regression, following the methodology of existing research [18]. Model (5) in Table 4 presents the regression results of the robustness test, wherein the lagged term of the ratio of urban–rural consumption is significantly positive, the coefficient of the digital economy is positive, and the coefficient of the digital economy in a flat direction is significantly negative, all of which are significant at the 1% level. Hence, these empirical findings can be considered reliable.

Table 4. The nonlinear regression results of the impact of the digital economy on the urban–rural consumption gap.

	(1)	(2)	(3)	(4)	(5)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**	**DIGE**
L.Theil	0.8532 ***	0.8186 ***	0.8570 ***	0.7439 ***	
	(0.0445)	(0.0262)	(0.0298)	(0.0271)	
L.congap					0.4443 ***
					(0.0427)
DIGE	0.0141 *				0.4151 **
	(0.0069)				(0.1839)
DIGE2	−0.0091 *				−0.5242 ***
	(0.0053)				(0.1713)
DIGIN		0.0276 **			
		(0.0122)			
DIGIN2		−0.0415 *			
		(0.0217)			
INDIG			0.0210 *		
			(0.0118)		
INDIG2			−0.0531 *		
			(0.0273)		
DIGEN				−0.2877 **	
				(0.1360)	
DIGEN2				1.0938	
				(0.8412)	

Table 4. *Cont.*

	(1)	(2)	(3)	(4)	(5)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**	**DIGE**
_cons	−0.0110	−0.0107	0.0143	−0.0124	0.2937
	(0.0083)	(0.0106)	(0.0093)	(0.0143)	(0.1959)
Control	YES	YES	YES	YES	YES
N	150	150	150	150	150
AR(1)	0.003	0.004	0.003	0.007	0.034
AR(2)	0.871	0.910	0.575	0.708	0.392
Hansen	0.943	0.960	0.983	0.984	0.972

Note: ***, **, and *, respectively, indicate significance at the levels of 10%, 5%, and 1%; numbers in brackets represent the standard deviation.

4.2. Results of Dynamic Threshold Regression n

4.2.1. Urban–Rural Income Gap

Table 5 presents the outcomes of the regression analysis, wherein the urban–rural income gap is incorporated as a threshold variable, aimed at exploring the threshold effect of the digital economy on the urban–rural consumption gap. Table 5 reveals that the digital economy, along with its sub-dimensions, has a nonlinear effect on the urban–rural consumption gap, and this impact is contingent on the income gap, which serves as a threshold variable. These results provide evidence in favor of Hypothesis 2. The outcomes of the regression analysis, reported in column (1), suggest that, when the urban–rural income gap is below 0.081, the development of the digital economy can lead to a substantial reduction in the urban–rural consumption gap. However, when the urban–rural income gap exceeds 0.081, the digital economy's growth can cause an expansion in the urban–rural consumption gap, albeit without significant effects. In other words, as the urban–rural income gap diminishes, the influence of the digital economy in reducing the urban–rural consumption gap becomes increasingly pronounced. The outcomes reported in columns (2) to (4) reveal that the threshold values of the income gap for digital industrialization, industrial digitization, and the digital environment that affect the urban–rural consumption gap are 0.062, 0.061, and 0.079, respectively. Specifically, when the urban–rural income gap exceeds the threshold value, both digital industrialization and industrial digitization tend to widen the urban–rural consumption gap, whereas the role of the digital environment in this regard is not significant. One possible explanation for these findings is that when the income gap between urban and rural areas is large, urban residents are more likely to be influenced by the comparison effect and engage in conspicuous consumption [26]. Additionally, the scale effect of digital industrialization and industrial digitization provides urban residents with more convenient consumption opportunities, thereby widening the urban–rural consumption gap. The digital environment plays a crucial role in mitigating the urban–rural consumption gap, particularly when the urban–rural income gap remains below a certain threshold. While both digital industrialization and industrial digitization can negatively impact the urban–rural consumption gap, the effect is not significant. The reduction in the urban–rural income gap is vital in enhancing the level of local urbanization and narrowing the gap in consumption propensity between rural and urban residents [46]. The establishment of a digital environment can facilitate the conversion of rural residents' consumption propensity into actual consumption, thereby diminishing the urban–rural consumption gap.

Table 5. Threshold effects of income gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
λ	0.081	0.062	0.061	0.079
	(0.017)	(0.022)	(0.016)	(0.02)
Confidence interval	[0.048, 0.114]	[0.02, 0.105]	[0.029, 0.093]	[0.039, 0.119]
Threshold ≤ λ	−0.061 **	−0.135	−0.204	−0.738 ***
	(0.03)	(0.091)	(0.135)	(0.334)
Threshold > λ	0.056	0.231 ***	0.325 ***	0.224
	(0.053)	(0.111)	(0.107)	(0.374)

Note: *** and **, respectively, indicate significance at the levels of 10% and 5%; numbers in brackets represent the standard error.

4.2.2. Urban–Rural Education Gap

Table 6 presents the regression outcomes using the urban–rural education gap as the threshold variable. Column (1) reveals that the threshold value of the urban–rural education gap, with the nonlinear effect of the digital economy on the urban–rural consumption gap, is 0.2292. With the interval of a low education gap (edugap ≤ 0.292), the development of the digital economy hinders the expansion of the urban–rural consumption gap. Conversely, with the high education gap interval (edugap > 0.292), the digital economy substantially widens the urban–rural consumption gap. The impact of the digital economy on the urban–rural consumption gap varies significantly at distinct education gap levels, thus confirming hypothesis 3. The observed phenomenon of a higher urban–rural education gap could be attributed to the more optimal consumption structure and higher propensity to consume that is present in the higher education group [47]. A wider education gap between urban and rural areas not only results in a disparity between these two areas in their residents' marginal propensity to consume but also impedes efforts to bridge the digital divide, specifically the usage gap, between urban and rural areas [46]. Consequently, the digital economy may exacerbate the urban–rural consumption gap when operating under the conditions of a wider education gap. The impact of digital industrialization, the digitalization of industry, and the digital environment on the urban–rural consumption gap varies significantly across distinct levels of the urban–rural education gap, as illustrated in columns (2) to (4) in Table 6. Firstly, the findings presented in Table 6 suggest that digital industrialization exerts a positive effect on the urban–rural consumption gap when the urban–rural education gap is relatively small. However, this relationship becomes insignificant once the education gap reaches a certain threshold. Secondly, industrial digitization has a consistent negative impact on the urban–rural income gap, and this effect becomes increasingly pronounced after the threshold point. Thirdly, as the education gap widens, the relationship between the digital environment and the urban–rural consumption gap exhibits a U-shaped pattern, characterized by initial convergence followed by subsequent divergence. The narrowing of the urban–rural education gap has resulted in increased digital technology adoption and reduced disparities in application ability between urban and rural residents. In this context, enhancing the digital environment could facilitate more equitable and comprehensive use of digital technology among both urban and rural residents, thus significantly mitigating the urban–rural consumption gap.

Table 6. Threshold effects of education gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
λ	0.292	0.228	0.304	0.289
	(0.027)	(0.034)	(0.034)	(0.043)
Confidence interval	[0.239, 0.344]	[0.162, 0.295]	[0.237, 0.371]	[0.204, 0.373]
Threshold ≤ λ	−0.094 ***	0.146 **	−0.15 **	−1.063 ***
	(0.023)	(0.067)	(0.072)	(0.189)
Threshold > λ	0.096 *	−0.084	−0.261 *	0.364 *
	(0.05)	(0.115)	(0.155)	(0.209)

Note: ***, **, and *, respectively, indicate significance at the levels of 10%, 5%, and 1%; numbers in brackets represent the standard error.

4.2.3. Livelihood-Based Fiscal Expenditure

Table 7 presents the nonlinear effects of the digital economy on the urban–rural consumption gap, using livelihood-based fiscal spending as the threshold variable. The impact of the digital economy on the urban–rural consumption gap is examined in light of this threshold variable. Column (1) of Table 7 reveals that the threshold value of livelihood-based fiscal spending is 0.369. Prior to reaching this threshold, the digital economy constrains the urban–rural consumption gap. However, beyond this threshold, the digital economy widens the urban–rural consumption gap. In other words, the nonlinear relationship between the digital economy and the urban–rural consumption gap takes on a U-shaped pattern as the level of livelihood-based fiscal spending increases. These findings provide empirical support for Hypothesis 4. Columns (2) to (4) of Table 7 reveal that, under the threshold effect of livelihood-based fiscal spending, the impact of digital industrialization on the consumption gap displays a U-shaped, nonlinear relationship. Furthermore, both industrial digitization and the digital environment significantly impede the widening of the consumption gap when livelihood-based fiscal spending is low. However, the effect of these factors on the urban–rural consumption gap is insignificant when livelihood-based fiscal spending exceeds the threshold. One possible reason for this result could be the long-term balanced and complementary relationship between livelihood-based fiscal spending and residents' consumption. As the degree of digital industrialization increases, residents are more likely to benefit from livelihood-based fiscal spending, which, in turn, hinders the narrowing of the urban–rural consumption gap. However, it is important to note that further increases in livelihood-based fiscal expenditure may also limit residents' consumption. In particular, the complementary effect of this expenditure on consumption is more pronounced among rural residents, given that their expenditure primarily caters to meeting their basic needs, and livelihood-based fiscal expenditure is more effective in supplementing them.

Table 7. Threshold effects of livelihood-based fiscal spending.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
λ	0.369	0.375	0.375	0.389
	(0.014)	(0.015)	(0.045)	(0.016)
Confidence interval	[0.341, 0.397]	[0.345, 0.405]	[0.286, 0.464]	[0.359, 0.42]
Threshold ≤ λ	−0.107 ***	−0.187 ***	−0.144 **	−0.619 **
	(0.032)	(0.065)	(0.067)	(0.298)
Threshold > λ	0.088 ***	0.237 ***	0.078	−0.32
	(0.029)	(0.068)	(0.061)	(0.398)

Note: *** and **, respectively, indicate significance at the levels of 10% and 5%; numbers in brackets represent the standard error.

4.3. Further Analysis

4.3.1. Classified Consumption Gap

To investigate the varying effects of the digital economy on different types of consumption, this study disaggregates the consumption gap between urban and rural residents into three categories: the subsistence consumption gap (lcongap), the hedonic consumption gap (econgap), and the developmental consumption gap (dcongap). Subsistence consumption encompasses expenditure on essentials such as food, clothing, and housing, while hedonic consumption encompasses expenditure on household equipment, transportation, and communication. Finally, developmental consumption includes expenditure on healthcare and recreation, among other items [45].

Tables 8–10 present the effects of the digital economy and its sub-dimensions on the urban–rural subsistence, hedonic, and developmental consumption gaps, respectively. Each model was estimated using the S-GMM method, and the validity of the instrumental variables was confirmed using the AR(1), AR(2), and Hansen tests. The absence of second-order autocorrelation in the instrumental variables was also verified, and the GMM estimates were deemed valid. The findings presented in Table 8 reveal that the digital economy and its sub-dimensions exhibit a nonlinear effect on the urban–rural subsistence consumption gap, characterized by an initial reduction followed by subsequent widening.

Table 8. The impact of the digital economy on the urban–rural subsistence consumption gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
L.lcongap	0.5942 ***	0.5065 ***	0.4176 ***	0.5211 ***
	(0.0685)	(0.0527)	(0.0951)	(0.0848)
DIGE	−0.0394 *			
	(0.0226)			
DIGE2	0.0560 **			
	(0.0232)			
DIGIN		−0.0695 **		
		(0.0286)		
DIGIN2		0.2190 ***		
		(0.0757)		
INDIG			−0.1452 **	
			(0.0619)	
INDIG2			0.5961 ***	
			(0.1803)	
DIGEN				−0.4197 *
				(0.2236)
DIGEN2				2.8870 *
				(1.4347)
_cons	−0.0283	−0.0287	−0.0801 ***	−0.0055
	(0.0361)	(0.0427)	(0.0260)	(0.0149)
Control	YES	YES	YES	YES
N	150	150	150	150
AR(1)	0.043	0.048	0.044	0.043
AR(2)	0.437	0.427	0.456	0.435
Hansen	0.949	0.953	0.982	0.958

Note: ***, **, and *, respectively, indicate significance at the levels of 10%, 5%, and 1%; numbers in brackets represent the standard error.

Table 9. The impact of the digital economy on the urban–rural hedonic consumption gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
L.econgap	0.7968 ***	0.2293 ***	0.2638 ***	0.2676 ***
	(0.0812)	(0.0491)	(0.0511)	(0.0515)
DIGE	0.0451 *			
	(0.0190)			
DIGE2	−0.0618 ***			
	(0.0177)			
DIGIN		−0.1998 *		
		(0.1138)		
DIGIN2		0.3471		
		(0.2933)		
INDIG			−0.1974 **	
			(0.0836)	
INDIG2			0.5800 ***	
			(0.1951)	
DIGEN				−1.0923 ***
				(0.3347)
DIGEN2				6.3589 ***
				(2.2018)
_cons	0.3414 ***	0.0492	0.0870	−0.0068
	(0.0222)	(0.0733)	(0.0710)	(0.0389)
Control	YES	YES	YES	YES
N	150	150	150	150
AR(1)	0.029	0.058	0.059	0.036
AR(2)	0.489	0.502	0.480	0.510
Hansen	0.963	0.966	0.953	0.989

Note: ***, **, and *, respectively, indicate significance at the levels of 10%, 5%, and 1%; numbers in brackets represent the standard error.

Table 10. The impact of the digital economy on the urban–rural developmental consumption gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
L.dcongap	0.523 ***	0.428 ***	0.521 ***	0.627 ***
	(19.349)	(14.943)	(32.842)	(24.818)
DIGE	0.050 ***			
	(2.929)			
DIGE2	−0.088 ***			
	(−5.085)			
DIGIN		0.113 ***		
		(3.605)		
DIGIN2		−0.442 ***		
		(−9.958)		
INDIG			−0.066 *	
			(−1.750)	
INDIG2			−0.087	
			(−0.791)	
DIGEN				0.179 *
				(1.801)
DIGEN2				−3.615 ***
				(−4.013)
_cons	0.162 ***	0.156 ***	0.089 ***	−0.116 ***
	(5.781)	(4.637)	(4.546)	(−2.982)
Control	YES	YES	YES	YES
N	150	150	150	150

Table 10. *Cont.*

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
AR(1)	0.096	0.097	0.080	0.059
AR(2)	0.401	0.454	0.316	0.202
Hansen	0.966	0.972	0.954	0.985

Note: *** and *, respectively, indicate significance at the levels of 10% and 1%; numbers in brackets represent the standard error.

Based on the findings presented in Table 9, it is apparent that an inverted U-shaped relationship exists between the digital economy and the hedonic consumption gap, whereby the gap initially expands before subsequently narrowing. Conversely, the impact of industrial digitization and the digital environment on the hedonic consumption gap exhibits a U-shaped relationship, whereby the gap first narrows before expanding. Moreover, digital industrialization is found to have a significant negative effect on the hedonic consumption gap.

Table 10 reveals that the impact of the digital economy, digital industrialization, and digital environment on the developmental consumption gap follows an inverted U-shaped relationship, whereby the effect is initially positive, and subsequently, negative. Conversely, the digitalization of industry demonstrates a significant negative relationship with both the hedonic and developmental consumption gaps.

Upon comparing Tables 8–10, notable differences are evident in the impact of the digital economy and its sub-dimensions on consumption inequality across the urban and rural categories. Additionally, it is worth noting that the urban–rural consumption gap in the preceding period has a significant positive effect on the consumption gap in the current period. These findings suggest that the impact of the digital economy on the subsistence consumption gap is in contrast with its effect on the hedonic and developmental consumption gaps. An increase in the level of the digital economy results in a narrowing of the gap between urban and rural high-level consumption and promotes the upgrading of the consumption structure of rural residents. This may be because residents are only able to pursue higher-level consumption needs after their subsistence needs have been satisfied. When the digital economy is underdeveloped, rural residents can satisfy their basic needs through digital means, and the development of e-commerce platforms can further reduce the price of goods, prompting rural residents to pursue higher-level consumption. Regarding digital industrialization, the relationship between this factor and the subsistence consumption gap is U-shaped, while the impact on the hedonic consumption gap is consistently negative. The relationship between digital industrialization, the digital environment, and the developmental consumption gap is represented by an inverted U-shaped. This may be because, during the early stages of digital industrialization, the new products and services brought by it are limited, and the ability of rural residents to access and apply digital technology, and thus improve consumption quality, is weak. As the level of digital industrialization rises, the scale effect of the digital economy emerges, and digital platforms continue to innovate products to meet consumer needs, thus satisfying more diverse consumption needs and reducing the gap between hedonic and developmental consumption. Finally, the impact of industrial digitization and the digital environment on the gap between subsistence and hedonic consumption is U-shaped. This may be because the process of empowering traditional industries through digital technology breaks down traditional boundary restrictions and extends consumption to digital products and services. As digital industrialization develops and digital technology becomes more deeply integrated in secondary and tertiary industries, the innovation effect brought by the digital environment is more likely to drive the consumption demand of urban residents with higher population concentration, thus widening the gap between subsistence and hedonistic consumption.

4.3.2. Regional Heterogeneity

In the transition from traditional urbanization to new urbanization, the impact of urbanization development on the urban–rural consumption gap gradually increases [18]. The process of population urbanization is accompanied by the continuous improvement of residents' income levels and human capital, which is conducive to increasing people's opportunities and ability to use digital technology. The transfer of rural residents to cities and the concentration of populations in cities and towns are also conducive to the scale effect of the digital economy. The urbanization of 30 provinces in China represents a major factor in the development of urbanization, which has increased the overall level of information technology application in the whole population, thus having a heterogeneous impact on urban and rural consumption. Based on the mean urbanization rate of 60% in China, this study classified 30 of its provinces into two groups using the urbanization rate, assigning a value of 1 (urbanrate = 1) to provinces with urbanization rates above or equal to 60%, and 0 (urbanrate = 0) to those with rates below 60%. The interaction term was then used to examine the regional differences in the impact of the digital economy on the urban–rural consumption gap. The regression results, shown in Table 11, show that when the urbanization rate is less than 60%, the digital economy significantly suppresses the widening of the urban–rural consumption gap. However, as the urbanization rate expands, the suppression effect of the digital economy on the urban–rural consumption gap gradually decreases. The increase in the urbanization rate implies an increase in the urban population and an expansion of urban scale, which also leads to a gradual imbalance in the rural population ratio. As a result, the effect of the digital economy on the urban–rural consumption gap gradually weakens. Moreover, according to the regression results shown in column (3), it is found that industrial digitization widens the urban–rural consumption gap after the urbanization rate increases to more than 60%. This could be because industrial digitization can improve labor productivity and production quality, and at the same time, increase urban jobs and wage income, leading to an increase in urban–rural income inequality. Additionally, the digitization of industry may also lead to the spillover of consumption demand, resulting in differences between urban and rural residents in terms of consumption quality, brands, and services, thus further widening the urban–rural consumption gap.

Table 11. Regional heterogeneity of the impact of the digital economy on consumption gap.

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
L.Theil	0.6799 ***	0.6988 ***	0.6631 ***	0.7482 ***
	(0.0269)	(0.0211)	(0.0385)	(0.0142)
urbanrate	−0.0077 **	−0.0063 ***	−0.0163 ***	−0.0123 ***
	(0.0028)	(0.0016)	(0.0030)	(0.0028)
DIGE	−0.0318 ***			
	(0.0093)			
DIGE*urbanrate	0.0280 **			
	(0.0109)			
DIGIN		−0.0426 ***		
		(0.0124)		
DIGIN*urbanrate		0.0406 ***		
		(0.0139)		
INDIG			−0.1565 ***	
			(0.0242)	
INDIG*urbanrate			0.1617 ***	
			(0.0249)	
DIGEN				−0.3209 ***
				(0.0685)

Table 11. *Cont.*

	(1)	(2)	(3)	(4)
	DIGE	**DIGIN**	**INDIG**	**DIGEN**
DIGEN*urbanrate				0.2690 ***
				(0.0799)
_cons	0.0167	0.0196 ***	0.0235 **	0.0191 **
	(0.0103)	(0.0070)	(0.0098)	(0.0085)
Control	YES	YES	YES	YES
N	150	150	150	150
AR(1)	0.013	0.013	0.014	0.012
AR(2)	0.904	0.968	0.598	0.955
Hansen	0.800	0.755	0.801	0.827

Note: *** and **, respectively, indicate significance at the levels of 10% and 5%; numbers in brackets represent the standard error.

5. Conclusions and Policy Implications

Digital technology plays a crucial role in facilitating the effective flow of information and maintaining a supply–demand balance. It also promotes residents' willingness and ability to consume, to some extent. However, there exist differences between urban and rural residents in the dividends they receive from the digital development process, resulting in a significant impact of the digital economy on the urban–rural consumption gap. This study investigates the nonlinear effects and impact mechanisms of the digital economy and its sub-dimensions on the urban–rural consumption gap by utilizing the urban–rural income gap, urban–rural education gap, and livelihood-based fiscal expenditure level as threshold variables. Moreover, the study decomposes the urban–rural consumption gap into subsistence, hedonic, and developmental consumption gaps to further evaluate the heterogeneous effects of the digital economy on different categories of the urban–rural consumption gap. The study yields the following conclusions: Firstly, the digital economy, digital industrialization, and industrial digitization have an inverted U-shaped nonlinear impact on the urban–rural consumption gap, while the digital environment has a significant suppressing effect on the urban–rural consumption gap. Secondly, the income gap, education gap, and livelihood financial expenditure exhibit threshold effects in the digital economy's effect on the urban–rural consumption gap. Among these, the threshold effect of the income gap generally displays a U-shaped relationship, inhibiting the urban–rural consumption gap before the threshold and promoting it after the threshold. As the urban–rural education gap expands, the impact of industrial digitization on narrowing the urban–rural consumption gap becomes more significant, while the impact of the digital environment shows a U-shaped relationship. The digital economy significantly narrows the urban–rural consumption gap when the level of livelihood-based financial expenditure is below the threshold, but it expands the gap when the level is above the threshold. This is primarily due to the positive effect of digital industrialization, while the impacts of industrial digitization and the digital environment are insignificant. Thirdly, this study finds heterogeneity in the impact of the digital economy on different categories of the urban–rural consumption gap. Overall, the digital economy is helpful in alleviating the gap between urban and rural hedonic and developmental consumption and promoting the optimization and upgrading of the consumption structure as its own development level increases. Fourthly, it should be noted that the impact of the digital economy on the disparity in consumption patterns between urban and rural areas varies across regions with divergent levels of urbanization. Specifically, it has been observed that the digital economy, as well as its sub-components, exert a greater restraining influence on the urban–rural consumption gap in regions characterized by low levels of urbanization. However, as the level of urbanization increases, this narrowing effect tends to diminish.

In response to the above findings and combined with the theoretical analysis, this paper proposes the following policy implications: Firstly, based on the preceding analysis, it is evident that, of the three sub-dimensions of the digital economy, the digital environment consistently exerts a substantial inhibitory effect on the consumption gap between

urban and rural areas. Thus, in the course of advancing the digital economy, due attention ought to be paid to the innovation environment and to enhancing the digital literacy of the populace. It is necessary to leverage the innovative and spillover effects of digital environments. This will help to bridge the digital divide between urban and rural areas and enhance residents' digital literacy, thereby enabling the rural economy to fully benefit from the scale and empowerment effects of digital industrialization and industrial digitization. Moreover, it is crucial to encourage digital industries to expand into counties and towns, promote the integration of rural residents into these new industries, and provide employment opportunities through digital technology. This will foster digital industrialization and the digitalization of rural industries, ultimately increasing the capacity of rural residents to consume, as well as increasing their willingness and confidence to do so. By strengthening the connection between rural communities and emerging digital industries, a virtuous cycle of development can be created that benefits both urban and rural areas, thereby achieving more inclusive and sustainable growth. Secondly, it is essential to focus on the urban–rural income gap and the education gap, as higher income and education gaps significantly weaken the impact of the digital economy on reducing the urban–rural consumption gap. Therefore, in addition to focusing on the development of the digital economy, we should promote the integration of digital and traditional industries, advance the rationalization and development of real industries, reduce the crowding-out effect of the digital economy on the real economy, and prevent the development of the digital economy from limiting the employment quality of rural residents with low education levels and limited skills. This will help prevent a widening of the urban–rural consumption gap. Thirdly, given the substantial complementary link between livelihood-based fiscal expenditure and the consumption of rural inhabitants, it would benefit the government to proactively seek appropriate subsidies and approaches to optimizing the consumption structure of rural households while guaranteeing an adequate level of rural livelihood-based fiscal expenditure. Furthermore, the authorities should exert greater effort toward refining the allocation of resources earmarked for education and healthcare in livelihood expenditure, and toward enhancing the structure of financial investment in social security programs, particularly in less developed rural areas. Such measures would help alleviate the disparities in access to public services between urban and rural areas and mitigate the potential exacerbation of the urban–rural divide arising from vertical financial imbalances. Fifthly, it is essential to encourage the digital content and media industry to further penetrate rural communities, while also stimulating rural residents' interest in digital technology and reducing the threshold of digital use through publicity and training. This will enable digital industrialization and the digital environment to effectively narrow the gap between urban and rural hedonistic and developmental consumption, promoting the equalization of high-level consumption between urban and rural areas and achieving the coordinated development of both. Sixthly, the preceding analysis reveals that the impact of the digital economy on reducing the urban–rural consumption gap is diminished as the level of urbanization increases, primarily due to inadequate digital usage among rural inhabitants. To address this challenge, it is essential to stimulate the interest of rural residents in utilizing digital technology and reduce the barriers to digital use through public awareness campaigns and training initiatives. This approach could enable digital industrialization and the digital environment to narrow the urban–rural consumption gap in terms of both hedonic- and development-oriented consumption. In so doing, it would facilitate the promotion of equitable high-level consumption patterns between urban and rural areas and foster the coordinated development of both regions.

Limited by the length of the paper and time and energy constraints, the authors of this paper encountered the following research deficiencies: First, the primary constraint on this study is the paucity of available data. Specifically, the empirical analysis is based on a panel dataset of only 30 Chinese provinces spanning the years 2014 to 2019. To achieve greater specificity in the conclusions drawn, future research may benefit from incorporating data from lower administrative levels, such as prefectures and municipalities. Second, it is worth

noting that, at present, there exists no unified and authoritative standard for measuring the digital economy. While this study endeavored to assess the development level of the digital economy in each province by selecting 25 subdivision indicators from multiple dimensions, it should be acknowledged that the definition of the digital economy is relatively broad, thus posing challenges in the measurement of some indicators. Accordingly, the issue of how to accurately measure the development level of the digital economy remains a pertinent matter that warrants further investigation in the future.

Author Contributions: Conceptualization, Y.Z. and G.M.; methodology, Y.T.; validation, Q.D.; funding acquisition, Y.Z.; data curation, G.M. and Q.D.; supervision, Y.Z.; writing—original draft preparation, G.M. and Q.D.; writing—review and editing, Y.T. and Y.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the National Social Science Foundation of China (No. 20BJY149) and the Heilongjiang Provincial Philosophy and Social Science Planning Project (No.18JYH757).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We thank the Modern Agricultural Development Research Center of the Northeast Agricultural University for supporting this study.

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

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