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Consumption Subsidies, Residents' Welfare and Industrial Support: Based on the Comparison of Efficiency of Various Consumption Subsidies

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Abstract: *This paper discusses the effects of cash subsidies, cash coupons and discount coupons on improving residents' welfare and supporting specific industries by constructing a theoretical model. The conclusion is that there is no difference between different subsidy methods when the amount of subsidy is small, and the efficiency of subsidy does not change with the amount of subsidy. On the contrary, cash subsidy is more conducive to improving residents' welfare, while consumption coupons are more conducive to supporting specific industries. Especially when the amount of subsidy is large, discount vouchers are better than cash vouchers in industrial support, while cash vouchers can improve residents' welfare more effectively than discount vouchers. This research contributes to the development of subsidy policies and seems to provide an explanation for the differences in consumption subsidy patterns and economic performance of governments around the world.*

Keywords: *Consumption subsidy, Resident welfare, Industry support*

1. Introduction

As countries around the world are experiencing economic stagnation following the COVID-19 outbreak, tourism, catering and accommodation industries have been hit particularly hard[1]. In the face of economic recession, governments often resort to large-scale fiscal policies and other measures to boost the economy, such as direct income subsidies to residents or consumption vouchers. Its purpose, on the one hand, is to improve the welfare of residents by directly subsidizing their income; on the other hand, it is to support specific industries through targeted consumption coupons. Ultimately, the effect is to boost the economy[2].

In the wake of the COVID-19 pandemic, European and American countries are more likely to use direct cash handouts, such as the US government's $1,200 subsidy for each adult citizen. The Chinese government has mainly adopted a certain amount of consumer vouchers. In terms of the amount of money, the Chinese government's economic stimulus is not very strong, except for a limited number of consumer coupons and conventional fiscal and tax policies, there is no cash distribution. However, The performance of China's macroeconomic data is significantly better than that of European and American countries[3]. Classical economic theory generally believes that cash subsidies can increase residents' welfare more effectively than in-kind subsidies. However, is the difference in subsidy methods similar to the support for specific industries? To answer this question, this paper will compare the efficiency of cash subsidies and consumption vouchers in improving residents' welfare and supporting specific industries.

Large-scale government use of consumer vouchers began mainly after the financial crisis of 2008. It was also from this period that the academic circle paid more and more attention to the study of consumption coupons[4]. Current studies mainly discuss the effect of consumption coupons on stimulating economy from a macro perspective (Lin, 2020). Among them, Wilde et al. (2009) and Hanson(2010) believe that consumption vouchers can stimulate consumption; However, Hoynes & Schanzenbach(2009) and Moffitt(1989) did not support this conclusion. Existing studies rarely carry out in-depth theoretical analysis, and mainly focus on the impact of consumption coupons on the quantity of goods consumed or residents' welfare, and rarely compare the two in a unified framework. This study will attempt to complete these two tasks. By constructing a theoretical model, this paper makes a theoretical analysis of several different ways of cash subsidy and consumption coupons, and compares the effects of different subsidy ways in improving residents' welfare and industrial support.

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

The first part of this paper introduces the theoretical framework and calculates the consumer equilibrium under different subsidy modes. The second part compares the efficiency of policies. Finally, conclusions and policy suggestions are given.

2. Theoretical model

Consider three main ways of subsidizing consumption[5]. The first is cash subsidies, in which the government hands out a set amount of cash directly to all or some of the residents, which can be used for any purchase. In addition, the government has introduced consumer vouchers that allow targeted purchases of certain products. There are cash coupons and discount coupons: cash coupons can be used to buy specific items within the amount of money, while discount coupons need to be matched with cash to buy specific items.

In addition, since short-term economic shocks are discussed, policy efficiency is discussed in a relatively short period. It is assumed that consumption subsidies will not affect commodity prices, that is, commodity prices are exogenous given[6-7]. At the same time, the change of saving amount is not considered, that is, before and after consumption subsidy, the part of residents' own income used for consumption is fixed and is represented by I.

(Representative) residents' consumption preference is C-D utility function:

$$U = X^{\alpha}Y^{1-\alpha} \tag{1}$$

Here, X represents the goods within the range of consumption coupons 1, Y is the commodity that cannot be purchased with the consumption voucher; The parameter α is used to distinguish residents' consumption preference for two kinds of goods. I represents the portion of residents' own income used for consumption. According to budget constraints, the consumer equilibrium before consumption subsidies can be calculated:

$$X = \alpha I/P_X, Y = (1-\alpha)I/P_Y$$

$$V = \alpha^{\alpha}(1-\alpha)^{(1-\alpha)}\frac{I}{P_X{}^{\alpha}P_Y{}^{(1-\alpha)}} \tag{2}$$

Here, P_X and P_Y represent the price level of two kinds of goods respectively; V represents resident welfare (indirect utility).

2.1. Cash Subsidy

Considering that residents receive cash subsidy I_1, the consumer equilibrium of residents after receiving cash subsidy is:

$$X_1 = \alpha(I+I_1)/P_X, Y_1 = (1-\alpha)(I+I_1)/P_Y$$

$$V_1 = \alpha^{\alpha}(1-\alpha)^{(1-\alpha)}\frac{I+I_1}{P_X{}^{\alpha}P_Y{}^{(1-\alpha)}} \tag{3}$$

The change rate of resident welfare and the change rate of commodity sales (sales volume and sales volume)2 are:

$$V_1/V - 1 = X_1/X - 1 = Y_1/Y - 1 = I_1/I \tag{4}$$

Cash subsidy has no difference for all kinds of goods, so it has the same influence on the sales of all kinds of goods, and also has the same influence on residents' welfare. Assuming that all the subsidies are borne by government finance, we can calculate the residents' welfare and sales of various commodities improved by government subsidies per unit amount, that is, the efficiency of government

[1]Mainly for non-durable goods and services.
[2]Because the price is exogenous, the sales volume changes by the same margin as the sales volume.

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

subsidies:

$$(V_1/V-1)/I_1=(X_1/X-1)/I_1=(Y_1/Y-1)/I_1$$
$$=\partial(V_1/V-1)/\partial I_1=\partial(X_1/X-1)/\partial I_1=\partial(Y_1/Y-1)/I_1=1/I \quad (5)$$

Obviously, the average efficiency and marginal efficiency of cash subsidies are constant.

2.2. Cash coupon

Consider that residents get cash coupons of amount I_2, which can be used to purchase goods X. Let's say the cash bond can't be traded in the market. The consumer equilibrium of residents after obtaining cash coupons is shown in Figure 1, which obviously includes two situations.

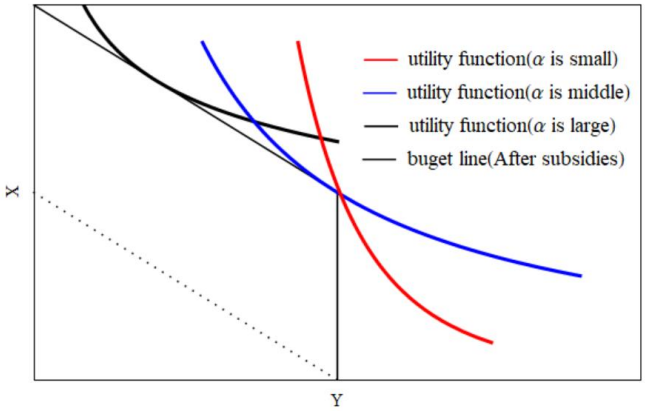

Figure 1: Consumer Equilibrium of Cash coupons

If $I_2\le\alpha(I+I_2)$, namely $I_2\le\frac{\alpha}{1-\alpha}I$ or $\alpha\ge I_2/(I+I_2)$, the residents to purchase goods X amount not less than I_2 this means you also need to pay additional cash to buy commodity X. In this case, cash coupons are equivalent to cash subsidies:

$$X_2=\alpha(I+I_2)/P_X, Y_2=(1-\alpha)(I+I_2)/P_Y, V_2=\alpha^\alpha(1-\alpha)^{(1-\alpha)}\frac{I+I_2}{{P_X}^\alpha {P_Y}^{(1-\alpha)}}$$
$$X_2/X-1=Y_2/Y-1=V_2/V-1=I_2/I$$
$$(X_2/X-1)/I_2=(Y_2/Y-1)/I_2=(V_2/V-1)/I_2$$
$$=\partial(X_2/X-1)/\partial I_2=\partial(Y_2/Y-1)/I_2=\partial(V_2/V-1)/\partial I_2=1/I \quad (6)$$

If $I_2>\alpha(I+I_2)$, that is, $I_2>\frac{\alpha}{1-\alpha}I$ or $\alpha<I_2/(I+I_2)$, the cash voucher is sufficient to satisfy the resident's purchase of commodity X. In this case, the cash coupon will be used exclusively for X and I will be used exclusively for the purchase of commodity Y:

$$X_2=I_2/P_X, Y_2=I/P_Y, V_2=\frac{{I_2}^\alpha I^{(1-\alpha)}}{{P_X}^\alpha {P_Y}^{(1-\alpha)}}$$
$$X_2/X-1=I_2/(\alpha I)-1>Y_2/Y-1=\alpha/(1-\alpha)$$
$$V_2/V-1=(I_2/(\alpha I))^\alpha(1-\alpha)^{(\alpha-1)}-1>Y_2/Y-1$$
$$(X_2/X-1)/I_2=1/(\alpha I)-1/I_2, (Y_2/Y-1)/I_2=\alpha/\big(I_2(1-\alpha)\big)$$
$$(V_2/V-1)/I_2=(\alpha I)^{-\alpha}\big(I_2(1-\alpha)\big)^{(\alpha-1)}-1/I_2$$

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

$$\partial(X_2/X-1)/\partial I_2 = 1/(\alpha I), \partial(Y_2/Y-1)/\partial I_2 = 0,$$

$$\partial(V_2/V-1)/\partial I_2 = \alpha(\alpha I)^{-\alpha}\big((1-\alpha)I_2\big)^{(\alpha-1)} \tag{7}$$

When the amount of cash coupon is high, the marginal efficiency of subsidy for the sales of commodity X is constant and greater than the efficiency of cash subsidy. The total "spillover" effect on the sale of good Y is fixed; The (average and marginal) efficiency of the welfare of residents decreases as the amount of subsidy increases.

2.3. Discount coupons

Consider residents getting discount coupons of amount I_3. The discount coupon can be used with cash to purchase item X at a usage ratio quota of $\lambda: 1-\lambda$, i.e., within the amount of the discount coupon, the purchase of item X receives a price discount of λ share. Also assume that discount coupons cannot be traded on the market. Therefore, if the amount of the discount coupon is too high, it is not fully used. The calculation of the consumer equilibrium of residents after receiving the coupon, as shown in Figure 2, obviously includes two scenarios.

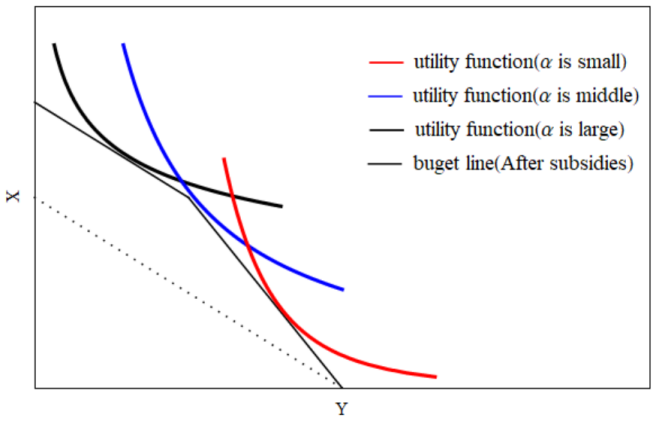

Figure 2: Consumer equilibrium of discount coupons

If $I_3 \le \frac{\lambda}{1-\lambda}\alpha I$, namely $\alpha \ge \frac{1-\lambda}{\lambda} I_3/I$, the coupon will be fully used, equivalent to a subsidy I_3:

$$X_3 = \alpha(I+I_3)/P_X, Y_3 = (1-\alpha)(I+I_3)/P_Y$$

$$V_3 = \alpha^{\alpha}(1-\alpha)^{(1-\alpha)}\frac{I+I_3}{{P_X}^{\alpha}{P_Y}^{(1-\alpha)}}$$

$$V_3/V-1 = X_3/X-1 = Y_3/Y-1 = I_3/I$$

$$(V_3/V-1)/I_3 = (X_3/X-1)/I_3 = (Y_3/Y-1)/I_3 = 1/I$$

$$= \partial(X_3/X-1)/\partial I_3 = \partial(Y_3/Y-1)/I_3 = \partial(V_3/V-1)/\partial I_3 = 1/I \tag{8}$$

If $I_3 > \frac{\lambda}{1-\lambda}\alpha I$, i.e. $\alpha < \frac{1-\lambda}{\lambda} I_3/I$, the coupon amount is too high, the consumer use only one part. The actual amount used for each resident, namely effective subsidy is $\frac{\lambda}{1-\lambda}\alpha I$:

$$X_3 = \alpha I/[(1-\lambda)P_X], Y_3 = (1-\alpha)I/P_Y$$

$$V_3 = \alpha^{\alpha}(1-\alpha)^{(1-\alpha)}\frac{I}{((1-\lambda)P_X)^{\alpha}{P_Y}^{(1-\alpha)}}$$

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

$$X_3/X-1=\lambda/(1-\lambda),\ Y_3/Y-1=0,\ V_3/V-1=(1-\lambda)^{-\alpha}-1$$

$$(X_3/X-1)/\left(\frac{\lambda}{1-\lambda}\alpha I\right)=1/(\alpha I),(Y_3/Y-1)/\left(\frac{\lambda}{1-\lambda}\alpha I\right)=0$$

$$(V_3/V-1)/\left(\frac{\lambda}{1-\lambda}\alpha I\right)=((1-\lambda)^{1-\alpha}-1)/(\lambda\alpha I) \tag{9}$$

When the amount of the discount coupon is high, the discount coupon cannot be fully used by residents, and the face value of the discount coupon I_3 becomes meaningless. The factor influencing the subsidy amount $\frac{\lambda}{1-\lambda}\alpha I$ is the discount rate λ, and the subsidy amount increases with the increase of λ.

$$\partial(X_3/X-1)/\partial\left(\frac{\lambda}{1-\lambda}\alpha I\right)=1/(\alpha I),\partial(Y_3/Y-1)/\partial\left(\frac{\lambda}{1-\lambda}\alpha I\right)=0$$

$$\partial(V_3/V-1)/\partial\left(\frac{\lambda}{1-\lambda}\alpha I\right)=(1-\lambda)^{1-\alpha}/I \tag{10}$$

When the amount of discount coupon is high, the marginal efficiency of subsidy's influence on the sales of commodity X is the same as that of cash coupon. There is no "spillover effect" for the sale of goods Y. The (average and marginal) efficiency affecting the welfare of residents decreases as the discount rate increases and the amount of effective subsidy increases.

3. Comparison of policy efficiency

In order to compare the efficiency differences of different subsidy methods, the amount of government subsidy can be given.

3.1. Small amount of subsidy

Analysis from the previous section, you can see, if the coupon and discount cash subsidies strength is less than $\min\{\frac{\alpha}{1-\alpha}I,\frac{\lambda}{1-\lambda}\alpha I\}$ (namely $\frac{\lambda}{1-\lambda}\alpha I$ when $\lambda\le 1/(2-\alpha)$;$\frac{\alpha}{1-\alpha}I$ when $\lambda>1/(2-\alpha)$), cash coupon, discount coupon and cash allowance are equivalent. Under the same amount of subsidy, the impact on the market and residents' welfare is exactly the same.

However, due to the large number of residents who may get subsidies and their different preferences for commodities, some residents who get cash coupons or discount coupons may not prefer commodity X, so unless the amount of cash coupons or discount coupons is very low, it is difficult to ensure that the residents who get cash coupons or discount coupons can fully use them. If the intensity of the subsidy is too low, it will be contrary to the government's support and economic incentives for specific industries.

3.2. Moderate amount of subsidy

Discussed in two different conditions, (1) when $\frac{\alpha}{1-\alpha}I\ge\frac{\lambda}{1-\lambda}\alpha I$, namely $\lambda\le 1/(2-\alpha)$, cash coupons and cash equivalent. Compared with the efficiency of the coupon,let $I_1=I_2=\frac{\lambda}{1-\lambda}\alpha I$, namely $\lambda=1/(1+\alpha I/I_2)\le 1/(2-\alpha)$. It can be judged that,

$$X_3/X_1=1/\big(1-\lambda(1-\alpha)\big)>1,\ Y_3/Y_1-1=(1-\lambda)/\big(1-\lambda(1-\alpha)\big)<1$$

$$V_3/V_1=(1-\lambda)^{(1-\alpha)}/\big(1-\lambda(1-\alpha)\big)<1 \tag{11}$$

(2) when $\frac{\alpha}{1-\alpha}I<\frac{\lambda}{1-\lambda}\alpha I$, i.e. $\lambda>1/(2-\alpha)$, discount coupon is equivalent to cash allowance. Compared with the efficiency of discount coupons,let $I_1=I_2=\frac{\lambda}{1-\lambda}\alpha I$. It can be judged that,

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

$$X_2/X_1 = \lambda/\big(1-\lambda(1-\alpha)\big) > 1,\ Y_2/Y_1 = \big(\tfrac{1-\lambda}{1-\alpha}\big)/\big(1-\lambda(1-\alpha)\big) < 1$$

$$V_2/V_1 = \lambda^{\alpha}\big(\tfrac{1-\lambda}{1-\alpha}\big)^{(1-\alpha)}/\big(1-\lambda(1-\alpha)\big) \tag{12}$$

V_2/V_1 is more difficult to determine and can be determined using a numerical simulation, as shown in Figure 3, can determine $V_2/V_1 < 1$.

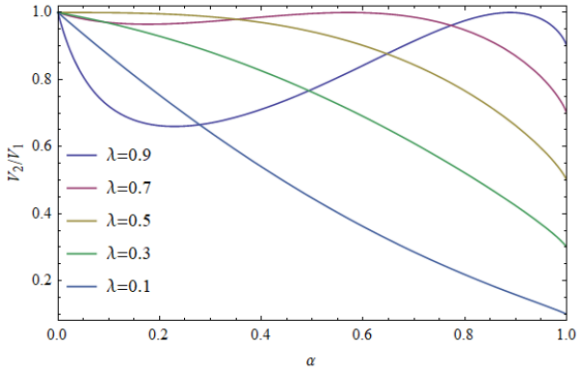

Figure 3: Variation of V_2/V_1 values for different λ

3.3. The subsidy amount is relatively high

Considering that the subsidies for individual residents are higher when $I_2 > \frac{\alpha}{1-\alpha}I$ namely $I_3 \geq \frac{\lambda}{1-\lambda}\alpha I$, I compared with the efficiency of cash coupons, coupons, set $I_1 = I_2 = \frac{\lambda}{1-\lambda}\alpha I$, at this time there must be $\lambda > 1/(2-\alpha)$. It can be judged that,

$$X_3/X_2 = 1/\lambda > 1,\ Y_3/Y_2 = 1-\alpha < 1, V_3/V_2 = \lambda^{-\alpha}(1-\alpha)^{(1-\alpha)} \tag{13}$$

Obviously, when $\lambda < \lambda_0$, $V_3/V_2 > 1$; When $\lambda = \lambda_0$, $V_3/V_2 = 1$; When $\lambda > \lambda_0$, $V_3/V_2 < 1$; Here, $\lambda_0 = (1-\alpha)^{(\frac{1-\alpha}{\alpha})}$, and λ_0 increases as α increases. Figure 4 shows that $\lambda_0 \leq 1/(2-\alpha)$. It can be judged that,

$$V_3 < V_2 < V_1 \tag{14}$$

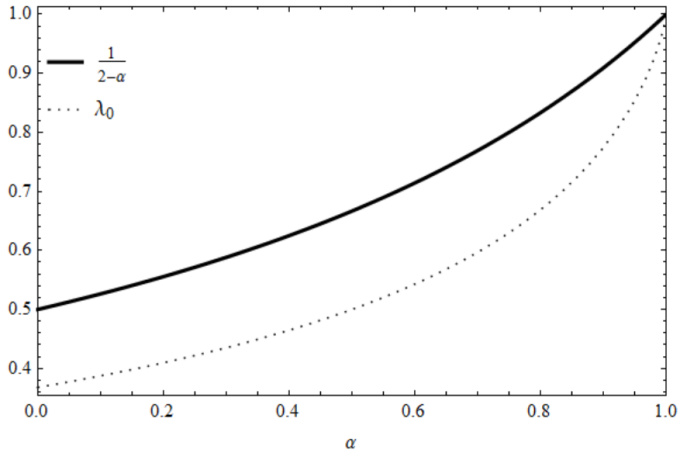

Figure 4: Comparison of $1/(2-\alpha)$ and λ_0

The results of the comparison are summarized in the table below.

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

Effective subsidy	Increase the efficiency of commodity X sales			Improve the efficiency of residents' welfare		
	Cash	Cash coupon	Discount coupon	Cash	Cash coupon	Discount coupon
$I.\ \lambda < 1/(2-\alpha)$						
$< \frac{\lambda}{1-\lambda}\alpha I$	equivalence			equivalence		
$= \frac{\lambda}{1-\lambda}\alpha I$	equivalence		best	equivalence		worst
$II.\ \lambda = 1/(2-\alpha)$						
$\leq \frac{\lambda}{1-\lambda}\alpha I = \frac{\alpha}{1-\alpha}I$	equivalence			equivalence		
$III.\ \lambda > 1/(2-\alpha)$						
$\leq \frac{\alpha}{1-\alpha}I$	equivalence			equivalence		
$(\frac{\alpha}{1-\alpha}I, \frac{\lambda}{1-\lambda}\alpha I)$	Equivalent to discount coupon	best	Equivalent to cash	Equivalent to discount coupon	worst	Equivalent to cash
$= \frac{\lambda}{1-\lambda}\alpha I$	best	moderate	worst	best	moderate	worst

It should be noted that although the effective subsidy amount of discount coupons cannot exceed a certain value with a given discount rate, when the discount rate is high enough, the discount coupons, like cash and cash coupons, can achieve any subsidy amount and subsidy effect.

4. Conclusions

This paper discusses the effects of cash subsidy, cash coupon and discount coupon on improving residents' welfare and supporting specific industries by constructing a theoretical model. The main conclusions are as follows:

(1) When the subsidy amount is small, the subsidy effect of different ways is the same, and the average and marginal efficiency of the subsidy do not change with the change of the subsidy amount.

(2) When the subsidy amount is large, the marginal efficiency of cash coupons is constant and higher than that of cash subsidies; The effect on sales of non-target goods is fixed; The (average and marginal) efficiency of the welfare of residents decreases as the amount of subsidy increases. The marginal efficiency of discount coupons is the same as that of cash coupons. It has no effect on the sales of non-target goods. The (average and marginal) efficiency affecting the welfare of residents decreases with the increase of the discount rate and the increase of the subsidy amount.

(3) Cash subsidies have the highest efficiency in improving residents' welfare, but the lowest efficiency in supporting specific industries. Compared with the cash voucher, When the subsidy amount reaches the effective subsidy amount of the discount coupon, the cash coupon is superior to the discount coupon; otherwise, the discount coupon is superior to the cash coupon. Industrial support has the opposite effect.

This paper gives some policy implications. Among all kinds of consumption subsidies, cash subsidies can effectively improve residents' welfare, but the object of "spillover" of purchasing power is not clear, so it cannot better support specific industries. It is more suitable for the situation where economic shock covers a wide range of industries, especially residents' welfare is greatly affected. On the other hand, consumption vouchers can not only improve residents' welfare, but also support specific industries more effectively, which is more suitable for different industries with unbalanced economic impact. In particular, when the amount of subsidy is large, discount coupons support industries more effectively than cash coupons. Moreover, discount coupons are easier to operate. If a larger amount of discount coupons is issued to single-family residents, the effect of the discount coupons can be better controlled, and residents can actually use part or all of them according to their own needs. This study seems to provide an explanation for the motivation and eventual economic performance of the Chinese government's use of consumer vouchers in the wake of the COVID-19 pandemic, while European and American countries have adopted more cash subsidies.

Of course, the theoretical research of this paper also has some worthy of improvement. First, in reality, consumption coupons can be traded in a specific market (such as underground market), which

ISSN 2616-7433 Vol. 4, Issue 3: 57-64, DOI: 10.25236/FSST.2022.040311

may affect the balance of consumption. Second, there are a large number of residents who receive consumption subsidies and their preferences vary. If the consumption of all residents is balanced and summed up, further research can be conducted. Thirdly, this paper only uses Copulglas function, so there is no substitute complementarity between the two types of goods, and it cannot completely simulate the substitute complementarity between all kinds of goods in reality. Thinking about these problems is the direction of the author's future research.

References

[1] Rachdi M, Laksaci A, Almanjahie I M, et al. FDA: theoretical and practical efficiency of the local linear estimation based on the kNN smoothing of the conditional distribution when there are missing data[J]. Journal of Statistical Computation and Simulation, 2020, 99(8):1479-1495.
[2] Parke E. Wilde, Lisa M. Troy and Beatrice L. Rogers. Food Stamps and Food Spending: An Engel Function Approach[J]. American Journal of Agricultural Economics, 2009, 91(2):416-430.
[3] Khoshnood S, Mohaghegh M A, Ghafori K, et al. A comparison of the efficiency of molecular and conventional methods in the diagnosis of cutaneous leishmaniosis[J]. Annals of Parasitology, 2021, 67(1):39-44.
[4] Schanzenbach H. Consumption Responses to In-Kind Transfers: Evidence from the Introduction of the Food Stamp Program[J]. American Economic Journal Applied Economics, 2009, 1(4):109-139.
[5] Grebenyuk E A . Identification of Significant Factors for Improving the Efficiency of Enterprises Based on the Construction of an Efficient Frontier[J]. Journal of Physics: Conference Series, 2021, 1864(1):012101.
[6] Xu P, Luo F, Zhang Z, et al. Research on Innovation Efficiency of Listed Companies in Development Zone Based on the Three-Stage DEA-Tobit Model: A Case Study of Hubei Province[J]. Discrete Dynamics in Nature and Society, 2020, 2020(3):1-12.
[7] Wang L, Wang T, Zhang Y, et al. Accuracy and Efficiency: The Comparison of Different RPC Parameters Solving Methods[J]. Journal of Earth Science and Environmental Protection (English), 2020, 8(10):10.