Beautiful Countryside Construction and Planning Adjusted by Macro Economy

Fukang Deng, Xiaofang Chen

School of management, Suzhou University, Suzhou 234000, Anhui, China

Abstract
By combining the basic theories of property management and economics, this paper regards beautiful countryside construction as goods circulating in the market and analyzes the specific demand function model of all types. On this basis, with accumulated economic benefits during rural planning and construction as the objective function, it sets up a rural construction and planning model based on specific demand function and finally analyzes the optimal solutions of target functions under various demand functions. Results show that when rural construction involves 12 cycles, the optimal unit price of macro property sales of all types of demand functions fluctuates within the same numerical range, instead of changing remarkably with different demand functions. Meanwhile, when the demand function is linear, i.e., namely, when rural construction is urgent need for development, both the macro property market demands in rural construction and planning and macro investment property demands in rural construction are large. The resulting accumulated economic benefits are large, too.
Key words: AUTIFUL UNTRYSIDE, MAND FUNCTION, ECONOMIC BENERITS, PLANNING AND CONSTRUCTION

1. Introduction

In recent years, economy and society have developed fast, but they are based on the strong development, utilization and excessive consumption of environment and resources to a certain extent. However, the agricultural and rural economic and social development and farmers' life are facing some problems such as the tightening resource constraints, serious ecological degradation and aggravated environmental pollution [1]. No matter which problem is first put hand to, in the final analysis, it is the problem of sustainable development [2]. Carrying out the beautiful countryside construction is the best way to solve the above problems. With the issue of related policy on the 12th five-year plan, provinces and cities in our country have begun advancing beautiful countryside construction. In the process of rural construction, in order to realize the six urban and rural integration indices urban and rural planning, infrastructure, industrial layout,labor and employment, public service and social management, national government departments and units at various levels have begun to explore the road of rural development, and the main directions of rural development and construction [3-4] are on the principle of neighboring rural's resource integration, the scenic area and industry as the key point, and income increase as the fundament. Beautiful countryside which integrates landscape, industry and humanities is made through rural style and features, rural industry and rural culture, rural environment, rural tourism and rural life, making the planning and construction of beautiful countryside enter into a higher-level development stage, and thus improving all aspects' comprehensive benefits brought by rural construction.

However, the current study on the beautiful countryside construction and planning still stays on policy type advice and guidance, and meanwhile, the

research on practice and theoretical level is still in the early exploration stage [5-6]. Therefore, this paper studies the beautiful countryside construction and planning theory in combination with the related theory of beautiful countryside construction, makes a deep analysis from the perspective of economics with the property management, and sets up a rural construction dynamic programming model with comprehensive rural economic benefit as the goal. The paper provides new research ideas for the research on beautiful countryside construction, and seeks the solution in view of practical problems met in the rural construction process, which gives full play to the comprehensive functions and economic benefits of beautiful country construction and realizes the beautiful countryside planning and construction and the innovation of theoretical development.

2.Rural construction and Planning Models Based on Demands

2.1. Basic demand function models

2.1.1. Basic demand function model

Demand function is an econometric model in which the demand of goods is made as the dependent variable and the various factors influencing the demand of goods, such as income, price, the price of other goods as the independent variables, and function relation is used to represent the relationship between the factors influencing the demand [7-8]. From the economic point of view, the main factors influencing the demand of goods are income and price, and therefore demand function reflects the law of demand of goods and people's demand behavior for goods, and the relation between the main factors such as income, price and the demand. In practical applications, the commonly used basic demand function model is as follows:

1: Linear demand function model, as shown in Formula 1 below:

$$D_i = a + \sum_{j=1}^{n} b_j p_j + r_i Y + u \tag{1}$$

The structure of model shows that there is a linear relation among the i th goods' demand D_i, price p_j and consumer income Y, and u is the error term, and this model is suitable for the small income range.

2: Semilogarithmic demand function model, as shown in Formula 2 below:

$$D_i = a + \sum_{j=1}^{n} b_j \ln(p_j) + r_i \ln(Y) + u \tag{2}$$

The structure of model shows that there is a logarithmic relation among the i th goods' demand D_i price p_j and consumer income Y, and u is the error term, and this model is suitable for the large income range.

3: Logarithm linear demand function model, as shown in Formula 3 below:

$$\ln(D_i) = a + \sum_{j=1}^{n} b_j \ln(p_j) + r_i \ln(Y) + u \tag{3}$$

The structure of model shows that there is a linear relation among the i th goods' demand D_i 's logarithm, price p_j and consumer income Y 's logarithm and u is the error term, and this model is widely used for economic prediction.

2.2.2. Specific demand function model

However, according to the results of related research on dynamic pricing and inventory control [9-10], through calculating and gaining the total utility function of two goods and maximizing the utility function, the formula of goods demand function can be gained, and the demand function will be expanded into a more general case. They are shown as follows:

1: Linear demand function, as shown in Formula 4 below:

$$D(p_1) = A \cdot w_1 \left[1 - \frac{p_1}{v_1} \left(\frac{p_1 w_1 + p_2 w_2 - m(1-r)}{\frac{w_1}{v_1} p_1^{\,2} + \frac{w_2}{v_2} p_2^{\,2}} \right) \right] \tag{4}$$

Among them: x_1 and x_2 are the demand of goods 1 and the demand of goods 2 respectively; p_1 and p_2 are the unit price of goods 1 and 2 respectively; v_1 and v_2 are zero utility of goods 1 and 2 respectively; w_1 and w_2 are sturation demand of goods 1 and 2 respectively; m stands for the income level of consumers; r is the level of interest rates; A is the constant related to demand;

2: Specific power and random demand function. As is shown in Formula 5, and when A is random number, Formula 5 is random demand function.

$$D(p_1) = A \cdot \frac{m(1-r)}{p_1^{b}} \tag{5}$$

Among them: A is the constant related to demand; m stands for the income level of consumers; r is the level of interest rates; p_1 is the unit price of goods 1; b stands for price elasticity of demand, and $b > 1$.

2.2. The establishment of specific demand function model for rural construction and planning

Based on the above basic economics goods demand function's basic demand model and specific demand model analysis, in order to analyse the rural planning and construction from the perspectives of property management and economics theory, the ma-

cro grasp of comprehensive economic benefits brought by the rural construction is needed. Therefore, in the analysis, the rural construction is equivalent to the goods on the market, the demand of rural construction and planning is equivalent to the goods demand on the market, and macro rural property unit price is equivalent to the unit price of goods on the market. At the same time, combined with the specific demand function of a wide variety of goods, the rural construction and planning model on the basis of specific demand function is then established. The modeling steps and process are as follows:

1: Symbol Description

I_t: stands for the property quantity of economic benefits created by the country in Period t, and the value stands for the remaining quantity of macro property that can create economic benefits in the process of rural construction.

Q_t: stands for the property quantity of macro investment in Period t, and the value stands for the property quantity of macro investment in the rural construction by the state and government.

Q_0: stands for the budget's upper limit of property quantity of macro investment in Period t, and the value shows that for different rural construction, there is an upper limit of investment budget in each period of construction .

D_t: stands for the property quantity of macro demand in Period t, and the value stands for the macro property quantity demanded by the consumbers during the rural construction process.

p_{0t}: stands for the unit price of property quantity of macro investment in Period t, and the value indicates the unit price of macro investment's property quantity.

AI $_t$: stands for the average property level of economic benefits which could be created in the rural in Period t, and the value stands for the average remaining quantity of macro property which could create economic benefits in the process of rural construction.

C_t: stands for the consumption unit price in the rural property management in Period t, and the value stands for the consumption unit price of macro property management in the process of rural construction.

p_{1t}: stands for the unit price of macro property in Period t, and the value stands for the unit price of macro property which could create economic benefits in the process of rural construction.

S_t: stands for the actual sales of rural property in Period t, and the value stands for the actual sales of macro property which could create economic benefits in the process of rural construction.

R_t: stands for the economic efficiency value of rural planning and construction, and the value stands for the actual economic benefits of macro property which could create economic benefits during the whole process of rural construction.

2: Model Hypotheses

Hypothesis 1: Assume that a rural construction project is sold in T cycles.

Hypothesis 2: The unit price of property sales in each period of rural construction p_{1t} can be different, but the sales price in the same period remains the same.

Hypothesis 3: After the completion of rural construction sales, the property will not be returned during the entire rural construction, i.e., the property has a certain stability for use.

Hypothesis 4: The rural property demands in each period are continuous and uniform.

3: Model Establishment

As the actual macro property sales in Period t are constrained by I_t, Q_t and D_t., the actual macro property sales are $\min(I_t+Q_t,D_t)$. The property management consumption and macro property investment costs in rural construction in Period t are $p_{0t}\cdot Q_t+C_t\cdot AI_t$. Therefore, the economic benefits of rural planning construction in Period t are shown in Formula 6 below.

$$R_t(p_{1t},Q_t)=p_{1t}\cdot\min(I_t+Q_t,D_t)-(p_{0t}\cdot Q_t+C_t\cdot AI_t)+R_{t-1} \quad (6)$$

Where p_{1t} and Q_t are independent variables of planning to be solved. However, this objective function is subject to the follwing constraints:

1)Boundary constraint:

In early rural construction, the profit of macro property sales is 0, as shown in Formula 7 below:

$$R_0=0 \quad (7)$$

2) Constraint on the average remaining quantity of macro property that can create economic benefits in Period t:

I_{t+1} in Period t+1 is constrained by I_t, Q_t and D_t in Period t, as shown in Formula 8 below:

$$I_{t+1}=I_t+Q_t-\min(I_t+Q_t,D_t)=\max(I_t+Q_t-D_t,0) \quad (8)$$

From Formula 8, it can be learned that when $I_{t+1}=I_t+Q_t-D_t$, i.e., $I_t+Q_t\geq D_t$, AI_t in Period t is shown in Formula 9 below. When I_{t+1}=0, i.e., $I_t+Q_t<D_t$, AI_t in Period t is shown in Formula 10 below.

$$AI_t=\frac{(I_t+Q_t)+(I_t+Q_t-D_t)}{2}=I_t+Q_t-\frac{D_t}{2} \quad (9)$$

$$AI_t=\frac{(I_t+Q_t)}{2}\cdot\frac{(I_t+Q_t)}{D_t} \quad (10)$$

3) Constraint on the upper limit of investment budget, as shown in Formula 11 below:

$$Q_t\leq Q_0 \quad (11)$$

4) Non-negative constraint:

This paper makes a quantitative analysis of rural construction development and its macro property quantity, so the variable can be a real number, as

shown in Formula 12 below:

$$p_{1t} \geq 0 \quad Q_t \geq 0 \tag{12}$$

Accumulated economic benefits in T periods during rural planning and construction being the objective function, the resulting final model is shown in Formula 13 below:

$$\max f \quad R_t(p_{1t}, Q_t) = p_{1t} \cdot \min(I_t + Q_t, D_t) - (p_{0t} \cdot Q_t + C_t \cdot AI_t) + R_{t-1}$$

$$S.T. \begin{cases} R_0 = 0 \\ AI_t = \begin{cases} I_t + Q_t - \dfrac{D_t}{2}, I_t + Q_t \geq D_t \\ \dfrac{I_t + Q_t}{2} \cdot \dfrac{I_t + Q_t}{D_t}, I_t + Q_t < D_t \end{cases} \\ Q_t \leq Q_0 \\ p_{1t} \geq 0 \\ Q_t \geq 0 \\ t = 1, 2, 3, ..., T \end{cases} \tag{13}$$

For different developments of rural demands, D_t can be divided into different types of demand functions.

3. Numerical Solution and Result Analysis of Models

The above models are dynamic planning models. Below, this paper mainly adopts the simulative solution of actual numerical values, reflects the construction and planning process of beautiful countryside adjusted by macro economy intuitively through the results of model solution, and analyzes the process and nature of construction and planning under different demand models respectively as follows:

3.1. Specific power demand function model solution

The final model demand function of rural planning and construction is $D(p_1) = A \cdot \frac{m(1-r)}{p_1^b}$. A is a fixed constant. Relevant parameters set in the process of model solution are shown in Tables 1 and 2 below:

Table 1. elevant Parameters of Specific Power Demand Function Model

Relevant Parameter	Parameter Value
A	1
b	1.5
T	12
I_t	150
Q_0	300

Table 2. Parameter Values in All Periods

T	m/yuan	r/%	p_{0t}/yuan	C_t/yuan
1	11700	3.20	11.3	1.0
2	11600	3.10	10.8	1.0
3	10800	2.90	10.7	0.9
4	11100	2.90	10.6	0.9
5	10500	3.00	10.9	0.8
6	11300	3.00	11.3	1.1
7	11600	2.85	11.1	1.0
8	10800	2.90	10.6	0.9
9	10400	2.95	10.8	0.8
10	10800	3.00	10.7	0.9
11	11100	2.97	10.5	0.9
12	11600	3.10	11.0	1.0

Substitute the above model parameter values and parameter values in all periods into the model. The optimization results after solution are shown in Table 3 and Figure 1 below:

Table 3. Calculation Results of Specific Power Demand Function Model

T	I_t/each	D_t/ each	S_t/ each	AI_t/ each	p_{1t}/yuan	Q_t/ each	R_t/yuan
1	150	119.96	119.96	91.516	20.734	1.4949	2378.8
2	31.538	134.15	134.15	112.99	19.148	148.52	3230.5
3	45.911	105.93	105.93	52.967	21.4	60.023	4807.5
4	0.00051306	114.88	114.88	72.682	20.648	130.12	5734.8
5	15.243	103.9	103.9	52.883	21.26	89.591	6924.9
6	0.93229	118.02	118.02	80.027	20.508	138.1	7696.7
7	21.018	110.72	110.72	101.05	21.799	135.39	8506.5
8	45.684	110.34	110.34	59.344	20.826	68.829	10021
9	4.176	106.41	106.41	102.59	20.799	151.62	10515
10	49.389	105.94	105.94	90.91	21.385	94.489	11688
11	37.942	112.3	112.3	56.151	20.952	74.359	13209
12	0.00051404	111.38	111.38	55.69	21.676	111.38	14343

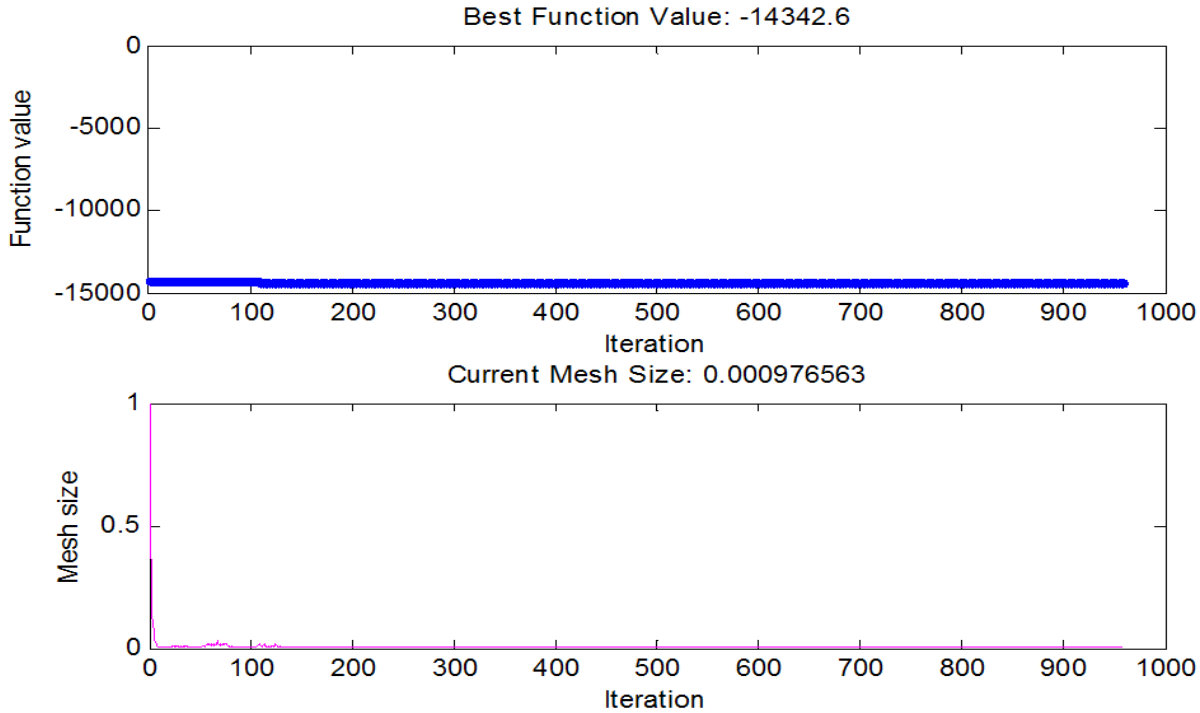

Figure 1. Iteration and Optimization Results of Objective Function of Model: Specific Power Demand Function

Through the above results of model solution, it can be seen that the sales price p_{1t} of macro property quantity in each period of rural construction and planning is not the same, but different. It fluctuates around 20 yuan as a whole. The final optimization results of objective function are 14,343 yuan.

3.2. Random demand function model solution

When the rural development demand function is a random function, $D(p_1) = A \cdot \frac{m(1-r)}{p_1^b}$. A in each period is a random number. Relevant parameters set in the process of model solution are shown in Table 4 below:

Table 4. Relevant Parameters of Random Demand Function Model

Relevant Parameter	Parameter Value
A	Normal distribution random number of $u=1, \sigma^2=2$
b	1.5
T	12
I_t	150
Q_0	300

The optimization results after solution are shown in Table 5 and Figure 2 below:

Table 5. Calculation Results of Random Demand Function Model

T	I_t/each	D_t/ each	S_t/ each	AI_t/ each	p_{1t}/yuan	Q_t/ each	R_t/yuan
1	150	452.47	450	337.5	22.6	300	6556.1
2	0	0	0	186.5	17.139	186.5	4355.4
3	186.5	215.1	215.1	246.52	17.814	167.57	6172.3
4	138.97	124.46	124.46	315.25	18.646	238.51	5681
5	253.02	349.42	349.42	234.81	21.695	156.5	11368
6	60.097	261.74	261.74	131.31	21.773	202.09	14639
7	0.44019	86.429	86.429	97.485	21.813	140.26	14870
8	54.271	0	0	286.74	20.662	232.47	12148
9	286.74	294.53	294.53	147.36	21.165	7.8842	18179
10	0.089775	95.539	95.539	70.72	18.436	118.4	18610
11	22.95	184.27	184.27	223.89	20.491	293.08	19107
12	131.75	305.5	305.5	268.58	21.056	173.75	23475

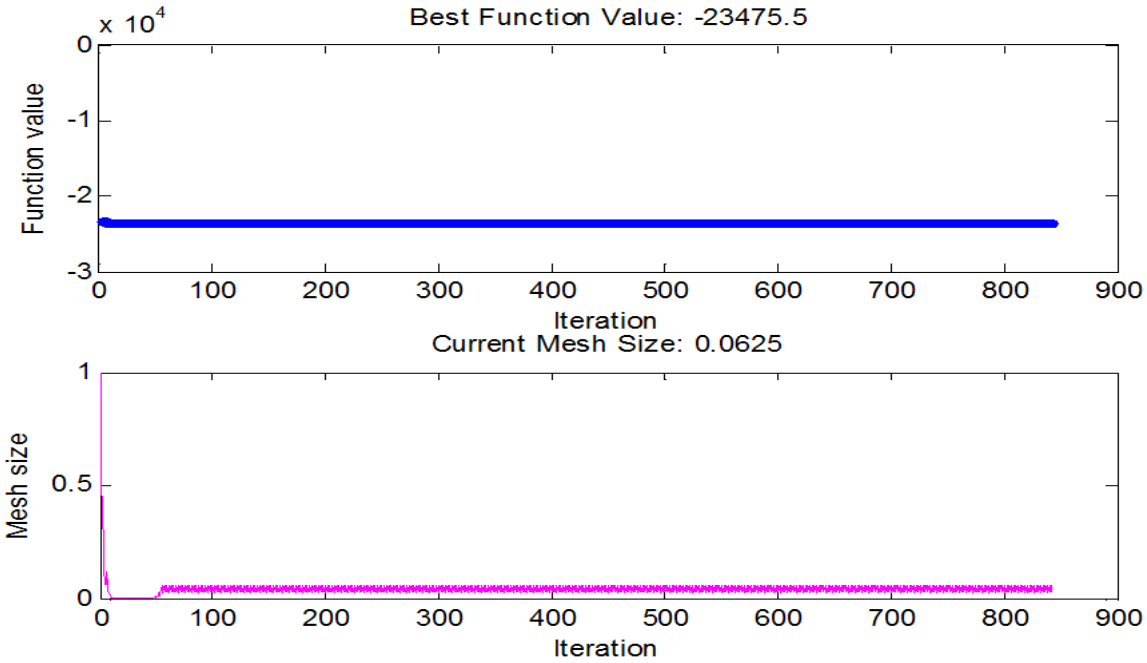

Figure 2. Iteration and Optimization Results of Objective Function of Model: Random Demand Function

Through the above results of model solution, it can be seen that as the actual rural property demand in Period 1 is too large. The remaining property quantity I_t that can create economic benefits in Period 2 is 0. So benefits can be only obtained after new rural property quantity is developed and constructed. Besides, the model results still give the unit price of macro property sales in Period 2 p_{1t}, i.e. 17.139 yuan. This value can reflect the potential economic benefits of rural construction. Meanwhile, in each period, the fluctuation ranges of sales price of macro property quantity and specific power demand function results are basically the same. The final optimization results of objective function, random demand function are 23,475 yuan.

3.3. Linear demand function model solution

The demand function of final model is

$$D(p_1) = A \cdot w_1 \left[1 - \frac{p_1}{v_1} \left(\frac{p_1 w_1 + p_2 w_2 - m(1-r)}{\frac{w_1}{v_1} p_1^{\,2} + \frac{w_2}{v_2} p_2^{\,2}} \right) \right]$$

A is a fixed constant. Relevant parameters set in the process of model solution are shown in Table 6 below:

Table 6. Relevant Parameters of Linear Demand Function Model

Relevant Parameter	Parameter Value
A	1
T	12
I_1	150
Q_0 w_1 w_2 v_1 v_2 p_2	300 1000 950 6 5.5 20

The optimization results after solution are shown in Table 7 and Figure 3 below.

Through the above results of model solution, it can be seen that both the macro property demand D_t and macro investment property quantity in each period of rural construction and planning Q_t are large, but the sales price is basically stable and still fluctuates around 20 yuan. The final optimization results of objective function are 30,709 yuan.

Table 7. Calculation Results of Linear Demand Function Model

T	I_t/each	D_t/ each	S_t/ each	AI_t/ each	p_{1t}/yuan	Q_t/ each	R_t/yuan
1	150	276.82	276.82	158.19	20.56	146.6	3876.8
2	19.779	278.81	278.81	144.94	20.386	264.57	6558.2
3	5.539	267.65	267.65	146.26	20.05	274.55	8855.4
4	12.437	250.24	250.24	167.15	21.101	279.84	11019
5	42.029	245.48	245.48	178.81	20.651	259.52	13116
6	56.071	239.11	238.37	118.82	21.814	182.3	16126
7	0	252.33	252.33	127.01	21.568	253.17	18631
8	0.84648	254.79	254.79	129.96	20.583	256.51	21039
9	2.5629	232.79	232.79	162.92	21.098	276.76	22831
10	46.527	257.03	257.03	211.24	20.477	293.23	24767
11	82.727	253.46	253.46	129.6	20.951	173.6	28138
12	2.8663	279.47	279.47	145.96	20.358	282.83	30709

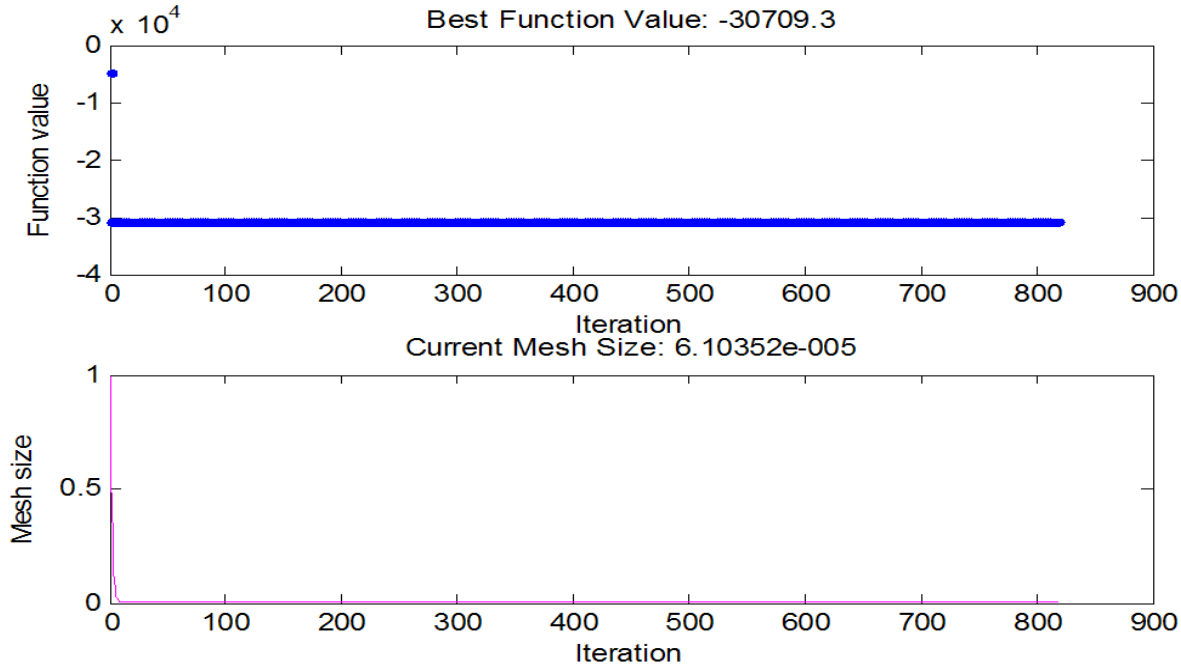

Figure 3. Iteration and Optimization Results of Objective Function of Model: Linear Demand Function

Through the above results of model solution, it can be seen that both the macro property demand D_t and macro investment property quantity in each period of rural construction and planning Q_t are large, but the sales price is basically stable and still fluctuates around 20 yuan. The final optimization results of objective function are 30,709 yuan.

4. Conclusion

This chapter, from the perspective of property management and economics, regards rural construction as goods and analyzes the specific demand function model of all types. On this basis, with accumulated economic benefits during rural planning and construction as the objective function, it sets up a rural construction and planning model based on specific demand function, probes into various constraints of this model and finally analyzes the solutions and nature of each model, through example computaiton. Results show that when rural construction involves 12 cycles, the optimal unit price of macro property sales of all types of demand functions fluctuates within the same numerical range. The unit price of macro property sales in each period is not the same. Meanwhile, when the demand function is linear, both mac-

ro property market demands in rural construction and planning and macro investment property demands in rural construction are large. The resulting accumulated economic benefits are large, too.

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