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Analysis on Influencing Factors of GDP in Hefei under Econometric Model

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Abstract

Hefei, Anhui Province, as a member of the world alliance of science and technology cities, a modern manufacturing base and comprehensive transportation hub, an important national scientific research and education base, one of China's four science and education bases, and one of China's favorite reading cities; It has the reputation of "Jianghuai first county and wuchu hub". As the most rapidly developing provincial capital in recent years, its economic structure and development status have a good reference for other cities. This article aims to introduce the impact of local financial budget expenditure, real estate development investment and total retail sales on the economic development of Hefei by using the relevant knowledge of econometrics, and make expectations for the future development prospect of Hefei.

Keywords

Urban GDP; Real Estate; Expenditure.

1. Raising Question

Hefei, the capital of Anhui Province, is located in East China, central Anhui, between the Yangtze River and Huaihe River, surrounded by Chaohu Lake; China city's city center of the Yangtze River Delta is a sub center city established by the State Council, the central city of China's integrated circuit industry, a national science and technology innovation pilot city, and a comprehensive national science center. The "one belt and one road" and the Yangtze River Economic Belt strategic double point City,[1] the core city of Wanjiang City belt, and the central city of G60 science creation corridor. Its GDP has increased rapidly in the past two decades (see Figure 1). Hefei's GDP growth rate from 2001 to 2018 was 2052.5%, making it the provincial capital city with the fastest economic growth. Especially in 2019, Hefei's annual GDP reached 940.94 billion yuan, an increase of 9.35% over the previous year. Among them, the added value of the primary industry was 29.186 billion yuan, an increase of 1.7%; The added value of the secondary industry was 341.532 billion yuan, an increase of 7.7%; The added value of the tertiary industry was 570.222 billion yuan, an increase of 7.8%. In 2020, Hefei's GDP will reach trillion, so we can study it and analyze the reasons for its rapid growth.

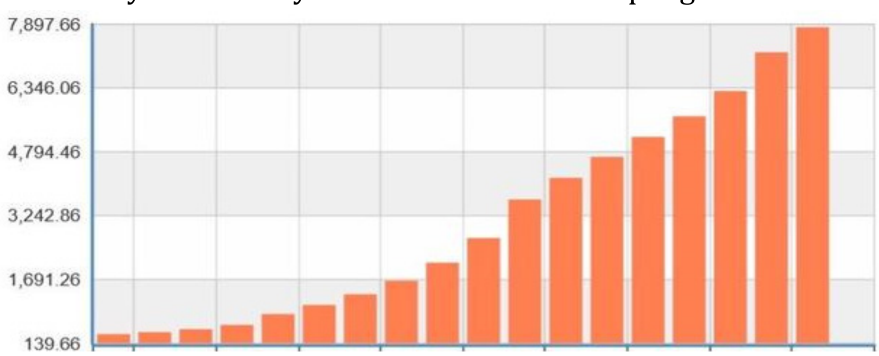

Figure 1. Hefei's GDP development in recent years

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2. Theoretical Review

GDP is one of the more important comprehensive statistical indicators and core indicators in the national economic accounting system. Many important economic structures, such as industrial structure, regional economic structure, consumption demand and so on, are expressed through GDP, and they are an important basis for formulating economic structure adjustment strategies and policies. Therefore, the study of Hefei GDP can reflect the proportional relationship between investment and consumption, social production and use and macroeconomic benefits, which provides a certain idea for future development.

3. Model Setting

In order to obtain the numerical value and set the model, the GDP of Hefei from 2003 to 2018 is set as the explanatory variable y (RMB 100 million), the expenditure in the local financial budget X1 (RMB 100 million), the balance of deposits of financial institutions X2 (RMB 100 million), the investment in real estate development X3 (RMB 100 million), and the total retail sales X4 (RMB 100 million). Based on this, the regression model is established.

4. Collection of Partial Data

Table 1. National tourism revenue and related data from 2001 to 2019

particular year	GDP (100 million yuan)	Expenditure within local financial budget (100 million yuan)	Balance of various deposits of financial institutions at the end of the year (100 million yuan)	Investment in real estate development (100 million yuan)	Total retail sales of social goods (100 million yuan)
2003	484.96	35.87	1059.62	89.70	207.4332
2004	589.70	44.93	1295.96	138.32	281.7239
2005	853.57	57.64	1521.85	190.29	324.3930
2006	1073.76	79.40	1862.46	280.64	384.3098
2007	1334.61	169.32	2231.33	385.01	469.0023
2008	1664.84	222.08	2725.68	565.47	617.2075
2009	2102.12	180.90	3735.31	670.36	801.5844
2010	2701.61	259.43	4541.78	819.03	1000.3416
2011	3636.60	338.51	5756.30	880.29	1281.3189
2012	4164.34	389.50	6913.84	913.80	1493.7888
2013	4672.91	438.62	8232.58	1105.81	1724.1704
2014	5180.56	500.34	9142.68	1127.36	1949.6970
2015	5660.27	571.54	10967.91	1259.14	2183.6501
2016	6274.38	614.85	13150.95	1352.59	2445.6959
2017	7213.45	655.90	13881.72	1557.41	2728.5104
2018	7822.91	1004.91	15338.45	1527.17	2976.7420

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Through the search and analysis of the database system of China economic network and the official website of the Bureau of statistics, the GDP and some influencing factors of Hefei in recent 20 years are obtained. The specific data are shown in the Table 1.

5. Model Initial Estimation

Trend analysis: enter plot y X1 x2 X3 X4 in eviews9.0

As shown below:

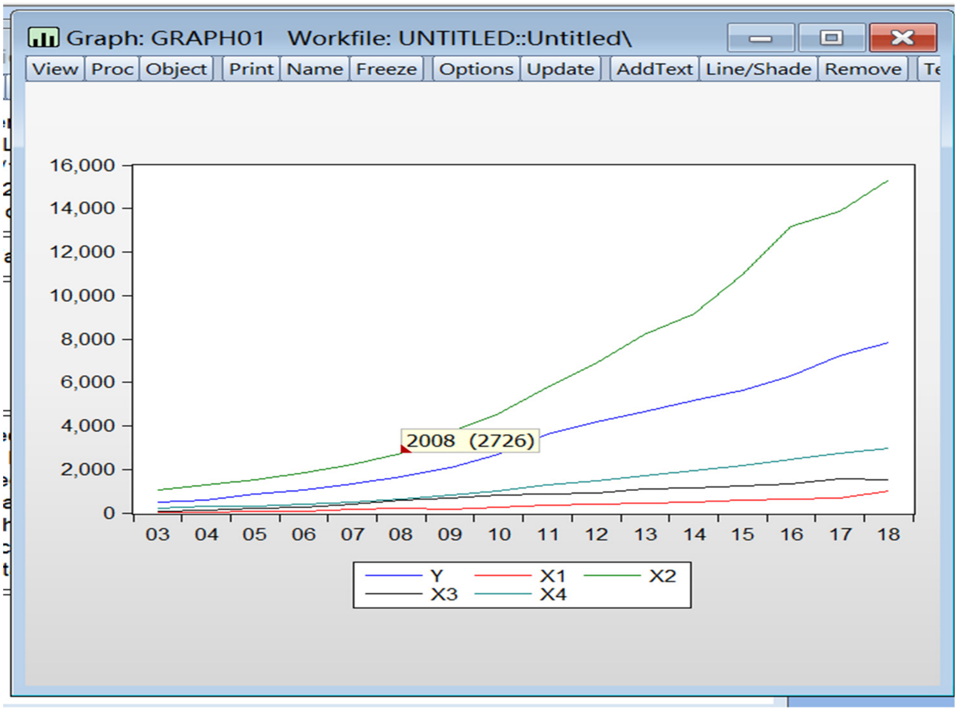

Figure 2. Trend chart analysis

It can be seen from the trend chart that the change direction of the explained variable GDP y (RMB 100 million), the balance of deposits of financial institutions X2 (RMB 100 million) and the total retail sales of social goods X4 (RMB 100 million) at the end of the year is the same, there is a certain correlation between them, and the change direction is not obvious with other explanatory variables.

Correlation diagram analysis: input in Eviews 9.0 respectively

SCAT X1 Y

SCAT X2 Y

SCAT X3 Y

SCAT X4 Y

It can be seen from the correlation chart that there is a positive linear correlation between the expenditure in the local financial budget X1 (billion yuan), the balance of deposits in financial institutions X2 (billion yuan), the investment in real estate development X3 (billion yuan), the total retail sales X4 (billion yuan) and the explained variable GDP y.

Correlation coefficient analysis: enter cor y X1 x2 X3 X4 in eviews9.0

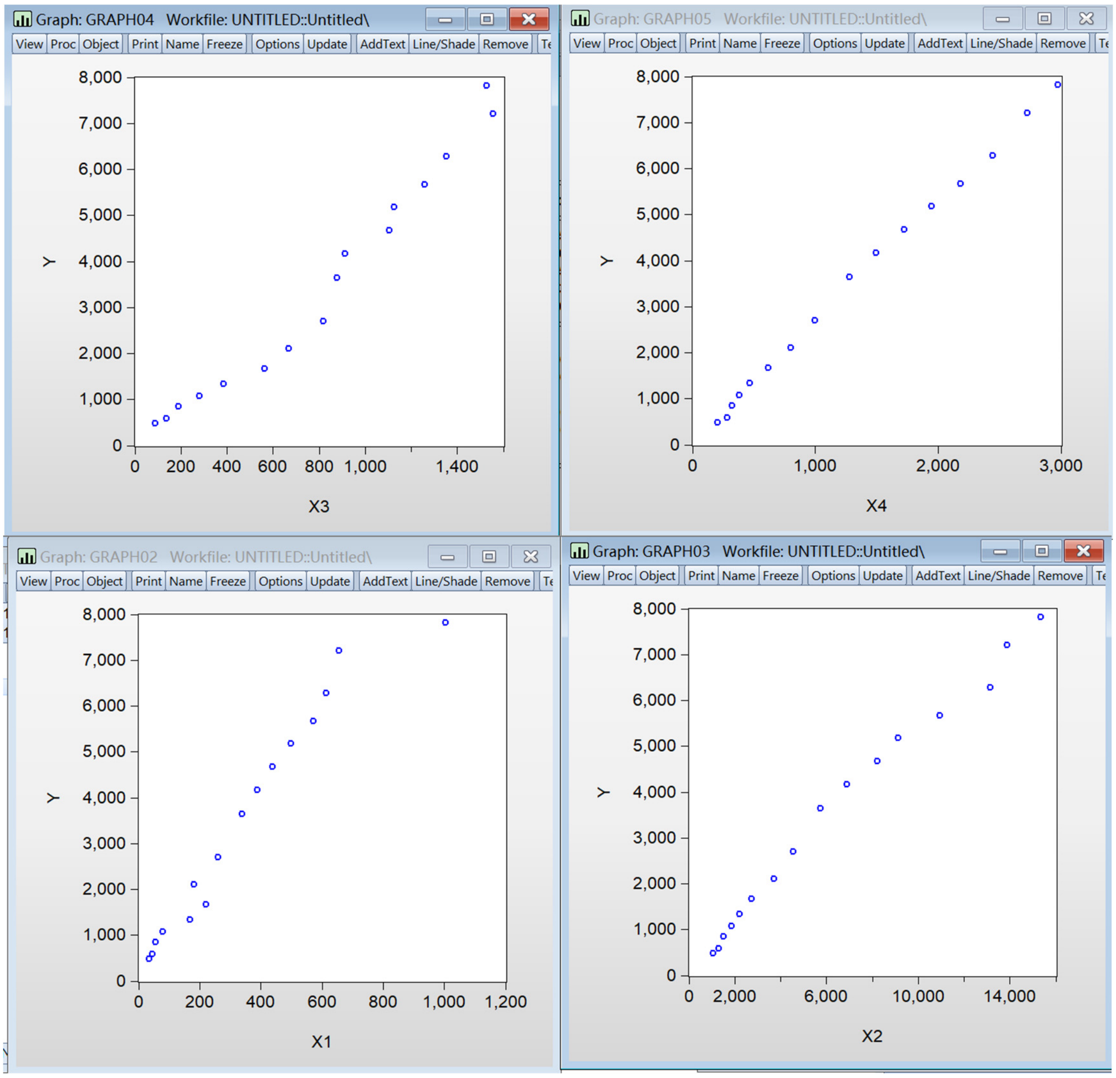

Figure 3. Correlation diagram analysis (a)

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Correlation

	Y	X1	X2	X3	X4
Y	1.000000	0.973380	0.993026	0.983008	0.998836
X1	0.973380	1.000000	0.972034	0.944255	0.973753
X2	0.993026	0.972034	1.000000	0.967306	0.996991
X3	0.983008	0.944255	0.967306	1.000000	0.979223
X4	0.998836	0.973753	0.996991	0.979223	1.000000

Figure 4. Correlation diagram analysis (b)

It can be seen from the figure that the correlation coefficients between the GDP of the explained variable y and the expenditure in the local financial budget of the explanatory variable X1 (billion yuan), the balance of deposits of financial institutions X2 (billion yuan), the investment in real estate development X3 (billion yuan), and the total retail sales of social goods X4 (billion yuan) are 0.973380, 0.993026, 0.983008 and 0.998836 respectively, and their absolute values are greater than 0.6, The preliminary results show that there may be a positive and highly linear correlation between GDP y and local budget expenditure X1 (billion yuan), year-end deposit

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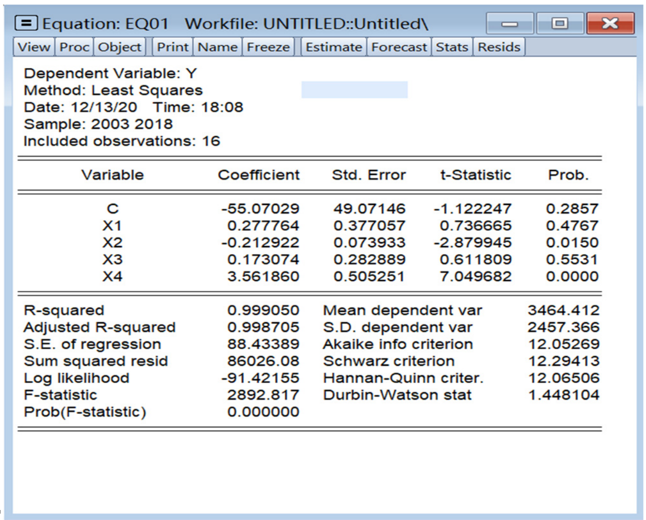
balance X2 (billion yuan), real estate development investment X3 (billion yuan), and total retail sales X4 (billion yuan).

According to the above analysis and economic theory, a multiple linear regression model of influencing factors of Hefei's GDP is preliminarily established:

$$y = c + \beta_1 x1 + \beta_2 x2 + \beta_3 x3 + \beta_4 x4 + \mu$$

6. Multicollinearity Test

According to the relevant data in the table, use eviews9.0 and the least square method for multiple linear regression analysis. Input LS Y C X1 x2 X3 X4 in eviews9.0, and the results are as follows:


Equation: EQ01 Workfile: UNTITLED::Untitled\
View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 18:08
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-55.07029	49.07146	-1.122247	0.2857
X1	0.277764	0.377057	0.736665	0.4767
X2	-0.212922	0.073933	-2.879945	0.0150
X3	0.173074	0.282889	0.611809	0.5531
X4	3.561860	0.505251	7.049682	0.0000

R-squared	0.999050	Mean dependent var	3464.412
Adjusted R-squared	0.998705	S.D. dependent var	2457.366
S.E. of regression	88.43389	Akaike info criterion	12.05269
Sum squared resid	86026.08	Schwarz criterion	12.29413
Log likelihood	-91.42155	Hannan-Quinn criter.	12.06506
F-statistic	2892.817	Durbin-Watson stat	1.448104
Prob(F-statistic)	0.000000		

:

Figure 5. Least square method

Therefore, the report form of the model is:

Y= -55.0702921022 + 0.277764497482*X1 - 0.212921634916*X2 + 0.173073970316*X3 + 3.56185993802*X4

(49.07146) (0.377057) (0.073933) (0.282889) (0.505251)

t=(-1.122247) (0.736665) (-2.879945) (0.611809) (7.049682)

R^2=0.999050 F=2892.817 prob(F)=0.000000 DW=1.448104

Model statistical inference test

Economic significance test: it can be seen from the Figure that the coefficient of variable X2 is negative. However, according to the general inference, the coefficient of x2 should be positive, because GDP = consumption + savings. The larger the deposit balance of financial institutions at the end of the year, the higher the GDP. Therefore, this negative sign is not in line with the economic significance.

Goodness of fit test: R2 = 0.999050, close to 1, indicating that the model has a high degree of fitting to the sample data.

F test: F = 2892.8173.36, and the prob (f) value of 0.000000 is also significantly less than that, indicating that the linear relationship of the model is significant, or the explanatory variable, the expenditure in the local financial budget X1 (billion yuan), the balance of various deposits of financial institutions X2 (billion yuan), the investment in real estate development X3 (billion yuan), and the total retail sales X4 (billion yuan) have a significant impact on the explained variable GDP y.

T test: the T values of expenditure X1 in local financial budget and investment X3 in real estate development are less than 2, indicating that these parameters have no significant impact on GDP y, and the absolute values of T values of other parameters are greater than 2, indicating that other parameters have a significant impact on GDP y.

Multicollinearity test

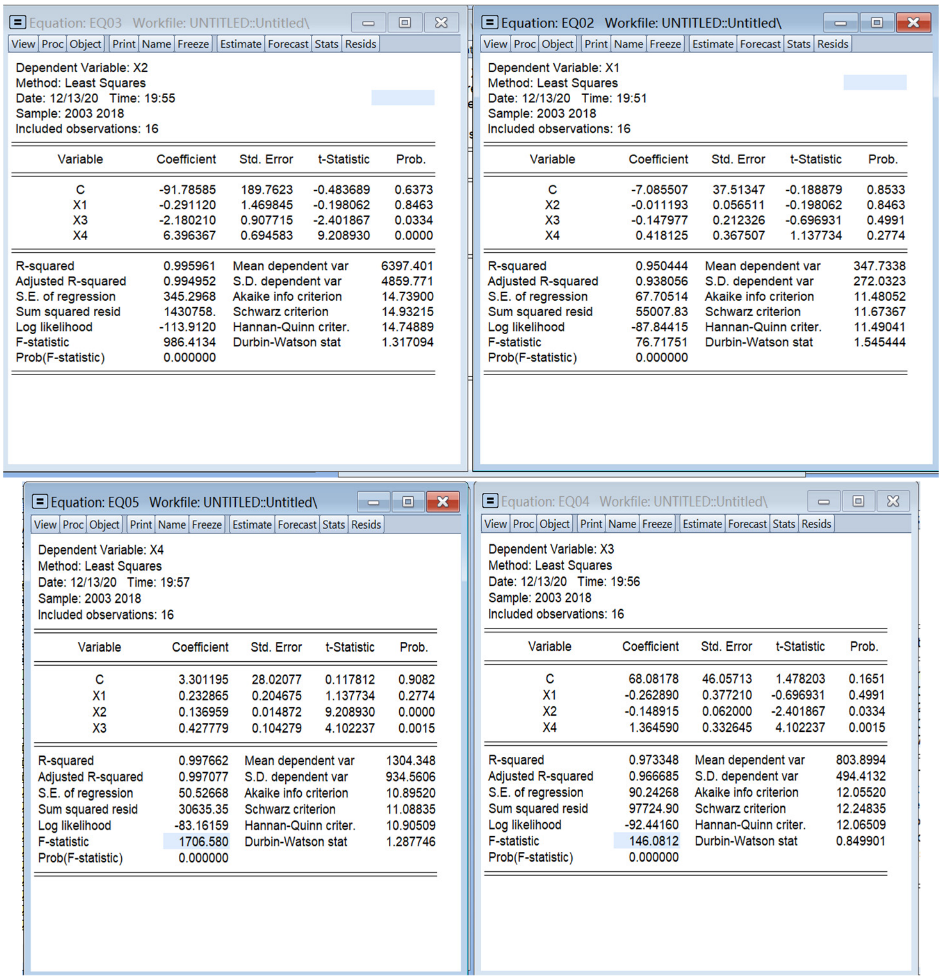
Multicollinearity test: considering that there are too many factors affecting the selection, the cor command can be used to test the correlation coefficient. The results are shown in the table below:

Table 2. Display results

	Y	X1	X2	X3	X4
Y	1.000000	0.973380	0.993026	0.983008	0.998836
X1	0.973380	1.000000	0.972034	0.944255	0.973753
X2	0.993026	0.972034	1.000000	0.967306	0.996991
X3	0.983008	0.944255	0.967306	1.000000	0.979223
X4	0.998836	0.973753	0.996991	0.979223	1.000000

It can be seen from the above table that the correlation coefficient between explanatory variables is greater than 0.8 and less than 0.8, which does not rule out the possibility of multicollinearity.

Further, with the help of auxiliary regression model test and variance expansion factor test, after Eviews 9.0 related operation



Equation: EQ03 Workfile: UNTITLED::Untitled\

Dependent Variable: X2
Method: Least Squares
Date: 12/13/20 Time: 19:55
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-91.78585	189.7623	-0.483689	0.6373
X1	-0.291120	1.469845	-0.198062	0.8463
X3	-2.180210	0.907715	-2.401867	0.0334
X4	6.396367	0.694583	9.208930	0.0000

R-squared	0.995961	Mean dependent var	6397.401
Adjusted R-squared	0.994952	S.D. dependent var	4859.771
S.E. of regression	345.2968	Akaike info criterion	14.73900
Sum squared resid	1430758.	Schwarz criterion	14.93215
Log likelihood	-113.9120	Hannan-Quinn criter.	14.74889
F-statistic	986.4134	Durbin-Watson stat	1.317094
Prob(F-statistic)	0.000000		

Equation: EQ02 Workfile: UNTITLED::Untitled\

Dependent Variable: X1
Method: Least Squares
Date: 12/13/20 Time: 19:51
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.085507	37.51347	-0.188879	0.8533
X2	-0.011193	0.056511	-0.198062	0.8463
X3	-0.147977	0.212326	-0.696931	0.4991
X4	0.418125	0.367507	1.137734	0.2774

R-squared	0.950444	Mean dependent var	347.7338
Adjusted R-squared	0.938056	S.D. dependent var	272.0323
S.E. of regression	67.70514	Akaike info criterion	11.48052
Sum squared resid	55007.83	Schwarz criterion	11.67367
Log likelihood	-87.84415	Hannan-Quinn criter.	11.49041
F-statistic	76.71751	Durbin-Watson stat	1.545444
Prob(F-statistic)	0.000000		

Equation: EQ05 Workfile: UNTITLED::Untitled\

Dependent Variable: X4
Method: Least Squares
Date: 12/13/20 Time: 19:57
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.301195	28.02077	0.117812	0.9082
X1	0.232865	0.204675	1.137734	0.2774
X2	0.136959	0.014872	9.208930	0.0000
X3	0.427779	0.104279	4.102237	0.0015

R-squared	0.997662	Mean dependent var	1304.348
Adjusted R-squared	0.997077	S.D. dependent var	934.5606
S.E. of regression	50.52668	Akaike info criterion	10.89520
Sum squared resid	30635.35	Schwarz criterion	11.08835
Log likelihood	-83.16159	Hannan-Quinn criter.	10.90509
F-statistic	1706.580	Durbin-Watson stat	1.287746
Prob(F-statistic)	0.000000		

Equation: EQ04 Workfile: UNTITLED::Untitled\

Dependent Variable: X3
Method: Least Squares
Date: 12/13/20 Time: 19:56
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	68.08178	46.05713	1.478203	0.1651
X1	-0.262890	0.377210	-0.696931	0.4991
X2	-0.148915	0.062000	-2.401867	0.0334
X4	1.364590	0.332645	4.102237	0.0015

R-squared	0.973348	Mean dependent var	803.8994
Adjusted R-squared	0.966685	S.D. dependent var	494.4132
S.E. of regression	90.24268	Akaike info criterion	12.05520
Sum squared resid	97724.90	Schwarz criterion	12.24835
Log likelihood	-92.44160	Hannan-Quinn criter.	12.06509
F-statistic	146.0812	Durbin-Watson stat	0.849901
Prob(F-statistic)	0.000000		

Figure 6. Variance expansion factor

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The relevant data obtained are as follows:

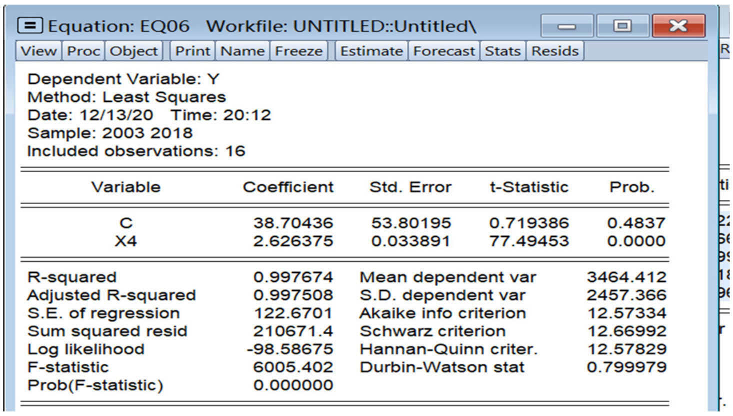
Table 3. VIF

Model	R^2	F statistic	Adjoint probability of F	VIF	TOL
X1=f (X2, x3, x4)	0.950444	76.71751	0.000000	20.17919	0.049556
X2=f (X1, x3, x4)	0.995961	986.4134	0.000000	247.5860	0.004039
X3=f (X1, x2, x4)	0.973348	146.0812	0.000000	37.52064	0.026652
X4=f (X1, x2, x3)	0.997662	1706.580	0.000000	427.7160	0.002338

It can be seen from the table that except that the variance expansion factor of each index is greater than 10 or the tolerance tol is less than 0.1, or the adjoint probability of F statistics is close to zero or less than the significance level of 0.05, it indicates that there is a certain multicollinearity. Finally, the regression model is established according to the principle of stepwise regression.

The univariate basic linear regression model is established

According to the correlation coefficient chart, the correlation coefficient between Y and X4 is the largest, so the univariate basic linear regression model of Y and X4 is established first. The results are as follows:


Equation: EQ06 Workfile: UNTITLED::Untitled\

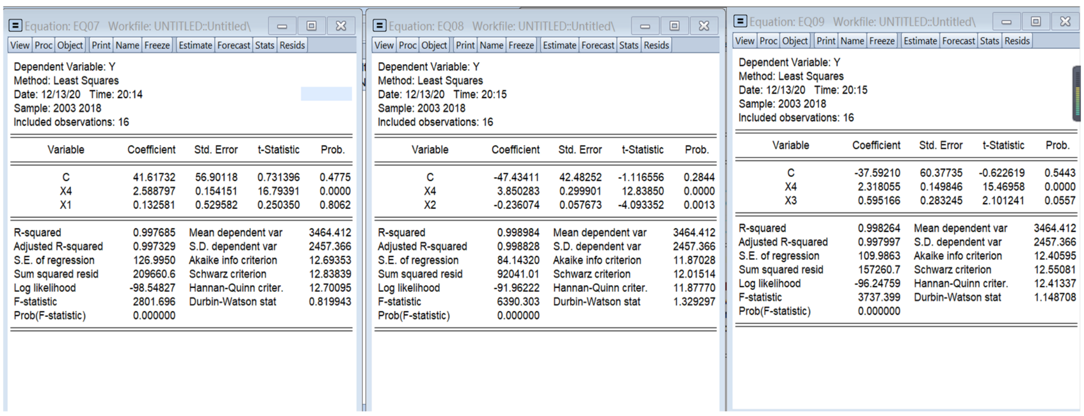
Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:12
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	38.70436	53.80195	0.719386	0.4837
X4	2.626375	0.033891	77.49453	0.0000

R-squared	0.997674	Mean dependent var	3464.412
Adjusted R-squared	0.997508	S.D. dependent var	2457.366
S.E. of regression	122.6701	Akaike info criterion	12.57334
Sum squared resid	210671.4	Schwarz criterion	12.66992
Log likelihood	-98.58675	Hannan-Quinn criter.	12.57829
F-statistic	6005.402	Durbin-Watson stat	0.799979
Prob(F-statistic)	0.000000		

Figure 7. Linear model

Taking the above univariate linear regression model as the basic model, other variables are successively introduced to estimate the binary regression model. The results are as follows:


Equation: EQ07 Workfile: UNTITLED::Untitled\

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:14
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41.61732	56.90118	0.731396	0.4775
X4	2.588797	0.154151	16.79391	0.0000
X1	0.132581	0.529582	0.250350	0.8062

R-squared	0.997685	Mean dependent var	3464.412
Adjusted R-squared	0.997329	S.D. dependent var	2457.366
S.E. of regression	126.9950	Akaike info criterion	12.69353
Sum squared resid	209660.6	Schwarz criterion	12.83839
Log likelihood	-98.54827	Hannan-Quinn criter.	12.70095
F-statistic	2801.696	Durbin-Watson stat	0.819943
Prob(F-statistic)	0.000000		

Equation: EQ08 Workfile: UNTITLED::Untitled\

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:15
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-47.43411	42.48252	-1.116556	0.2844
X4	3.850283	0.299901	12.83850	0.0000
X2	-0.236074	0.057673	-4.093352	0.0013

R-squared	0.998984	Mean dependent var	3464.412
Adjusted R-squared	0.998828	S.D. dependent var	2457.366
S.E. of regression	84.14320	Akaike info criterion	11.87028
Sum squared resid	92041.01	Schwarz criterion	12.01514
Log likelihood	-91.96222	Hannan-Quinn criter.	11.87770
F-statistic	6390.303	Durbin-Watson stat	1.329297
Prob(F-statistic)	0.000000		

Equation: EQ09 Workfile: UNTITLED::Untitled\

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:15
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-37.59210	60.37735	-0.622619	0.5443
X4	2.318055	0.149846	15.46958	0.0000
X3	0.595166	0.283245	2.101241	0.0557

R-squared	0.998264	Mean dependent var	3464.412
Adjusted R-squared	0.997997	S.D. dependent var	2457.366
S.E. of regression	109.9863	Akaike info criterion	12.40595
Sum squared resid	157260.7	Schwarz criterion	12.55081
Log likelihood	-96.24759	Hannan-Quinn criter.	12.41337
F-statistic	3737.399	Durbin-Watson stat	1.148708
Prob(F-statistic)	0.000000		

Figure 8. Binary regression model

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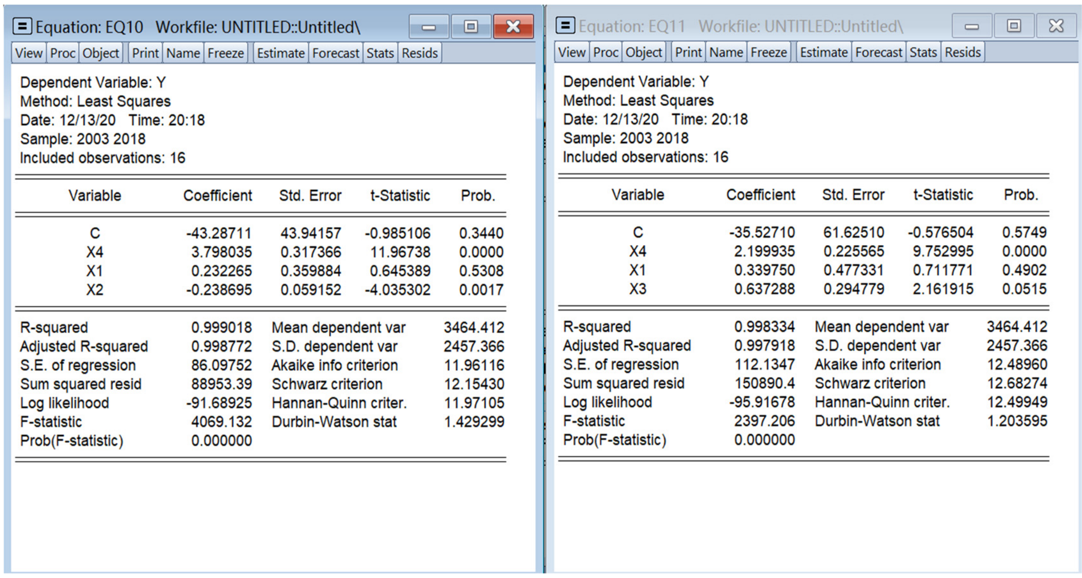
Therefore, the result of y = f (x4, x1) estimation is the optimal binary regression model. Based on this, a ternary regression model is established:


Equation: EQ10 Workfile: UNTITLED::Untitled\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:18
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-43.28711	43.94157	-0.985106	0.3440
X4	3.798035	0.317366	11.96738	0.0000
X1	0.232265	0.359884	0.645389	0.5308
X2	-0.238695	0.059152	-4.035302	0.0017

R-squared	0.999018	Mean dependent var	3464.412
Adjusted R-squared	0.998772	S.D. dependent var	2457.366
S.E. of regression	86.09752	Akaike info criterion	11.96116
Sum squared resid	88953.39	Schwarz criterion	12.15430
Log likelihood	-91.68925	Hannan-Quinn criter.	11.97105
F-statistic	4069.132	Durbin-Watson stat	1.429299
Prob(F-statistic)	0.000000		

Equation: EQ11 Workfile: UNTITLED::Untitled\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:18
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-35.52710	61.62510	-0.576504	0.5749
X4	2.199935	0.225565	9.752995	0.0000
X1	0.339750	0.477331	0.711771	0.4902
X3	0.637288	0.294779	2.161915	0.0515

R-squared	0.998334	Mean dependent var	3464.412
Adjusted R-squared	0.997918	S.D. dependent var	2457.366
S.E. of regression	112.1347	Akaike info criterion	12.48960
Sum squared resid	150890.4	Schwarz criterion	12.68274
Log likelihood	-95.91678	Hannan-Quinn criter.	12.49949
F-statistic	2397.206	Durbin-Watson stat	1.203595
Prob(F-statistic)	0.000000		

Figure 9. Ternary regression

Variables are introduced into the model one by one, and the step-by-step estimation results are listed in the table below.

Table 4. Various factors

equation	X4	X1	X2	X3	$\overline{R}^2$
①Y=f(x4)	2.626375 (77.49453)				0.997674
②Y=f(x4,x1)	2.588797 (16.79391)	0.132581 (0.250350)			0.997685
③Y=f(x4,x2)	3.850283 (12.83850)		-0.236074 (-4.093352)		0.998984
④Y=f(x4,x3)	2.318055 (15.46958)			0.595166 (2.101241)	0.998264
⑥Y=f(x4,x1,x2)	3.798035 (11.96738)	0.232265 (0.645389)	-0.238695 (-4.035302)		0.999018
⑦Y=f(x4,x1,x3)	2.199935 (9.752995)	0.339750 (0.711771)		0.637288 (2.161915)	0.998334
⑩Y=f(x4,x1,x3,x2)	3.561860 (7.049682)	0.277764 (0.736665)	0.173074 (0.611809)	-0.212922 (-2.879945)	0.999050

After repeated introduction, test and elimination, the ideal model is finally determined as

Y = -37.5920968011 + 2.31805470613*X4 + 0.595166252133*X3
(60.37735) (0.149846) (0.283245)
T= (-0.622619) (15.46958) (2.101241)
R^2=0.998264 $\overline{R}^2$ =0.997997 F=3737.399 DW=1.148708

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Equation: EQ09 Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 20:15
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-37.59210	60.37735	-0.622619	0.5443
X4	2.318055	0.149846	15.46958	0.0000
X3	0.595166	0.283245	2.101241	0.0557

R-squared	0.998264	Mean dependent var	3464.412
Adjusted R-squared	0.997997	S.D. dependent var	2457.366
S.E. of regression	109.9863	Akaike info criterion	12.40595
Sum squared resid	157260.7	Schwarz criterion	12.55081
Log likelihood	-96.24759	Hannan-Quinn criter.	12.41337
F-statistic	3737.399	Durbin-Watson stat	1.148708
Prob(F-statistic)	0.000000		

Figure 10. Ideal model

7. Model Test

Adjustment model statistical inference test

Goodness of fit test: R2 = 0.998264, close to 1, indicating that the model has high goodness of fit for sample data.

F test: F = 3737.399 3.81, and the prob (f) value of 0.000000 is also significantly less than, indicating that the overall linear relationship of the model is significant, or the combination of real estate development investment X3 (billion yuan) and total retail sales X4 (billion yuan) has a significant impact on the Explained variable GDP y.

T test: the T values of real estate development investment x 3 (billion yuan) and total retail sales x 4 (billion yuan) are greater than 2, indicating that the combination of real estate development investment x 3 (billion yuan) and total retail sales x 4 (billion yuan) has a significant impact on the Explained variable GDP y.

Heteroscedasticity test

Given the significance level of 0.05 based on the null hypothesis, use Eviews software to start the test according to view - residual tests - white heteroskedasticity.

Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

F-statistic	1.207575	Prob. F(5,10)	0.3726
Obs*R-squared	6.023617	Prob. Chi-Square(5)	0.3039
Scaled explained SS	2.859076	Prob. Chi-Square(5)	0.7217

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/13/20 Time: 21:26
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9590.548	9522.450	-1.007151	0.3376
X4^2	-0.014945	0.096207	-0.155339	0.8796
X4*X3	0.029309	0.385163	0.076095	0.9408
X4	57.96899	82.21043	0.705129	0.4968
X3^2	-0.062348	0.379838	-0.164144	0.8729
X3	-8.848935	134.0904	-0.065992	0.9487

R-squared	0.376476	Mean dependent var	9828.795
Adjusted R-squared	0.064714	S.D. dependent var	12172.80
S.E. of regression	11772.34	Akaike info criterion	21.86489
Sum squared resid	1.39E+09	Schwarz criterion	22.15461
Log likelihood	-168.9191	Hannan-Quinn criter.	21.87972
F-statistic	1.207575	Durbin-Watson stat	1.597912
Prob(F-statistic)	0.372594		

Figure 11. Heteroscedasticity test

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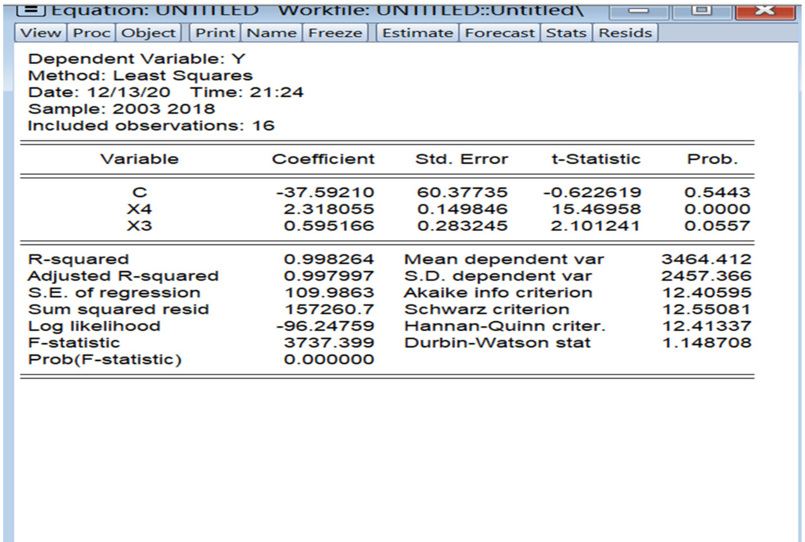
NR ^ 2 = 5.108704, check the criticality distribution table, (3) = 7.81, NR ^ 2 < 7.81, and the corresponding p value of F statistic is > 0.05. Accept the original hypothesis, and there is no Heteroscedasticity in the model.

Autocorrelation test



Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: Y
Method: Least Squares
Date: 12/13/20 Time: 21:24
Sample: 2003 2018
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-37.59210	60.37735	-0.622619	0.5443
X4	2.318055	0.149846	15.46958	0.0000
X3	0.595166	0.283245	2.101241	0.0557

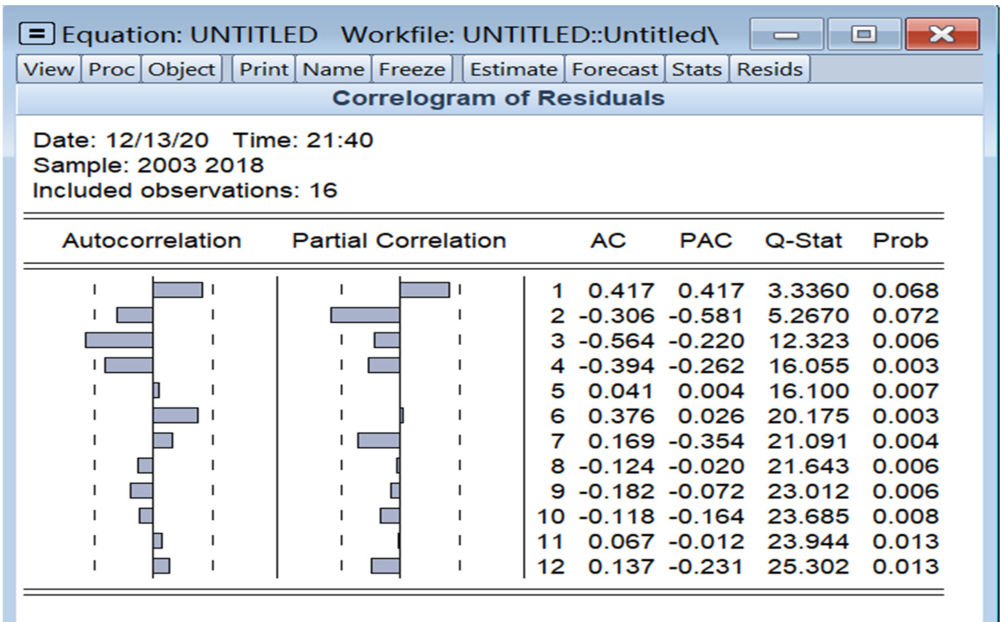
R-squared	0.998264	Mean dependent var	3464.412
Adjusted R-squared	0.997997	S.D. dependent var	2457.366
S.E. of regression	109.9863	Akaike info criterion	12.40595
Sum squared resid	157260.7	Schwarz criterion	12.55081
Log likelihood	-96.24759	Hannan-Quinn criter.	12.41337
F-statistic	3737.399	Durbin-Watson stat	1.148708
Prob(F-statistic)	0.000000		

Figure 12. Autocorrelation test

As shown in the Figure, the DW value is 1.148708, the sample size is 16, and the number of explanatory variables (excluding constant terms) is 2. Query the DW distribution table, and you can get the critical values DL = 0.982 and Du = 1.539. Since 1.148708 < 1.539, it is impossible to judge whether there is autocorrelation between error terms. Due to the limitations of DW test, it is impossible to test high-order autocorrelation, and other methods are needed to assist the test.

Partial correlation coefficient test

Click View / residual test / correlogram-q-statistics in the equation window



Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Correlogram of Residuals

Date: 12/13/20 Time: 21:40
Sample: 2003 2018
Included observations: 16

	AC	PAC	Q-Stat	Prob
1	0.417	0.417	3.3360	0.068
2	-0.306	-0.581	5.2670	0.072
3	-0.564	-0.220	12.323	0.006
4	-0.394	-0.262	16.055	0.003
5	0.041	0.004	16.100	0.007
6	0.376	0.026	20.175	0.003
7	0.169	-0.354	21.091	0.004
8	-0.124	-0.020	21.643	0.006
9	-0.182	-0.072	23.012	0.006
10	-0.118	-0.164	23.685	0.008
11	0.067	-0.012	23.944	0.013
12	0.137	-0.231	25.302	0.013

Figure 13. Partial correlation coefficient test

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It can be seen from the graph that the equation has high-order autocorrelation.

In addition, BG test method is adopted. In Eviews, click view, residual diagnostics, series correlation LM Test

Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.003280	Prob. F(2,11)	0.0285
Obs*R-squared	7.621665	Prob. Chi-Square(2)	0.0221

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/13/20 Time: 21:45
Sample: 2003 2018
Included observations: 16
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.12710	47.73877	-0.274978	0.7884
X4	-0.054450	0.120866	-0.450501	0.6611
X3	0.104957	0.227991	0.460357	0.6542
RESID(-1)	0.684805	0.243675	2.810322	0.0170
RESID(-2)	-0.623102	0.248920	-2.503218	0.0293

R-squared	0.476354	Mean dependent var	-3.81E-13
Adjusted R-squared	0.285937	S.D. dependent var	102.3916
S.E. of regression	86.52322	Akaike info criterion	12.00901
Sum squared resid	82348.94	Schwarz criterion	12.25044
Log likelihood	-91.07207	Hannan-Quinn criter.	12.02137
F-statistic	2.501640	Durbin-Watson stat	2.385156
Prob(F-statistic)	0.103136		

Figure 14. BG inspection

It can be seen from the above table that = 7.621665 > (2) = 5.99147, prob (TR) = 0.0221 is less than the given significance level = 0.05, there is autocorrelation, and the autocorrelation is adjusted now.

Generalized difference method to adjust autocorrelation

Enter the command LS Y C X3 X4 AR (1) using the Cochran okot iterative method

Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: Y
Method: ARMA Maximum Likelihood (BFGS)
Date: 12/13/20 Time: 21:56
Sample: 2003 2018
Included observations: 16
Convergence achieved after 4 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-22.10100	61.54559	-0.359100	0.7270
X3	0.592010	0.277090	2.136528	0.0584
X4	2.311729	0.147612	15.66085	0.0000
AR(1)	0.655663	0.319357	2.053074	0.0672
AR(2)	-0.589933	0.236208	-2.497513	0.0316
SIGMASQ	4995.102	2870.591	1.740095	0.1125

R-squared	0.999118	Mean dependent var	3464.412
Adjusted R-squared	0.998676	S.D. dependent var	2457.366
S.E. of regression	89.39890	Akaike info criterion	12.16921
Sum squared resid	79921.63	Schwarz criterion	12.45893
Log likelihood	-91.35366	Hannan-Quinn criter.	12.18404
F-statistic	2264.714	Durbin-Watson stat	2.216517
Prob(F-statistic)	0.000000		

Inverted AR Roots	.33-.69i	.33+.69i

Figure 15. Autocorrelation test

From the Figure, DW = 2.216517, the critical value DL = 0.982, Du = 1.539, and 4-1.539 > 2.216517 > 1.539 can be obtained from the above data, so there is no autocorrelation after correction.

Finally, the regression equation is

Y = -22.1009995149 + 0.592009875514*X3 + 2.31172895349*X4 +[AR (1)=0.655662836979, AR(2)=-0.589932912832,UNCOND]

(61.54559) (0.277090) (0.147612) (0.319357) (0.236208)

T=(-0.359100) (2.136528) (15.66085) (2.053074) (-2.497513)

R^2=0.999118 $\overline{R}^2 = 0.998676$ DW=2.216517 F=2264.714 prob(F)=0.00000

The estimation results of the model show that the GDP y mainly depends on the investment in real estate development X3 and the total retail sales X4. Under the condition that other factors remain unchanged, for every 100 million yuan increase in real estate development investment X3, the resident consumption level y will increase by 592010 million yuan; With other factors unchanged, when the total retail sales of social goods X4 increases by 100 million yuan, the consumption level of residents will increase by 231.172.9 million yuan.

8. Conclusions and Recommendations

1. Real estate plays an important role in promoting urban economic development

With the acceleration of China's urbanization process and the rapid economic development, real estate has developed rapidly. At present, it plays an important role in economic development, has become a pillar industry of the economy, and its contribution to GDP is becoming increasingly prominent. It can drive the development of multiple industrial chains, from upstream production to downstream residence, stimulate the development of multiple industries, increase the contribution of various industries to GDP, and thus play an important role in economic development. With the continuous development of Hefei, a large number of people flow in, which leads to the increase of house purchase demand. Sufficient labor force, employment and migrant population provide a broad consumer market for real estate in Hefei. At the same time, the development of urbanization is also that the population will be further concentrated. The radiation effect of mega cities on surrounding cities is becoming more and more obvious, and the degree of regional integration will be further improved, to drive the housing demand in the suburbs and surrounding areas, which will also stimulate the vitality of the city's real estate market.

2. Social consumption contributes to economic growth

As an integral part of GDP, the total retail sales of social consumer goods are the total amount of consumer goods directly sold by various industries of the national economy to urban and rural residents and social groups. It can reflect the social supply of various commodities from all walks of life and the total amount of consumer goods of residents; It is an important index to study the changes of domestic retail market and reflect the degree of economic prosperity. The troika driving economic growth are investment, export and consumption. The total retail sales of social consumer goods reflect the level of social consumption.

proposal

1. Strengthen the management of the real estate market and promote the steady development of the real estate market

As a pillar industry to promote economic growth, real estate has played an important role in economic growth, and its multiplier effect on economic growth is very prominent. Due to the huge radiation range of real estate, most industries are driven by it, which also leads to the contribution rate of real estate to economic growth of more than 10% in recent years. According to the estimates of relevant experts, for every 1 percentage point increase in investment growth in real estate, the growth rate of GDP will increase by 0.9 percentage points; In addition, according to incomplete statistics, the real estate industry has absorbed at least 30% of the floating population; Therefore, from the perspective of policy, it is suggested to focus on stability. Under the condition that the overall economic environment has not changed greatly, it is best to focus on strict real estate regulation policies and still play the role of long-term mechanism. The real estate industry is different from the stock market. The impact of house price fluctuations is immeasurable. Therefore, we must not let this industry affecting the social economy in an uncontrollable state, so it must be stable.

2. Appropriately control prices and stimulate consumption

As an important factor affecting consumption, prices reflect the purchasing power of residents, but too high prices will reduce the social purchasing power. Affected by the traditional consumption habits, China has become a large country of savings. Residents are used to depositing most of their personal surplus income in banks for security and appreciation. However, a sharp rise in prices will lead to a decline in the income of bank deposits. Once the price rise rate exceeds the interest rate of bank deposits and is exceeded by the price rise rate, there will be a negative interest rate, the money deposited in the bank will not increase, but depreciate, resulting in the shrinkage of residents' property; Then it affects residents' consumption confidence and consumption psychology. Families tighten their spending, calculate carefully, reduce their consumption tendency, and inhibit residents' purchase desire; Finally, the consumption level of society will be reduced and the total retail sales of social goods will be reduced. Therefore, the government's appropriate price control will increase residents' consumption psychology and purchasing power, thus increasing the total retail sales and promoting the development of GDP.

3. Continue to stabilize the development of industry

Industry is a very important material production department in the national economy. Without the existence and development of industry and the machinery and equipment provided by industry for other sectors, there will be no further development of other sectors of the national economy; Moreover, the degree of industrial modernization and its development scale ultimately determine the appearance of the whole national economy. Therefore, industry is the leading factor of the national economy. Stabilizing the development of industry will make the social economy grow continuously, to drive the development of other industries.

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