Consumer Price Index Analysis and Forecast Policy Recommendations of Jincheng City

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Abstract

Based on the relevant theories of Consumer Price Index (CPI) and the method of literature study and empirical analysis, this paper expounds the meaning, fluctuation characteristics, influencing factors and functions of Consumer Price Index (CPI). The ARMA model is used to predict and analyze the time series data of Jincheng from 1987 to 2018, and then the relevant policy suggestions are put forward. The research holds that the price of agricultural products and oil price are the main factors affecting the Consumer Price Index (CPI) of Shanxi cities, and the government departments should strengthen macro-control, implement measures such as safeguarding farmers ' basic income, vigorously promote energy price reform, make the Jincheng economy run smoothly, and improve the overall living standard of Jincheng city residents.

Keywords

CPI; Jincheng City; ARMA Model.

1. Introduction

As a city with great potential for development, it is necessary to keep the general price level fluctuating in a small range while ensuring the steady improvement of the overall quality of life of the citizens in Jincheng. Meanwhile, it is necessary to develop the economic construction of Jincheng vigorously. Consumer Price Index (CPI) is an important indicator to measure the overall development trend of the macro economy, which can reflect the changes of the general Price level. If the fluctuation range of CPI is too large, inflation is bound to appear, which will cause the overall economic development speed to be too fast and create a false prosperity scene, which is not conducive to economic development. Therefore, the forecast of CPI is very important for Jincheng to formulate macro-economic policy.

Chen Wanying (2015), on the basis of explaining the fluctuation characteristics and driving factors of the consumer price index (CPI), used the vector autoregressive model and ARIMA model to make short-term forecast analysis on the monthly CPI data from 2001 to 2013 and the annual CPI data from 1978 to 2013 in Beijing, and put forward relevant policy suggestions according to the results. Xiqin (2017) analyzed the monthly CPI data of Anhui Province from January 2000 to October 2016 in time series, and by comparing the model's good fit, AIC value and SC value, finally selected the SARIMA model that is most suitable for Anhui Province and made short-term predictions, which has certain economic and practical significance for the economic development of Anhui Province. However, both of them have not tested the model in many aspects, and there are still some shortcomings. Based on the relevant theories of CPI, this paper expounds the meaning, fluctuation characteristics, influencing factors and functions of CPI, uses ARMA model to forecast the time series data of Jincheng city from 1987 to 2018 in a short term, and tests the model in many aspects, which has certain economic and practical significance.

2. Jincheng CPI fluctuation characteristics and influencing factors

2.1. Jincheng CPI fluctuation characteristics

This paper analyzes the CPI data of Jincheng from 1987 to 2018 (last year =100) and takes two troughs as a cycle. It can be seen from Figure 1 that there are currently six complete cycles, and the seventh cycle has not yet ended. Generally speaking, before 1997, the CPI in Jincheng fluctuated greatly, but after 1997, the CPI in Jincheng fluctuated within 10 percent.
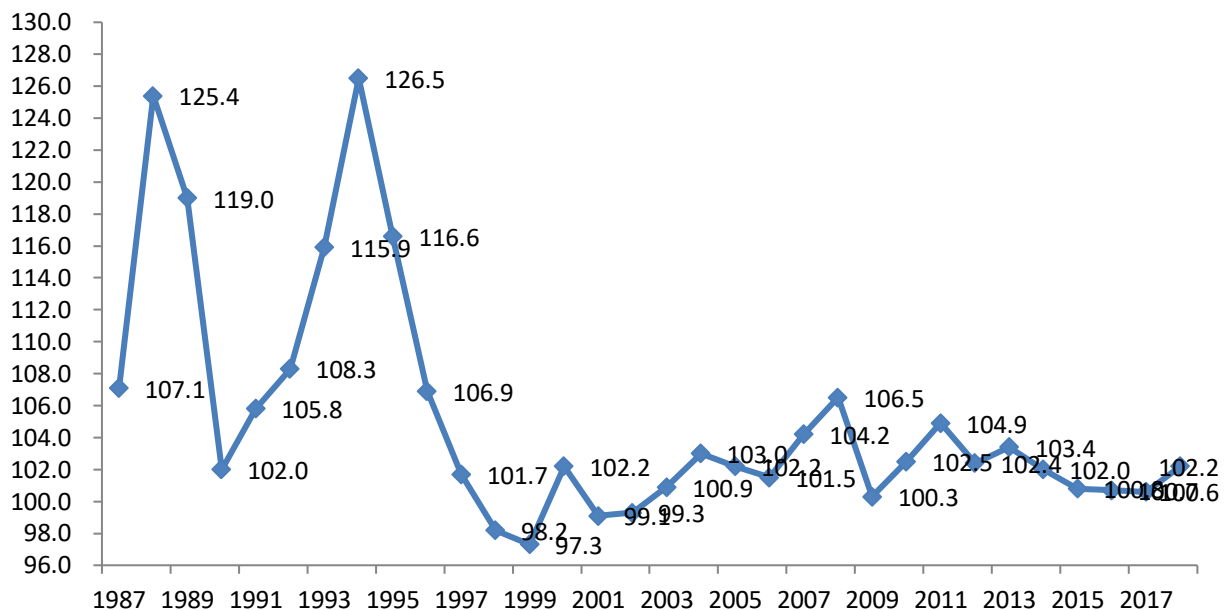

Figure 1. CPI trend chart of Jincheng from 1987 to 2018

2.1.1. First cycle (1987-1990)

The cycle lasted four years, with a peak of 125.4, a trough of 102.0 and an amplitude of 23.2. The largest fluctuations of more than 20 percent occurred in 1987-1988. Among the eight categories, entertainment, education, cultural goods and services rose 38 percent, food 33.5 percent, medical care and personal goods 12.3 percent, home equipment and repair services 16 percent, and clothing 15 percent. In 1987, it established the basic line of "taking economic construction as the center, adhering to the Four Cardinal Principles, and adhering to the reform and opening up". This major measure promoted the economic development of Jincheng and made the CPI data of Jincheng in 1989 reach 119.0. In this regard, the government of Jincheng City also followed the national policy and adopted the corresponding macro-economic regulation and control policy, which made the CPI of Jincheng City drop.

2.1.2. Second cycle (1990-1999)

Among these cycles, this one is the longest, with a duration of nearly 9 years, with a peak at 126.5, a trough at 97.3, and an amplitude of 29.2. In 1993-1994, the CPI fluctuated greatly, with a year-on-year increase of 49.2% for food, 12% for clothing, and 19.4% for household equipment, supplies, and maintenance services. This is the biggest fluctuation in these several cycles. The period of decline is longer than the period of rise. There are several peaks of price fluctuation, and it reached the highest in 1994. Since then, the government of Jincheng City realized the emergence of inflation and actively implemented the tightening monetary policy implemented by the central government. Moreover, because of the emergence of the Asian financial crisis in 1998, the CPI of Jincheng dropped, but the fluctuation was always controlled within 10 percentage points, which was relatively stable.

2.1.3. Third Cycle (1999-2001)

The cycle lasts two years, which is relatively short. The peak is located at 102.2, the trough is located at 97.3, and the amplitude is 4.9. The fluctuation range of the peak and trough is small, and the amplitude is small. Therefore, the long-term trend of rising consumer index is suppressed, and the price can be maintained at a stable level in the long run.

2.1.4. Fourth Cycle (2001-2006)

The duration of this cycle is 5 years, and the CPI fluctuation is not very large, with a peak of 103 and a trough of 99.1, with an amplitude of 3.9.

2.1.5. Fifth Cycle (2006-2009)

The duration of this cycle is 3 years, and the cycle is short, with a peak at 106.5, a trough at 100.3, and an amplitude of 6.2. This period was mainly affected by economic overheating, most obviously in 2007, when the general price level was affected by the surge in global oil prices and the increase in commodity prices. In addition, due to the impact of the outbreak of the global financial crisis, the accelerated economic growth, the sharp rise in the housing price, the high price of the stock market and other factors further accelerated the emergence of the price bubble. During this period, the CPI fluctuations were mainly due to the overall rise in prices. At this time, China's economy suffered a very serious impact, the export sharply reduced, a large number of enterprises engaged in import and export trade are facing a very severe challenge, the problem of a sharp rise in the unemployment rate is more prominent.

2.1.6. The Sixth Cycle (2009-2012)

The cycle lasted for 3 years, and the cycle was short, with the peak at 104.9, the trough at 100.3 and the amplitude at 4.6. The CPI showed a trend of small fluctuations. During the week, CPI volatility increased as agricultural prices rose. Because of poor market regulation, many agricultural products were deliberately hyped and their prices soared, which greatly contributed to the CPI increase in Jincheng. For example, "bean you play", "to money onion", "garlic you ruthless" and other phenomena, very vivid description of the price of these agricultural products.

2.1.7. Seventh Cycle (2012-2018)

The cycle lasted for 6 years, and the cycle was long, with a peak at 103.4, a trough at 100.6, and an amplitude of 2.8. During this period, the overall fluctuation range of CPI was not large, and prices remained at a stable level for a long time.

2.2. Factors affecting CPI

China's consumer price index (CPI) is mainly composed of eight classes of goods and services: live food categories, transport and communications categories, categories, household appliances and maintenance service categories, entertainment, education, cultural goods and services categories, tobacco and alcohol products categories, health care and personal health care products, clothing categories. The theoretical viewpoints of influencing factors of CPI rise mainly include: cost - driven inflation theory, demand - driven inflation theory, structural inflation theory and mixed inflation theory. The direct cause of CPI fluctuations is the fluctuation of consumer expenditures, mainly due to the fluctuation of commodity prices. However, in real life, the fluctuation of commodity prices will be affected by the price of agricultural products, the price of oil, the ex-factory price of products and the supply and demand relationship of all kinds of commodities.

Agriculture is the primary industry, its development for the development of all walks of life in China has provided a very rich primary products, and agricultural products are produced in the agricultural life of the basic goods. Therefore, the fluctuation of agricultural product price has a very important impact on the economic development and the fluctuation of the consumer

price index. Agricultural products are the most important necessities in People's Daily life. Therefore, the increase in the price of agricultural products will affect CPI in all aspects of life. First, the rise in agricultural prices will directly affect the food prices in the CPI component. Secondly, agricultural products are also involved in raw materials in all walks of life. Therefore, the price rise of agricultural products will affect other industries through a variety of media, and then lead to the price rise of products of other industries. In the food consumer price, the price of agricultural products will directly affect the food price, and the trend is roughly the same. For example, a few years ago, the phenomenon of "playing with beans", the rise in the price of beans directly led to the rise in the price of soy products using beans as raw materials. People's demand for food is rigid, and the rise of agricultural prices will increase people's living costs, which will lead to the rise of wages, forming the bad economic phenomenon of "wage-price spiral". If the price of cotton rises, it will cause the price of clothing products to rise, and the price of wood will lead to the price of paper-making, flooring and other industrial products. As the saying goes, the fluctuation of agricultural prices will have a considerable impact on the industry related to agricultural products, and will bring great pressure to the price level.

Oil is the basic raw material for modern industry and an important energy source for modern industry, and the oil industry is also a basic industry, providing basic supporting services for agriculture and other industries as well as People's Daily life, so that people can enjoy a high-quality life, plays a pivotal role in the whole national economy. The rise in oil prices will affect CPI from all aspects of life, with "housing" and "transportation and communication" being the two major categories affected. In the residential category, the fluctuation of oil price will affect the price of other living energy, such as natural gas and liquefied natural gas, which will increase the price of water, electricity and other fuels. In the transportation and communications categories, higher oil prices will affect the motor fuel gasoline and diesel prices. The rise of oil price will also affect the production cost of enterprises, leading to the increase of the ex-factory price of products, so that the CPI will also rise. Moreover, in a short period of time, there was a very close relationship between oil price fluctuations and CPI, and the NDRC mitigated the impact by intervening in oil prices in the domestic market and market competition within the oil industry. But in the long term the transmission mechanism between oil price fluctuations and the CPI is not direct transmission, but is given priority to with an indirect, so it is very difficult caused by the National Development and Reform Commission intervention in the domestic market price of oil, and oil industry internal cannot resolve the risk, so the trend of long-term oil prices will push the CPI rise.

3. Analyze and forecast CPI in Jincheng City

3.1. Data collection and collation

This paper analyzes the CPI data of Jincheng from 1987 to 2018 (last year =100). Since the year-on-year data does not contain seasonal factors, there is no need to make seasonal adjustments to the time series data.

Table 1. CPI data of Jincheng from 1987 to 2018

Year	Jincheng CPI
1987	107.1
1988	125.4
1989	119.0
1990	102.0
1991	105.8
1992	108.3
1993	115.9
1994	126.5

1995	116.6
1996	106.9
1997	101.7
1998	98.2
1999	97.3
2000	102.2
2001	99.1
2002	99.3
2003	100.9
2004	103.0
2005	102.2
2006	101.5
2007	104.2
2008	106.5
2009	100.3
2010	102.5
2011	104.9
2012	102.4
2013	103.4
2014	102.0
2015	100.8
2016	100.7
2017	100.6
2018	102.2

3.2. Stationary test of serial CPI

Here, the "ADF" test method is used to conduct unit root test on the time series data of Jincheng from 1987 to 2018 to judge the stability of the time series data. Use "Eviews7.2" to get the following results.

Augmented Dickey-Fuller Unit Root Test on CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.971726	0.0048
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

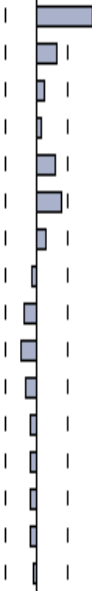Figure 2. Stationary test of CPI data in Jincheng

According to the information in Figure 2, the null hypothesis is that CPI has a unit root, and the T statistic is -3.971726, and the corresponding P value is 0.0048. When the significance level $\alpha=0.05$, the null hypothesis can be rejected, that is, the time series CPI has no unit root and is a stationary series.

3.3. Model recognition

Although the serial CPI has passed the stationarity test, the autocorrelation function and partial autocorrelation function of the samples still need to be calculated to select the appropriate model and determine the parameters for estimation.

As can be seen from Table 2, the histograms of both autocorrelation function and partial autocorrelation function decrease with the increase of lag order. The histogram of the autocorrelation function exceeds the confidence interval at order 1 and order 5, while the histogram of the partial autocorrelation function exceeds the confidence interval only at order 1. Therefore, a more appropriate ARMA (p,q) model was selected for prediction analysis.

Table 2. Correlogram of CPI

Date: 09/26/20 Time: 20:52							
Sample: 1987 2018							
Observations: 32							
Autocorrelation	Partial autocorrelation			AC	PAC	Q-statistic	Prob
		1	0.642	0.642	14.454	0.000
		2	0.229	-0.311	16.353	0.000
		3	0.095	0.192	16.692	0.001
		4	0.053	-0.093	16.802	0.002
		5	0.206	0.400	18.517	0.002
		6	0.291	-0.165	22.067	0.001
		7	0.108	-0.103	22.577	0.002
		8	-0.049	-0.034	22.687	0.004
		9	-0.143	-0.118	23.648	0.005
		10	-0.173	-0.007	25.126	0.005
		11	-0.119	-0.147	25.860	0.007
		12	-0.080	0.075	26.212	0.010
		13	-0.080	-0.028	26.581	0.014
		14	-0.067	0.077	26.853	0.020
		15	-0.069	-0.026	27.155	0.027
		16	-0.044	0.088	27.285	0.038

3.4. Establish ARMA model

The parameters of ARMA (p,q) model cannot be accurately judged from Table 2. The optimal model can be obtained by comparing the AIC criteria, SC criteria and goodness of fit of the model.

Table 3. Regression results of ARMA model 1

Variable	Coefficient	Std.err	t-Sstatistic	Prob.
C	102.0274	4.977704	20.49689	0.0000
AR(1)	0.999950	0.299754	3.335907	0.0033
AR(2)	-0.475999	0.320050	-1.487262	0.1525
AR(3)	0.219290	0.229568	0.955233	0.3509
AR(4)	-0.299982	0.188909	-1.587966	0.1280
AR(5)	0.362621	0.134450	2.697065	0.0139
MA(1)	0.119042	0.368617	0.322943	0.7501
R^2	0.737922	AIC		5.680375
$\overline{R^2}$	0.659299	SC		6.016333
Inverted AR root	.89	.50-.70i	.50+.70i	-.45-.59i
Inverted MA root	.12			

According to the information in Table 3, AR (2), AR (3) and AR (4) did not pass the t test, so they were removed to get the results in the table below.

Table 4. Regression results of ARMA model 2 variables

Variable	Coefficient	Std.err	t-Sstatistic	Prob.
C	101.8926	6.284614	16.21303	0.0000
AR(1)	0.604927	0.189826	3.186742	0.0041
AR(5)	0.196664	0.125885	1.562248	0.1319
MA(1)	0.455072	0.223492	2.036187	0.0534
R^2	0.672324	AIC		5.681537
$\overline{R^2}$	0.629583	SC		5.873513
AInverted AR rootR	.90	.34+.64i	.34-.64i	-.49-.41i
	-.49+.41i			
Inverted MA root	-.46			

As can be seen from the information in Table 4, AR (5) does not pass the t test, so it is removed and the ARMA (1,1) model is established to get the results in the following table.

Table 5. Regression results of ARMA(1,1) model

Variable	Coefficient	Std.err	t-Sstatistic	Prob.
C	105.0170	2.353135	44.62857	0.0000
AR(1)	0.344840	0.193823	1.779146	0.0861
MA(1)	0.757758	0.129988	5.829441	0.0000
R^2	0.603139	AIC		6.109033
$\overline{R^2}$	0.574792	SC		6.247806
Inverted MA root	-.76			

The information table 5 shows that the AR (1), MA (1) are by t test, but the ARMA (1, 1) model of goodness-of-fit (0.6031) and no ARMA (5, 1) goodness-of-fit (0.6723) is high, the ARMA (1, 1) model of the AIC value (6.1090) and SC (6.2478) is better than ARMA (5, 1) model of the AIC value (5.6815) and SC (5.8735), so that ARMA (1, 1) model is not the most suitable model. Therefore, the constant terms are removed and the ARMA (5,1) model is rebuilt. The results are as follows.

Table 6. Regression results of ARMA(5,1) model

Variable	Coefficient	Std.err	t-Sstatistic	Prob.
AR(1)	0.731603	0.108473	6.744576	0.0000
AR(5)	0.262461	0.106360	2.467655	0.0211
MA(1)	0.392720	0.213424	1.840098	0.0782
R^2	0.660804	AIC		5.642014
$\overline{R^2}$	0.632538	SC		5.785996
Inverted AR root	1.00	.38+.67i	.38-.67i	-.51-.43i
	-.51+.43i			
Inverted MA root	-.39			

As can be seen from Table 6, AR (1), AR (5) and Ma (1) all pass the t-test when the significance level α=0.1, and the values of AC and SIC are small and the goodness of fit is high, so this model is selected.

3.5. Test of the model

To test the stability of the residual sequence of the ARMA(5,1) model, the "ADF" test is used here, and the results are shown in the figure below.
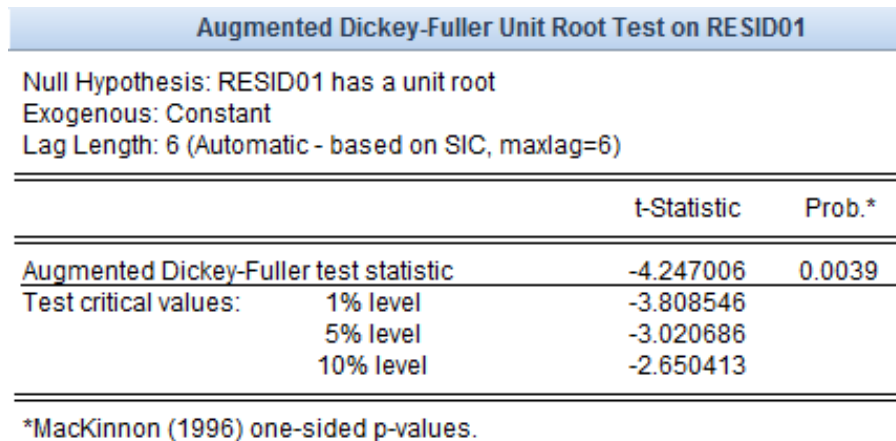
Augmented Dickey-Fuller Unit Root Test on RESID01

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=6)

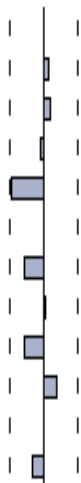|		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.247006	0.0039
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

Figure 3. Stationary test of model residual sequence

According to the information in Fig. 3, the t-statistic is -4.247006 and the corresponding p value is 0.0039. When the significance level $\alpha=0.05$, the null hypothesis can be rejected, that is, the residual has no unit root and is a stationary series, indicating that the establishment of the model is reasonable.

Table7. Correlogram of Resid

Date: 09/26/20 Time: 20:52						
Sample: 1987 2018						
Observations: 32						
Autocorrelation	Partial autocorrelation		AC	PAC	Q-statistic	Prob
		1	-0.006	-0.006	0.0011	0.973
		2	0.064	0.064	0.1287	0.938
		3	0.082	0.083	0.3470	0.951
		4	-0.042	-0.045	0.4077	0.982
		5	-0.361	-0.377	5.0467	0.410
		6	-0.007	-0.023	5.0484	0.538
		7	-0.211	-0.171	6.7996	0.450
		8	0.016	0.091	6.8102	0.557
		9	-0.229	-0.284	9.0933	0.429
		10	0.147	0.059	10.094	0.432
		11	-0.007	-0.048	10.096	0.522
		12	-0.121	-0.263	10.863	0.541

It can be seen from Table 7 that the histogram of the autocorrelation function basically falls within the confidence interval. Therefore, it is considered that the residual sequence of ARMA(5,1) model does not have autocorrelation and is purely random sequence, which meets the conditional assumption of white noise sequence. Therefore, this model is accepted.

3.6. Model prediction

The established ARMA (5,1) model is used to forecast and estimate the CPI of Jincheng City from 2019 to 2021, and the results are shown in Table 8.

Table 8. CPI forecast value from 2019 to 2021

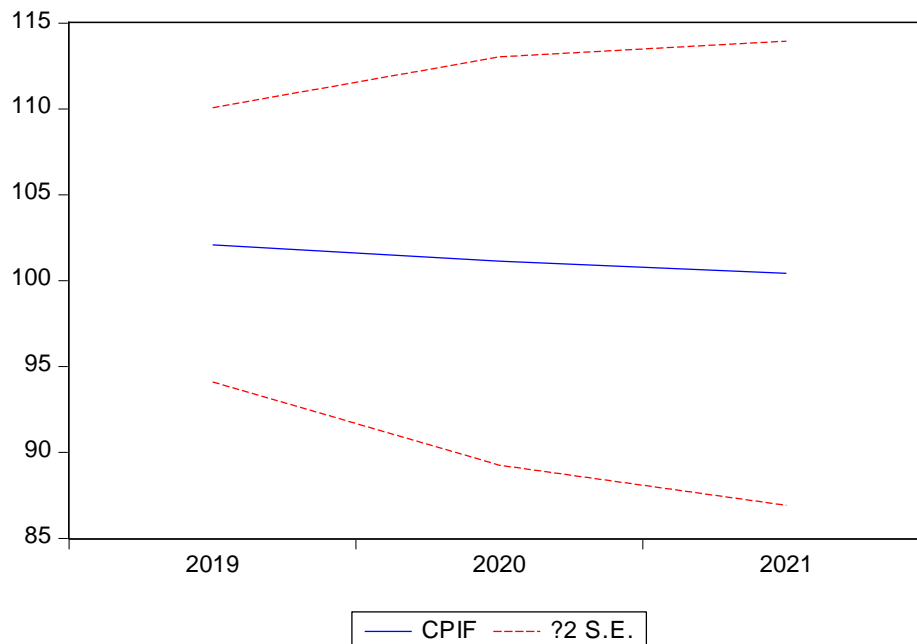| Year	2019	2020	2021
CPI forecast value	102.1	101.1	100.4

Figure 4. CPI forecast chart of Jincheng from 2019 to 2021

4. Countermeasures and Suggestions

According to the analysis and forecast, the CPI data of Jincheng from 2019 to 2021 basically tends to be stable, but it drops slightly, and deflation may appear in the future. Therefore, the Jincheng city government should focus on price control in the future to adhere to the overall stability of CPI as the goal, to avoid the phenomenon of price surge or sharp decline. In addition, it is necessary to strengthen the regulation of relevant standards, and the government departments of Jincheng City should also actively take certain measures to continue to maintain the stability of CPI.

4.1. Strengthening management of inflation expectations

From the point of view of the transmission mechanism of product price rise, the Jincheng government should strengthen the management of inflation expectation to prevent the spiraling trend of product price rise. When a kind of special product price fluctuations, such as agricultural or oil and so on, the relevant departments shall timely make a reasonable explanation, when consumers and producers in the heart to the trend of rising, the overall price level and will further lead to the rise in prices, Jincheng related departments should work to reduce people's expectations of inflation.

4.2. Strengthening key government oversight and regulation

From the point of view of industry associations, agriculture and energy industry is very big, the correlation of the price of the energy industry standard will affect the price of agricultural products closely, so governments should increase the intensity of macroeconomic regulation and control of Jincheng, the government should put these energy industry as the key control object, pay close attention to industry trends, to monitor its price and the related policies and measures for implementation in time, prevent the phenomenon of price volatility.

4.3. Ensuring farmers' basic income

From the point of view of a large outflow of rural population, in order to make farmers' enthusiasm for production higher, we must ensure that farmers are satisfied with the most basic money income, to avoid the lack of rural labor, which further leads to the decline in the

quality of agricultural products and agricultural products are not enough. In order to better guarantee the supply and quality of agricultural products, the government of Jincheng City should first improve the enthusiasm of farmers in production, formulate policies and measures in favor of farmers, and at the same time increase the proportion of agriculture in the financial expenditure. From the perspective of agricultural products as basic products, the government departments of Jincheng City should improve the market circulation system of agricultural products, avoid farmers in the position of information disadvantage, and reduce the circulation cost loss of intermediate links as much as possible, so as to reduce the impact of agricultural product price fluctuations on CPI.

4.4. Vigorously advancing energy system reform

From the transmission mechanism of oil price, we should perfect the energy system and push forward the reform of energy price. Due to many historical reasons, there are many unreasonable places in the formation of oil prices. The government departments should strictly control the upstream and downstream of the oil industry chain, and formulate relevant policies and measures in time to avoid the phenomenon of surging oil prices. On the one hand, to give full play to the resource advantage of Jincheng, improve the purity of coal washing, vigorously promote the use of new technologies on energy, improve the use efficiency of coal, thereby reducing the foreign trade coefficient of oil. On the other hand, we should actively promote the new energy policy, improve the use of new energy, and finally build a deeper balanced and coordinated energy consumption structure.

5. Conclusion

In summary, the CPI data of Jincheng from 1987 to 2018 is a group of stable time series data. By using Eviews7.2 software, this paper establishes ARMA (5,1) model to predict the CPI trend and value of Jincheng City in the next three years, and puts forward relevant policy suggestions. The accurate prediction of CPI in Jincheng City is conducive to the government of Jincheng City to grasp the future economic development, formulate policies that are more in line with the economic development of Jincheng City, carry out macro-control on the economy of Jincheng City better, and meet the citizens' yearning for a better life, which has very prominent economic and practical significance.

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