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INFLATION AND INFLATION DETERMINANTS IN CHINA

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I declare I have written the master's thesis independently. All works and major viewpoints of the other authors, data from other sources of literature and elsewhere used for writing this paper have been referenced.

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ABSTRACT

Inflation is a complicated economic phenomenon. It will disturb economic order and price system. Therefore, study inflation from different aspects can help to understand inflation forming, impact mechanism and in addition to find the way of manage inflation.

This thesis start with conclude different inflation theories, introduced China`s inflation background. Then use econometric method to have empirical test on different variables that might have relationship with inflation which include Exchange Rate, Money Supply (M2) and Shanghai Interbank Offered Rate. By set up VAR model, Unit Root Test, Cointegration Test, Granger-Causality Test, Variance Decomposition and Impulse Response analyze data.

Based on the theories of inflation and econometric method, this thesis will present some recommendations on control inflation in China.

Key words: Inflation, VAR model, Empirical Study, Exchange Rate, Money Supply

INTRODUCTION

Inflation is a worldwide problem, many countries are working on economic growth and maintain price stable as a goal in long term macro-control. This long term goal which is also the same in China. Since the reform and opening up policy, China`s economy is in rapid growth. There were several times high inflation happened in history. Before year 2000, there were two times mild inflation (1980, 1984-1985) and two times` high inflation rate (1984-1988, 1993-1996). After year 2000, there were few times small fluctuation, such as in 2004, inflation rate reached to 3.9% and in 2008 is 5.9%. Currently, Chinese economic still has a lot problems. There is structural problem of economic system, domestic and external demand, investment and consumption are in disequilibrium, the industrial structure of investment allocation is irrational; the resource and environmental cost for economic growth is high; the basis for steady agriculture development and continuous revenue is not stable; the increase of agriculture products become an impact factor of structural inflation; the low income group take a high percent, the wealth gap is still big. China also need to face complex international economic situation; oil, mineral bulk commodities price fluctuations; economic and price fluctuation from different countries. Therefore control inflation rate is a very important macroeconomic policy. High inflation rate will have influence to the normal economy system, this thesis focus on find out which factors can lead to inflation and its transmission mechanism, so that inflation can be better Understand, predict and managed.

The objective of this thesis is examining the main determinants of Chinese inflation. Even through there are many scholars are working on inflation determinants analysis, but there always different results about its determinants. This thesis would like to do an empirical study on Chinese inflation rate. The factors analyzed by econometric method are Exchange Rate

which take from CNY/USD, Money Supply (M2) and Interest Rate take the Shanghai Interbank Offered Rate.

There are three chapters of this paper, first chapter give an introduction to theories related to inflation which includes definition, talks from two different schools, Price School and Monetarist School; inflation measurement index, gives a brief overview about Consumption Price Index, Producer Price Index and GDP Deflator; and analysis from four aspects of inflation causes which are Keynesianism, Monetarism, Supply-Side Economics and Rational Expectation School; the effects of inflation to economy; also introduced the inflation background of China in different periods, an important separate line is the reform and opening up policy which indicate China transferred from planned economy to market economy.

Chapter two discussed some determinants of inflation such as stock price, exchange rate, money supply, real estate, output gap and external shock. Introduced scholars who had worked on those determinants and inflation and their research results. And also explained their transmission mechanism respectively.

Chapter three is empirical test by econometric method. The test is based on the data from October 2006 to December 2014 monthly data, the. The factors chosen are exchange rate, money supply and interest rate. Under VAR model through unit root test, cointegration test, Granger-Causality test, Variance Decomposition and impulse response analyze the data. My test find out exchange rate has effects to inflation. Inflation can effect interest rate but there is no correlation between inflation and money supply.

1. BACKGROUD

Inflation is a common economic phenomenon, it is an important economic research topic. Since currency appears, inflation is following, the direct perform of inflation is currency devaluation. China`s earliest paper currency is in Song Dynasty, but the government cannot control the amount of money supply, eventually currency became valueless and drop out circulation. There also Yuan Dynasty and Ming Dynasty tried issue paper currency, but both of them due to improperly control on currency lead to failure. At the early stage of reform and opening up, inflation does not performed by price but through tickets and long queue up. Then after the reform and opening-up policy, market became more important in resource allocation, price also become important as a signal of resource allocation. Under rapid development of economy, due to Chinese economic structure is imbalanced and gradually transfer from planned economy to market economy, the inflation pressure is high. Only during 1998-1999 the inflation rate is negative, other periods are in inflation situation, there are many years inflation rate are higher than 10%. High inflation rate had influence the normal economic order. Only by understand in certain background, what are the determinants of inflation and its transmission mechanism, it is possible to better manage inflation.

1.1 Definition

Due to the different ways of analyze inflation, the definitions are different. In general, there are two ways to define inflation. One is “Price School” which emphasize the result, define inflation as the process of continuously increase of general price; another is “Monetarist School”

that emphasize the reason of inflation, believes inflation happens because there are too much money supply than demand.

The representative of "Price School" are the economists of Post-Keynesianism. Such as Paul A. Samuelson, define inflation as continuous increase of general prices (Paul A. Samuelson, 2006). N. Gregory Mankiw (1999) define inflation in his book as "Inflation is an increase in the overall level of prices in the economy".

From "Monetarist School", the famous Milton Friedman said inflation is a monetary phenomenon that causes general commodity price continuous increase in long term. His definition has two points: 1) inflation is monetary phenomenon not economic phenomenon, inflation or deflation always have relationship with the amount of money supply; 2) the increase of price is in general level and long term. So if talk about inflation there must be analysis for money supply; if there is no problem about money supply, general price increase in long term would not happen. He believes there are three reasons of excessive money supply: 1) government expenditure increase. If government income is stable and there are rise expenses, government need to get more money, inflation would happen; 2) government carry out full employment policy; 3) central bank issued wrong monetary policy.

The reason of inflation is the increasing rate of money supply over the increase of social output (Friedman, 1956). But with the innovation of finance, it become difficult to measure the amount of money supply, so in practical this application is lacking of operability. There is economist combined the viewpoints of two schools. Michael Parkin define inflation in his book as the process of price increasing and currency devaluation.

In conclusion, inflation refers to money supply over money demand, purchasing power over commodity supply, thus result in currency devaluation and in a period the general price level continuous increase. There are three point in the concept: first, inflation refers to the increase of general price level not only one commodity. That means if one commodity price decrease but the general price level is increasing, it is also inflation. Second, inflation reflects commodity and labor price increase, assets price increase is not inflation even assets price

increase can effect inflation. Thirdly, inflation is general price continuous rise, not seasonal or occasionally.

1.2. Measurement Index

Inflation rate can be measured by several kinds of indexes. Different countries use different index according to their own situation. Commonly used indexes are as following (Hong Zhang, 2007):

1.2.1. Consumption Price Index (CPI)

CPI is the most commonly used index to measure inflation, it can better reflect the commodities prices change in normal life. It also can be used to determine the basis of salary and low income living allowance. CPI is calculated by several commodities price indexes, each kind of commodity weight set depend on its degree of importance in normal life. Due to the different habits in different countries, its calculation formula is different. Such as in China, pork is important consumer commodity, so it takes a higher percentage in the CPI calculation, however in American or European countries, beef and chicken will take higher percentage in consumer commodities. Thus CPI is the relative number which measures representative commodity and services price change level along with time in normal life. CPI is not only an economic index but also important for government policymakers. It is an indicator when enterprises make economic decisions; it is a basis when economic authorities make macro-control. For example, if CPI increases too fast, real interest rate will decline, thus people would like to consume more, enterprises would like to take a loan. Therefore, the increase of general price will lead to devaluation of currency, and the purchasing power of money which paid for loan in the future could not worth than current period. These factors will promote currency circulation and finally inflation will self-reinforcement. While the authorities find CPI is increasing, in order to make sure price stable, deflationary fiscal policy and monetary policy

will be taken. Adversely, if CPI is lower than expectation, government could issue expansionary fiscal and economic policy to promote economy growth. But one point to pay attention is CPI only reflect the end retail commodities and services price change level, not include coal, petroleum and steel such kind of bulk stock.

1.2.2. Producer Price Index (PPI)

PPI is measuring of average price changes from domestic producers of their output, such as purchase of raw materials and labors. PPI include all the products and services except the end commodity. In America, it includes about 3,000 goods, and in China there are more than 4,000, which including: fuel, energy, chemical materials, construction materials, agricultural products and so on. In general PPI is a leading indicator of CPI, while PPI is rising then the cost of goods would transfer to consumers. Thus the change of PPI can be helpful when predict CPI change. However, not all the products covered in PPI will transfer the cost of goods to consumer, only like electricity, natural gas such kind of in monopoly products would transfer cost, but competitive industry such as Auto companies are not easy to transfer their cost. The short term PPI change can indict the level of economic development. Because in short term there is no technology innovation or operation model change, so while there is no change from supply terminal, the change of PPI would come from demand side. While PPI is increasing that means economy is also increasing, if it is declining that means the economy is also goes bad, but if PPI increase too fast that means economy is overheating.

1.2.3. GDP deflator

GDP deflator measures the level of prices in domestic market which are all new, final goods and services in economy. In most systems the GDP deflator measures the ratio of nominal GDP to real GDP. The formula is:

$$\text{GDP deflator} = \text{Nominal GDP}/\text{Real GDP} \times 100$$

The basis to calculate GDP deflator has wider range than CPI and PPI, so it is more difficult to measure inflation. Also it need lots of data to calculate and the process is tedious so that this index is not often used, it is mainly used for long term inflation measurement.

1.2.4. Retail Price Index

RPI reflect the urban and rural retail price change trend and level in a certain period. The change of retail price has direct influence to urban and rural residence expenditure, state revenue, purchasing power and market supply and demand equilibrium, and the percentage relationship of consumption and accumulation. But RPI does not include service industry, and the investment products which take higher percentage than consumer goods in all commodity transaction cost. So RPI cannot give an accurate overall price level estimation.

Before 2000, not like most western countries that use CPI as the main index for monetary policy, China use RPI as a monetary policy guide. However, there are unexpected results arise due to use of RPI as main index. First, at that time government has strong control power on consumer goods , the listed prices used to calculate retail price is administratively determined, and market price is only partially influenced by monetary policy that mislead policy maker to make inappropriate decisions (Li Yunqi, 1989). As Li (1989) indicated, when policy makers “used the increase in retail prices to evaluate the effectiveness of tight monetary policy in 1986, they incorrectly concluded that the policy had not worked, encouraging them to give it up”. Secondly, the RPI does not include the service sector and investment sector which played more and more important roles in Chinese economy market, so it cannot fully reflect the real price fluctuation. Thirdly, as CPI become the primary index for many countries to use, so it is not convenient to compare internationally. And also the national bureau of statistics had more experiences in collecting data, find out CPI is more suitable for China to guide monetary policy, thus since 2001 CPI became the most widely used index.

Due to CPI become an important index, its measure method had been significantly improved. After 1978, there are three times important reform. In 1983, National Bureau of

Statistics set up Urban Social Economic Investigation Team take charge of price index. Their job is to select new data collection methods, decide the basket items and weights, also set up survey frequency. The changes are as following:

1) Investigators collect data directly from market instead of indirectly

2) Establish the catalogue

3) Weights of CPI are based on urban household expenditure database

4) Use monthly CPI instead of quarterly CPI

In 1994, separate CPI and PPI into two catalogues, calculate annual price by average monthly prices, agriculture production price index is extracted from RPI. Then another important reform is in January 2001, the National Bureau of Statistics reformed CPI data collection and calculation method. Especially the CPI calculation method has improved a lot, the international Laspeyres index was used instead of weighted average, which made CPI can truly reflect overall price fluctuation in different periods, and explain price movement trends accurately. Another improvement is the base year. Start to use a fixed base year and change it every five or ten years, the latest base year should be 2010. Also the basket items weight will be adjusted every year based on annual household consumption expenditure database (Yi Xu, 2006).

Table 1: CPI measures' Comparison

	Before 2001	After 2001
Calculation formula	Weighted average	Laspeyres index
Base year	Flexible based on report	Fixed. 2000 is the first base year
Month-on-month price index calculation	Current month price/last month price	Current month base index/last month base index
Monthly year-on-year price index calculation	Current month price/ price of the same month in last year	Current month base index/ base index of the same month in last year
Annual price index calculation	Average of monthly price indexes	Average of current year month base indexes/ Average of last year month base indexes
Quantity of consumption and services' catalogues	325	550

Source: (Yujie Xun 2011, 5)

Currently, Chinese CPI include eight categories: Food, Tobacco & Liquor and Articles, Clothing, Household Facilities & Articles and Services, Transportation & Communication, Health Care and Personal Articles, Recreation & Education and Culture Articles, Residence. And the weights are as following:

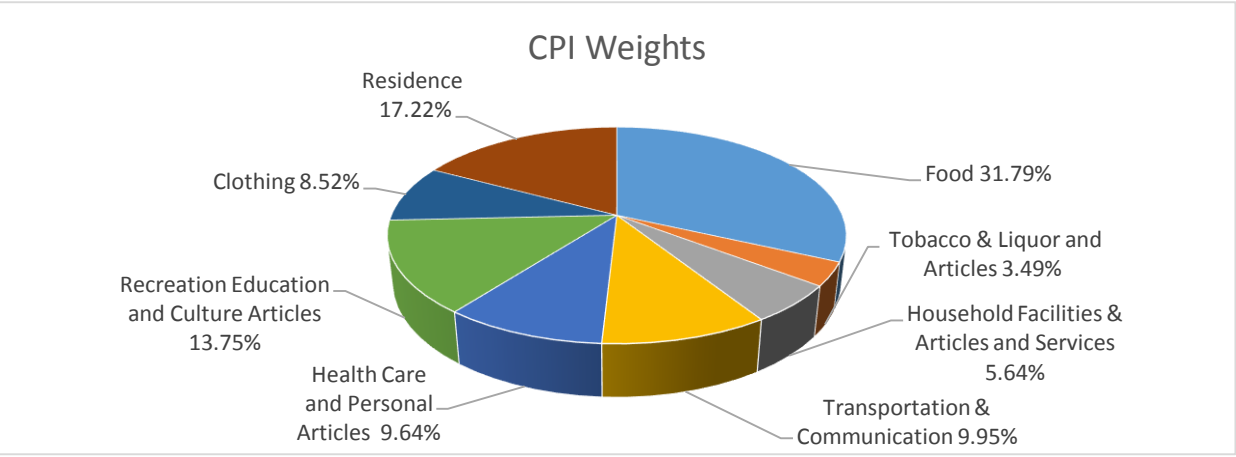

Figure 1. China`s CPI Weights

Source: Author`s own illustration based on China Securities Journal

In today`s China, in order to get accurate number of CPI, the process of collect CPI information is as following: first classify commodity and service level according to urban and rural household consumption expenditure, there are totally eight categories which include 262 basic class, covered almost all the consumptions. Then choose 500 cities as collection point which include 63 thousand supermarket, exclusive shop, open market, shopping center such kind of consumption units. The collection method is use specific people at fixed time to fixed point. The collection frequency is depends on commodities, for those closely related to common life such as meat, vegetables will take once every five days, for closes, transport and communication, durable consumer items collect two or three times per month; for water, electricity government pricing programs collect one time every month. After collected the data, calculate single commodity or service price index, then according to the commodity or service weight calculate category index and CPI.

1.3 Causes of Inflation

Different schools have different thoughts of the causes of inflation, four major schools are Keynesianism, Monetarism, Supply-side School and Expectation School.

1.3.1. Keynesianism

Keynesianism believe economic output is influenced by demand, government should take expansionary economic policy, so that can promote economic growth by increase aggregate demand. This theory firstly comes from Keynes` book which published in 1936 during the Great Depression. At that time, the problem of the society is lack of demand, and the reason is money is hold by minority people whose marginal propensity to consume is low, however those who have consumer demand do not have enough income. The right way to solve this problem is government can offer social security fund to low income group to maintain general living, also government can pay attention on infrastructure construction.

There are both good and bad aspects of Keynesianism, good point is it can help to promote economy increase, bad point is it will lead to inflation. There are some factors that might cause inflation because of Keynesianism: financial deficit, overheat investment and high welfare. The consequence of financial deficit is more money supply which can lead to inflation. Overheating may increase the price of basic commodities, high welfare would force government to borrow money in order to maintain welfare and finally goes to bankrupt and currency devaluation, just like Greece. Thus what Keynesianism says is the inducing factors of inflation, rarely talk about the effect of currency in inflation, finally inflation is performed by currency (Jin Jian, 2014).

1.3.2. Monetarism

The representative person of monetarism is Milton Friedman, and the book he wrote together with Anna Jacobson Schwartz <A Monetary History of the United States> is a master work for monetarism. The book analyzed money supply of United Stated from 1867 to 1960, and the effect of monetary policy in some important historical events. And it mentioned the crisis in 1929, it was not because monetary policy does not work but because authorities improperly used the monetary policy. Monetarism emphasize (1) long-run monetary neutrality, (2) short-run monetary non-neutrality, (3) the distinction between real and nominal interest rates, and (4) the role of monetary aggregates in policy analysis. (Bennett T. McCallum)

1.3.3. Supply-side Economics

Supply side economics developed in 1970s, it emphasizes supply side of economy, they believe demand would adapt to the change of supply. In the long run, income levels reflect the ability to produce goods and services. Higher income and living standards cannot be achieved without expansion in output. “Supply-side economics” also used to describe how changes in marginal tax rate influence economic activity. Supply-side economics believe that

high marginal tax rates strongly discourage income, output, and efficiency of resource use. (James D. Gwartney)

The representative person of Supply-side economics is Arthur Laffer, his Laffer curve pointed out government revenue will increase with the tax rate increase in the beginning, but after a certain extent, the government revenue will decline. Because high tax rate will discourage work effort and encourage tax avoidance and even tax evasion. So Supply-side economics encourage government to decline tax rate and encourage output policy to increase supply.

1.3.4. Rational Expectation School

Rational expectation school`s thought is people will do rational predict for future, and the predictions will influence the decision of current period. The way of modelling expectations was first proposed by John F. Muth. He assumes, when people doing prediction, they will use all available information. Then later became influential until Robert Lucas published "Expectations and the Neutrality of Money". He incorporates the idea of rational expectations into a dynamic general equilibrium model. The basic point of rational expectation school is: based on historical data of price change, people will make a prediction before they enter into market. There will accidental events in market, but people can calculate its probability distribution and chose a minimum risk scenario.

1.4 Impacts of Inflation to Economy

Inflation can have a series influence to economy, as a whole, it can cause the decline of purchasing power and the waste to resources that due to the decline of money; inflation can cause redistribution effects and output effects, lead to the distortion of price system and further more effect resource distribution; also might induce tax and some other economic indicators disorder (Hongye Gao, 2004). Moderate inflation effects on economy are depend on series

relevant factors, galloping inflation and hyperinflation have huge negative effect to economy, the extreme condition of hyperinflation will lead to economy collapse. Inflation not only have negative effect but there is also positive effect. Among the effects of inflation, the New-Classical Synthesis believes there is relationship between inflation and unemployment rate, the so called Philips Curve. High employment rate and economic growth are always the goal of economic development, so that inflation is an important research topic. For example, the former president of Federal Reserve Alan Greenspan use strict financial policy reached a certain equilibrium level between unemployment rate and inflation, made US economy in a steady growth.

The most obvious phenomenon is the decline of purchasing power of currency and the real interest rate of deposit. Assume if there is no inflation the expenses for commodity and service is P, while inflation rate is I, people buy the same commodity and service the expenses would be (1+i) times, the currency need is P*(1+i), so the purchasing power of same amount money is 1/(1+i). Because the relationship between nominal interest rate and real interest rate is *real interest rate=nominal interest rate-i*, so that means higher inflation rate, lower real interest rate. When the real interest rate decline, the possible situation is capital will transfer from bank to other investment which has higher return, such as invest to real estate and stock market. But for small amount capital holder some of them would like to deposit money in bank because it has lower risk to conserve money. Some large capital holder would like to invest money on real estate and stock market. According to the Capital-Asset Pricing Model$R = R_f + \beta(R_m + R_f)$, return and risk are in positive relation (Stephen, 2009).

Shoe leather cost and menu cost are cost of inflation. While banks indexation interest rate according to inflation, in order to reduce cash in hand, there will be resource waste, the wasted resource are time and other sources, especially when hyperinflation happens, the shoe leather cost will higher. Menu cost refers to the cost of price system adjust when inflation happen. For those single product or service enterprises, the menu cost is not high, but in reality, in order to lower risk and increase benefits, enterprises usually operate several products or

services, therefore the menu cost in order to adapt to inflation will be high, especially those retailing enterprises who has many different kinds of products and services.

Reallocation Effect is other influence of inflation to economy. According to the aggregate demand and aggregate supply model (AD-AS), inflation will lead to the change of real interest rate and nominal interest rate. Because there is inflation rate R*, the most obvious change would be price (P), reallocation Effect will occur (Paul, 2006). 1) If nominal variable does not change, a reallocation effect example is creditor and debtor, there is a loss to creditor and benefit to debtor. Because the real value of money paid back is smaller than before. Especially during hyperinflation period, the reallocation effect is more significant. 2) during inflation, if worker`s salary is indexed but enterprise`s contract is not indexed, there will be reallocation between worker and enterprise, the real income of worker does not decline, however, the benefits of enterprise declined. On the contrary, if worker`s salary is fixed but the products is change with inflation, then the reallocation between worker and enterprise would be worker get lower salary but enterprise get more benefits until adjustment made by labor union, real income renew to balance, finally only nominal variable changed.

If in a perfect market, all variables are able to adjust, salary, interest rate are all indexed, then inflation could only change nominal variable, real variable does not change at all. But the reality is market is imperfect, there is wage rigidity and information asymmetry, therefore there will disorder in price system, and furthermore is the inefficiency of market resource allocation. There is influence to tax system, the change of tax can change the attractiveness of investment on different region, and influence the final output.

There is relationship between inflation and unemployment rate. The Philips curve describes the relationship between inflation and unemployment rate, as figure 2 shows inflation and unemployment rate has negative relation. Point A is high inflation and low unemployment rate, point B is high unemployment rate and low inflation rate.

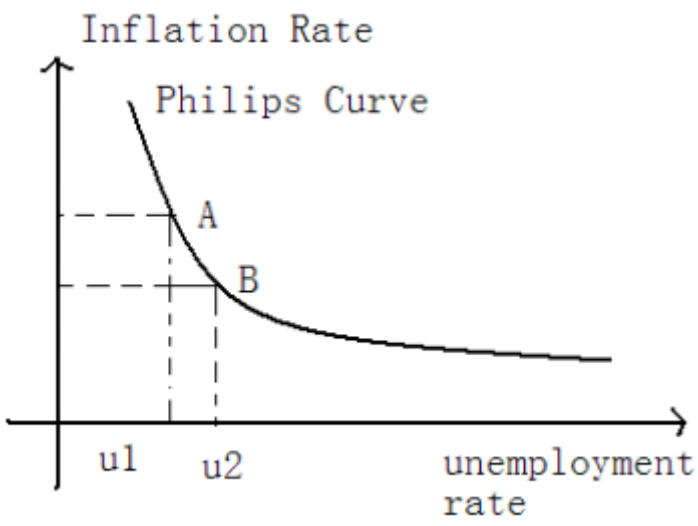

Figure 2. Philips Curve
Source: (Yonggang Liu 2010, 12)

Optimal inflation problem, some classical economists believe the optimal dynamic of price level is not absolute stable, it is inflation in a certain level. The typical cases are Productivity Norm and Friedman Rule. Productivity Norm refers to the movement of general price should consistent with the change of social productivity, or completely show the trends of social productivity. Friedman Rule is whether people decide to hold money or not is depend on the benefit and cost of currency, include: purchasing power, services can offer of currency as a productive factor, the demand of regard currency as asset and the cost of give up consumption. According to consumer equilibrium, if the benefit of holding currency is bigger than internal rate of discount, individual will chose to hold currency until amount increase, marginal benefit decrease until equals to internal rate of discount. If the benefit of holding money is smaller than discount rate, individual will reduce amount of holding money and turn to consumption, until the return increase and equal to internal discount rate. Therefore if it is in equilibrium (Yonggang Liu, 2010):

$-(\frac{1}{p}\frac{dp}{dt})^e + MPM + MNPS = IRD$ ①

$\mathrm{MPM} + \mathrm{MNPS} = \mathrm{MCM} = 0$ ②

$-(\frac{1}{p}\frac{dp}{dt})^e = IRD$ ③

$\mathrm{IRD} = \mathrm{r}$ ④

$\therefore -(\frac{1}{p}\frac{dp}{dt})^e = r$ ⑤

MPM – Marginal Product of Money

MNPS – Marginal Non-pecuniary Services

IRD – Internal Rate of Discount

MCM – Marginal Cost of Money

Set i as nominal interest rate, Fisher Effect is $\mathrm{r} + (\frac{1}{p}\frac{dp}{dt})^e = i$ ⑥. From equation 5 and 6 can get i=0. Therefore, according to Friedman`s point, the optimal price level should be while nominal interest rate is zero. Only confirm the optimal inflation, the control to economy can be better managed and promote economic growth.

1.5. Chinese Inflation in Different Periods

The inflation rate in China`s history is quite fluctuate, there are many times high inflation which due to the different backgrounds. Figure 2 shows the historical CPI from 1978 to 2013 in China. There is high fluctuation from 1984 to 1998, then after year 1998, the inflation rate is controlled better, there is no big fluctuation.

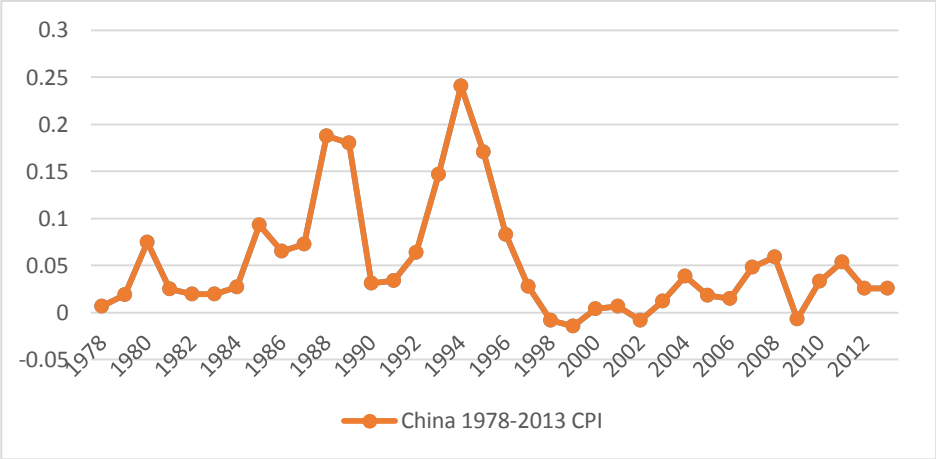

Figure 2. China`s 1978-2013 CPI

Source: National Bureau of Statistics of China

1.5.1 1949-1979 The Forms Of Inflation

From 1949 to 1956, China is in new democratic society, all industries are waiting for develop, this is a period from old economic model transfer to new economic model. In 1956, China finished socialist transformation, the manufacturing enterprises are state-operated or public-private partnership. During planned economy period, manufacturing plan is from administrative command. After 1956, China start the Great Leap Forward, living materials are in huge shortage. Government control all the goods and materials, people can get certain goods by tickets, even clothes, and there are more and more different kinds of tickets. Thus currency became useless, tickets are became more and more important. Due to the strong control of government in economy, the underground market appears among people. The price in underground market is higher than tickets, so tickets also became a goods in the underground market. Planned economy is also shortage economy, in order to stabilize price, the most efficiency way is to print different kinds of tickets, and distribute to department or residents in planned amount, people can only get goods and materials by showing tickets. If you have money but no tickets, it is not possible to get goods. Resources are in big shortage, even there

is no price change but it does not mean there is no inflation. The situation in underground market indicated the real price level is higher than nominal price level.

1.5.2. After Reform And Opening-up Policy

In the beginning of opening up, government gradually open the market, implement dual price system. Planned goods and materials still need tickets to get, but goods and materials which out of plan can according to market to set price. After Third Plenary Session of the 11th Central Committee of the Communist Party of China, there are two high inflation happened, both of them are happed during economy model transformation period. There is one time moderate inflation in 2007, but it is a good example to prove China`s economy is in a good condition and start to develop.

The first high inflation happens in 1984-1988. After the reform and opening-up, government decided to take economic development as the central task. But there are different views for economic growth mode and growth rate. During 1979 to 1982 is the first growth period of economy since Third Plenary Session of the 11th Central Committee of the Communist Party of China, and it is faster than many other countries from worldwide, with the investment of projects, China`s economy became hot. Then government start to cool down economy growth in order to control price stable. Rapid economic development would lead to economy overheat, and at that time, land contract system has not fully implemented, food products are in shortage, so inflation occurred. In 1984-1986, government issued tightening policies, including tightening money supply, reduce fixed asset investment and crack down on hoarding, there is certain effects of those policies, but due to government efforts on break through the price barrier, inflation exploded in 1988. The reasons of 1988 inflation are: on one hand, is the overheat of economy, on the other hand is people`s expectation on price increase.

The next time inflation is 1993 to 1996. In 1992, Xiaoping Deng give a speech on Southern tour, and then in the 14th plenary meeting, established the main status of market economy. These show a sign of economic growth, thus lead to an economic construction boom,

China`s economy entered into rapid growth stage. And foreign investment also increased in that year. From 1993 to 1995, the inflation rates are above 10%. There are several characteristics of this period inflation: First, inflation increase with the development of economy, reached 24%. Seriously disrupted economic order; Second, food price level increased the most; Third, investment scale is huge, lending too much and price increase very fast; Fourth, stock market, capital rising, real estate and development zone are hot; Fifth, basic goods and materials and services are in shortage; Sixth, financial industry over lending, come into many bad debt. During this overheat period, banks lend too much money to locals. Finally, under the strong governance of Rongji Zhu, the credit loans are under control and China`s economy achieved "soft landing".

The third time is in 2008 (5.9%). After the financial crisis in 1997, China continued deflation for five years, until joined World Trade Organization (WTO) in 2002, the economy is driven by export economy. Subsequently, China`s economy is correlated with world economy, thus inflation effected by world economy. In 2008, there is big change in the world economic situation. Financial crisis happens globally, most of the countries` economy grow slowly. In order to face the international crisis, authorities from different countries took the same expansionary policy, so that contribute to the price increase in the later periods. Due to the issue of fiscal and monetary stimulus policies, China`s economy suffering excessive liquidity. Thus after 2009, the liquidity got release. With the devaluation of dollar, international bulk stock price increased and there is excessive liquidity, the national price increased. China`s inflation rate is also increasing from July 2009 (-1.8%) to July 2011 (6.5%), then the government focusing on stabilize the prices of commodities, from 2012, the inflation rate are around 2.6% not more than 3% (NBS).

There are many Chinese scholars have worked on research about inflation, such as: Yanbin Chen and Lili Ma (2007) made empirical analysis of inflation to macro economy by build general equilibrium model. They make conclusion that high inflation will lead to economy loss, control inflation in appropriate level can help economy develop and welfare increase. In

2009, Cheng Li, Wentao Ma and Bin Wang proved inflation expectation can promote central bank and commercial bank adjust interest rate to stabilize macro-economic development. And they give advises on how to make policy under inflation. In short term, quantitative monetary tools can reduce the effect of inflation, while in long term, price-based monetary policy can work better on control inflation, so that provide an basis for central bank when make currency policy.

2. INFLATION DETERMINANTS AND TRANSMISSION MECHANISM

Inflation could induce economic system fluctuate, so it is an important task to manage inflation. By doing research and find out the list relevant literatures about inflation and theoretical analysis that from international scholars and Chinese scholars. This part discussed some determinants of inflation and its relationship with price level, it can just find the correct way to solve inflation problem. Inflation has relationship with many economic factors, this chapter will analyze several factors from literatures such as stock price, exchange rate, money supply, output gap and external shock. And also analyzed their transmission mechanism respectively.

2.1. Stock Price

David E. Rapach (2005) made a conclusion in the empirical research that in long term inflation would not weaken the real value of stock. Ray and Chatterjee (2001) researched the effect of financial assets on inflation of India by VAR model, they found use stock as a representative of financial assets, is the Granger cause of commodity wholesale price index changes which means the information of commodity price is included in stock price. Jinquan Liu and Fengyun Wang (2004) tested the positive correlation between volatility of inflation and inflation value by GRACH model. And then chose the rate of return of stock index as independent variable, inflation rate and its six lagged value of conditional heteroskedasticity as dependent variables to regress. Results showed the rate of return decline with the increase of

inflation volatility. The famous “Fisher Effect” considers stock as an asset, while inflation change, the nominal return of stock will change but the actual return maintain the same, so the nominal stock price and inflation is positive relationship to make sure keep its value. Michael W. Brandt proposed risk premium hypothesis which believes the raise of inflation increased the risk of future financial assets and the risk premium of investors, also raised the discount rate of cash flow, so that declined stock valuation, investors sale stock and stock price goes down and therefore return also fall (Michael, 2003).

Meng Gang and Jinxian Chen (2004) tested Kaul theory, the correlation of inflation and stock yield has stage characteristics. Hu Wang, Yuwei Wang and Conglai Fan (2008) use VAR model researched how financial assets which include stock price effects inflation. The result is Chinese stock market has positive influence on output gap, but the influence is quite weak. Chinese stock inflation contains inflation information. Jinquan Liu and Yanan Ma (2008) use the HP filter method resolve inflation rate into tendency and periodical two parts, and use Markov Regime Switching model divide stock return into three zones – market tightening regime, market expansion regime and mild tightening regime. Then in those three regimes respectively analyzed stock return, tendency component and periodical component by VAR model, there are two different conclusions. The relationship of stock return and inflation is depends on the regime of stock return. If stock in “market expansion regime” and “market tightening regime”, inflation has significant influence to stock return. But if stock market is in “mild tightening regime”, there is no relation between stock return and inflation. When the market is significant fluctuation stage, different regimes has different relationship of stock return and inflation, such as if market is in expansion stage, the tendency of stock return and inflation is positive correlation; while market is in decline stage, the tendency of stock return and inflation is negative correlation. Xiaofang Wang and Jizu Gao (2007) use ARDL cointegration and Granger Causality test analyzed ten years data from 1997 to 2006 of China to research the relationship between inflation and stock return. The result is in short term stock return and inflation has positive correlation, but the Granger causality is not significant. In long

term, there is long-run equilibrium relationship between stock market return and inflation, and Granger Causality test is two way significant. In half year, the short deviation of stock return to inflation is adjustable.

Transmission Mechanism

There are four explanations about the relationship of inflation and stock.

(1). Volatility hypothesis. There is causal relationship between high inflation and low stock return, the high inflation raised uncertainty of return, and then stock return goes down. Besides, high inflation will increase risk premium and therefore raise discount rate thus lead to the decline of current value of future cash flow, so that made real stock return decline.

(2). Proxy Effect Theory. Fama Proxy Effect theory based on the relationship between inflation and real activity is negative relation, real activity and stock return has positive relation, get the result stock return and inflation has negative relation. The negative stock return – inflation relation is induced by negative relations between inflation and real activity which in turn are explained by a combination of money demand theory and the quantity theory of money (Fama 1981).

(3). Nominal Contracting Hypothesis. "Nominal contracts stipulate payment of a fixed number of dollars at a pre-specified future date. The parties involved in the contract estimate the present value of the future payment taking into account the inflation that is expected to occur over the course of the contract. The deviations of the actual inflation rate from its expected value redistribute wealth between the parties to the nominal contract. Unexpected inflation increases the wealth of the debtor and decreases the wealth of the creditor, while unexpected deflation has the opposite effects. Firms always have variety of nominal assets and liabilities, so if the contracts do not have inflation adjustment clauses, unexpected inflation will affect their real value. If nominal contracting plays a large role in explaining the behavior of stock price, the returns for firms with different sets of nominal contracts should be affected differently by unexpected inflation" (French, Ruback & Schwert, 1983).

(4) Money Illusion Hypothesis. It refers people tend to think of currency in nominal, rather than real terms (Shafir, 2000). Modigliani & Cohn (1979) proposed, investors prefer to use nominal rate rather than real interest rate to capitalize their stock return. Thus, during high inflation period, nominal interest rate goes up, but investors do not realized return goes up, so use raised nominal interest rate to discount return for the past, therefor underestimated future cash flow, stock price also underestimated; while during low inflation period, overestimated future cash flow, stock price also overestimated.

Chinese stock market start from 1990s, most of the research are after 2000 and the scholars are more focus on proof hypothesis from foreign scholars. There are many different models can be used to test the relation between inflation and stock, so due to the differences of model and sample data, there always different conclusions.

Even there are lots of research show stock price have influence to inflation, but this paper would not analysis their relationship. There are several reasons:

- stock only occupy small percentage in the assets held by residents, according to Li Gan (2013) research, stock only take 0.69% in total assets of family
- Chinese listed companies don not set maximize the value of large blue chips as a goal of their companies
- Bear market is more than Bull market
- Many research indicated the relationship of inflation and stock market is weak.

2.2 Real Estate

Positive correlation

Goodhart and Hofmann (2000) use data from different countries analyzed relation of real estate price and inflation, result shows inflation can be decided by real estate, exchange rate and stock price. They also find that the aggregative indicator which combined real estate, real effective exchange rate and effective interest rate can doing better in predict inflation.

Weian Wang and Cong He (2005) through VAR model proved there is stable correlation between expected real estate return and expected inflation rate. Zhaoming Jing and Youhua Tan (2006) based on the CPI and real estate data of 1987-2005, use Granger Causality test and co-integration analysis proved real estate price Granger causes inflation. Zhongai Xu, Xuechun Zhang and Chuanwei Zhou (2012) based on the monthly data from July 2005 to August 2011, use money supply M2, CPI and real estate price to take Johansen Co-integration test and get the result, there is co-integration relationship between M2, real estate price and CPI which means real estate price and inflation is positive correlation in long term. Jinhai Yan (2009) chosen 40 sample data from 1998 to 2007, added output gap, real estate and effective interest rate, use ISLM model to take OLS estimation. Result shows real estate have positive effect to output gap; under Granger Causality test, real estate and inflation can interact each other.

Uncorrelated

Yongliang Deng (2010) set up a VAR model by exchange rate, money supply, real estate price and CPI. There are 51 sample data included from May 2005 to September 2009, according to the Granger Causality test and co-integration analysis, real estate price have inhibiting effect to inflation and RMB appreciation does not affect inflation.

In the existing literatures, most people believe there is positive correlation between real estate price and inflation, only few think there is negative correlation. Most literatures focus on the wealth effect of real estate, in fact, according to a survey to a famous decoration company, in 2005, the salary of one unskilled laborer is RMB50 /day, cementer can get RMB 60/day; in 2013, unskilled laborer is RMB260/day; cementer is RMB360/day. This can states that the literatures focus on real estate wealth effect is on contrary to fact. (Kun Xie, 2014)

In other country such as America already finished urbanization, but China is still in the process, so real estate participation degree in economy cannot compare with America, thus its pulling effect to salary should be considered. In the past literature, the investment and consumption ability of real estate are underestimated.

Transmission Mechanism

Chinese real estate market start from 1998, before that, China implemented housing distribution system, until housing system reform, commercial housing appears; with the process of urbanization, increased the demand of housing; and the rapid development of economy also increased people`s purchasing power. All the above reasons promoted the real estate market develop.

Real estate market influenced all the participants: government, urban resident and rural migrant workers in cities. In the real estate market, urban residents occupy a large percent in the investing market, according to a survey made by Southwestern University of Finance and Economics, the urban homeownership rate is 86%, bought for self-living take 42%, bought second one for investment take 18%, have more than three house take 24%. The rural migrant workers get benefit because the demolition and construction created a lot job opportunities, and the relative industries high salary attracted more worker and enterprises and finally the local government desire from land revenue. With the increase of housing price, the value of local land will increase, thus government will issue policies to help real estate develop, and government will invest more on infrastructure construction and enhance demolition to increase marketable land and price.

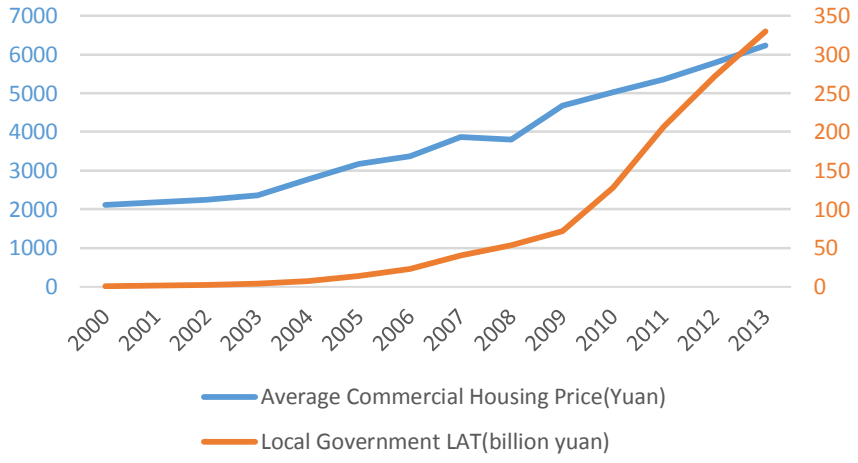

Figure 3. Trends of Average Commercial Housing Price and Local Government LAT.

Source: National Bureau of Statistics of China

There is high degree of relation between real estate price and local government land added value. The commercial housing to goods price have several effects which includes: first, it effects the owner who has real estate assets. Real estate has the property of asset, the change of housing price will lead to the change of balance sheet, and the appreciation of real estate will increase the asset value in balance sheet, so that no matter enterprise, family or government net asset value will increase. The increase of commercial housing price has big influence to urban residents, according to a survey from Li Gan (2013), 65% household wealth is come from real estate, and real estate has more than 86% contribution to the increase of net household value in 2011-2013. In such a condition, enterprises, individuals or government can get more loans, and their financing power also get increase and so that influences consumption and investment, which will bring pressure to inflation.

Secondly, wealth effect of real estate. Increase of asset from consumer will rise consumption demand, real estate increased family wealth.

Thirdly, real estate help increased wage costs. The development of real estate industry drive up the salary in real estate and also due to real estate attracted a lot workers, other industries need to higher wage to keep workers stay. Thus the higher cost will show from selling price and finally moved to consumers. There is also other party influenced by real estate market, local government. In order to get more land added value, government would increase infrastructure investment. There will be conflict between government and private enterprises to fight for talents and capital. The demand of investment from government increase the inflation pressure and on the other hand private department are facing talents, capital and rents costs increasing, thus supply curve move to left side.

2.3 Money Supply

Money supply effect inflation

Zhiwen Zhang and Qinxian Bai(2011) based on the data of 1995-2010, chosen factors: the difference of inflation rate, one period lagged inflation, GDP growth rate, M1 growth rate with GDP growth rate, and exchange rate, stock price as variables, use Two Stage Least Square get the result that the main factors effect China inflation is inflation inertia and the fast growth of GDP, excessive liquidity and external shock effect is weak. Liuyan Zhao and Yiming Wang (2005) use ECM and Co-integration analyzed 1951-2001 data, found out there is strong correlation between money growth and inflation.

Money supply does not affect inflation

Yanbin Chen Shilei Tang & Du Li (2008) use BVAR model analyzed variables exchange rate, CPI, national income and quantity of money. The conclusion is money supply has no effect to inflation. Lin Liu & Yunhui Jin (2005) use VAR and ECM also find the growth of money supply does not affect inflation. Rongping Shao & Kun Xu (2011) based on 2990-2010 CPI and M2/GDP data, compared with Australia, Korea United State and India on the same period, the result is the high M2/GDP ratio is because of China`s specialty of institution, excessive money supply is not the reason of inflation.

De Grauwe, Polan (2001) use the data from 160 countries to test quantity theory of money, there is strong correlation between inflation and money supply growth, but if remove those high inflation sample, the significance disappeared. Barbara Roffia, Andrea Zaghini (2007) analyzed the performance of inflation during high money supply period in 15 countries, the discover is high money supply does not inducing inflation, under the circumstance of high money supply, inflation depends on the current inflation level and assets price. (Kun Xie, 2014)

The quantity theory of money believe excess money supply will inducing excess liquidity, and excess liquidity promote people to consume and thereby commodities are in shortage. For the relation of money supply and inflation, many economists are doing research on if money supply can effect inflation? There always different answers in different papers. In conclusion, the reasons are: first, different models. That include the select of variables and model. There is big difference when chose the sample data, and then can chose different model

from co-integration test, VAR model, ECM or ADL. Second, the sample data can be monthly, quarterly or yearly.

Transmission Mechanism

Currency generated in the production of goods and commodities exchange, it can be the measure of value, means of circulation, storage and pay. At the beginning currency is mainly shells, silver or gold. Nowadays, currency is supplies by central bank.

Fisher (1911) proposed the money demand theory, money demand M can be expressed as the function of velocity of currency circulation (V), commodity price (P) and economic gross(Y). The equation is MV=PY, V is institutional factor which independent from M, Y=AY(K,L), A is technology, K and L are resource endowment, so Y and V are independent from M. According to the equation, if central bank issues too much money, then P will increase.

Keynes (1936) thinks the motivation of transaction, precautionary and speculative effect money demand. By further research he found the transaction and precautionary motive are decided by income Y, and the key variable can influence speculative motive is the opportunity cost of hold money – interest rate. So Keynes money demand function can be expressed as $M=L_1(Y) + L_2(r)$. Later Keynesian evolved the equation to M=kY – hr or $M = \frac{1}{2}\sqrt{\frac{2by}{r}}$. M is money demand, Y is total income, r is interest rate, b is transaction cost and k is the sensitive index of money demand to income, h is sensitive index of money demand to interest rate. According to Keynes`s equation, if central bank increase money supply, the interest rate will decline and then investment will increase, so the transmission mechanism is money supply – interest rate decline – investment increase – demand increase – price increase.

Friedman (1987) developed Fisher`s quantity theory of money, he set currency as asset, then demand of money is decided by total asset and the return of asset. He introduced the concept of "permanent income", the money demand function is $M = f(p, r_b, r_e, \frac{1}{p}, \frac{dp}{dt}, W, Y, U)$, Y is permanent income, p is price, r_b, r_e are the expected nominal return of bond and stock, U is other factors, W is the percentage of non - human wealth in total wealth. Monetarists regard currency as asset, the influence of money supply to economy is the

process of asset relocation. If central bank increase money supply, the nominal return of money will decrease, asset portfolio will readjustment, economic subject will decline the allocation of money and increase other assets, then during the process of get more asset and commodities, excess money will increase inflation.

Both Keynesian and monetarist money demand function implied the increase of money supply will promote the increase of investment, consumption and other assets, which means money is an important factor to inflation.

2.4 Interest Rate

Ravenna, Walsh & Chowdhury (2006) proved under optimal monetary policy, the cost channel of monetary policy in New Keynesian model is very important, the interest rate effect marginal cost so eventually lead to the change of inflation. However, Vasco J. Gabriel (2007) based on United State data use generalized likelihood test get the result that there is no evidence can prove cost channel exist. Then Rolf Scheufele (2009) based on Ravenna, walsh & Chowdhury`s Phillips Curve proved the existence of cost channel is "mixed".

Jinquan Liu & Meihua Jiang (2011) use nonlinear Taylor rule monetary policy, the actual output gap and inflation expectations as transfer variables, estimated the impacts mechanism of nonlinear monetary policy, the result shows there is significant LSTR1 nonlinearity. China`s interest rate can stabilize inflation, if there is high inflation the central bank need take policy to decline inflation, and in economic depression period need to stimulate output. Huachun Zhao & Jeffrey Forrest (2012), use the data from January 1994 to July 2005, take considered endogenous structure change Gregory-Hansen co-integration test method, proved China`s nominal interest rate and inflation does not have co-integration relation, so that mean in long term, the correlation of interest rate and inflation does not hold. Taiyuan Zhang, Chi Xie & Fang Gao (2007) use 200 listed companies in Shanghai and Shenzhen, researched the impacts of

short term and long term interest rate to Chinese enterprise capital structure, the result indicate there is significant impacts of short term and long term interest rate to capital structure.

Most of the researches on inflation and interest rate are based on Keynesian model, and an influential theory is Ravenna`s theory about interest rate can effect marginal cost and therefore effect inflation level. However it is narrow-minded to only talk the marginal cost effect of interest rate. Nowadays, many companies extended their research of interest rate to macro economy and result showed interest rate has an important effect to the leverage ratio of company and family`s balance sheet.

Transmission Mechanism

Interest rate can be say as the time price of currency, the change of interest rate will lead to supply and demand change, and further more effect inflation. The investment function Keynes gives I=b-hr, where I is investment, b is constant and h is the sensitive index of invest interest rate, according to the equation, interest rate decline will increase investment. That is because central bank put money into bond market so that lead to interest rate decline, investment and consumption increase, the aggregate demand increase and result to inflation. Hicks (1937) also use LM-IS model explained how interest rate change can effect output.

Interest rate is an important factor because it can effect asset value and the Net Present Value (NPV) of project, and also it will influence consumption and enterprise investment decision. As we know the NPV formula:

$$\mathrm{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

C_t is the net cash inflow during the period

C_0 is the initial investment

t is number of time period

r is discount rate

According to the formula, the change of r could influence NPV, so further more will effect investment decisions. If interest rate is high, the discounted period cash inflow is small

and NPV become smaller even negative so enterprises might not invest on the project. To the contrary, if interest rate is low, there will high NPV, there will high probability to invest on the project. Due to the credit evaluation system, the change of interest rate will influence enterprises or individual`s credit quality, and eventually influence the difficulty level to get capital. If interest rate is low that means the money supply is higher than demand, so it will be easier to get a loan, and that also means enterprises and individuals will have enough money to face inflation.

In many enterprises the leverage ratio is high, most of Chinese listed companies` leverage ratio is bigger than 1, thus the interest rate change will have big influence to the finance situation. High interest rate will rise liability, so if there is high interest rate, enterprises will use retained profit to pay the loans rather than expand the scale of production; for families will put money to deposit or pay debt. This is so called deleverage, it can help to ease the pressure of inflation, otherwise the leverage in low interest rate will lead to inflation.

2.5 Exchange Rate

Xiaofen Tan (2008) believes RMB appreciation can control inflation, because currency appreciation can shrink foreign exchange surplus, foreign exchange reserve would decline, and on the other hand, currency appreciation can help to reduce imported material price, so that can ease inflation which due to the increase of cost. Houjun Xiang & Lei Xu (2011) use nonlinear econometric studied the transmission effects of exchange rate, result shows Taylor`s conclusion still can be used for the relation of China`s exchange rate transfer effect coefficient and inflation, but the effect coefficient is big when inflation is high, smaller when inflation is low. Jian Lv (2007) analyzed data from 1994 to 2005, use variance analysis method find out the transfer effect of exchange rate to CPI is 10%. Chengsi Zhang (2009) use ADL model proved the fluctuation of nominal interest rate can increase inflation level.

Exchange rate reflect the value of domestic currency to foreign currency, currently China take managed fixing exchange rate system, fixing the USD/CNY-rate on each trading day. China decided starting from the Asian crisis in 1998-1999 to keep its currency fixed versus the value of the US dollar. It did so until July 2005. It then switched to a managed float of USD/CNY, where the value of the renminbi gradually increased versus the US dollar (thus, USD/CNY gradually declined). In the course of three years, the renminbi strengthened by as much as 21% versus the US dollar. A change in China's exchange rate policy came about in August 2008, as China's export sector came under enormous pressure after the US subprime crisis eventually led to a wide decline in world trade. To protect Chinese exporters from further competitive pressures, China again decided to're-peg' its currency vis-à-vis the US dollar. Only in June 2010, the PBoC announced that the exchange rate would be made more flexible again, after which USD/CNY gradually appreciated at a 5% annual pace (errresearch).

Transmission Mechanism

The effect of exchange rate to inflation is through money supply and commodity price. During the past decades, China labor productivity is bigger than US, and also with some other factors, Renminbi has high appreciation expectancy, so under the expectancy, many foreign speculative capital flow into China market and threaten the stable of macro economy, also pushed up asset price. There is research can prove before 2005 the income from investment is out flow, from 2005 the number became positive (Liping He, 2008). Especially after 2008, the data from China Commercial Department shows in the first quarter Foreign Direct Investment increased 60% reached $ 27.4 billion.

At that moment if RMB appreciate in a high level, the exporters do not have enough time to response with the impact, so government chosen managed floating RMB policy. China carry out fixed exchange rate and capital control, according to Mundell Triangle Theory China cannot keep the independency of currency policy, so central bank has to invest more RMB in foreign exchange market to write-off dollars which due to the trade surplus. That lead to the increase of money supply and money supply is one of the reason of inflation.

There are fixed exchange rate and floating exchange rate. The influence of exchange rate to inflation also can be reflected from import and export commodity price, while there is big demand from foreign market floating exchange rate will appreciate. But fixed exchange does not have such property. In some sense the appreciation of RMB can ease inflation, the because if exchange rate appreciate, the profit of domestic commodities will decline which promote exporters turn to domestic market thus increased commodity supply, that can help to ease inflation, and on the other hand, the appreciation of RMB helps declined the cost of import commodities also eased inflation.

2.6 External Shock

Claudio Borio & Andrew Filardo (2006) cited weighted output gap form several countries as variable to traditional Phillips Curve, and compared with the tradition model found the new model fitting degree is better. That means one country`s inflation does not only effected by own output gap and also effected by other country`s output gap. Michael LeBlanc and Menzie David (2004) use revised Phillips Curve studied five countries` petroleum price and inflation in different periods and found the relation is significant.

There also some Chinese scholars researched the external shock effect to inflation. Hongkai Li, Jiafei Zhang & Youqiang Luo (2006) give a result that petroleum price increase can promote inflation. Zeping Ren (2007) based on input-output data, use price input-out model analyzed the effect of petroleum price change to China`s inflation rate. Zhengyan Xiao & Deyan An (2009) use daily average price and monthly average price make up variable with CPI respectively, then by VAR model indicates in short term, about four month, petroleum price has effect to domestic overall price level, and in long term the effect is more stable. Zhiyong Fan & Dihai Xiang (2006) use VAR model give the results: import price fluctuation in short term can inducing producer price fluctuation, the consumer price fluctuations is effected by both import price fluctuation and domestic quantity of money. Zhengyan Xiao & Deyan An (2009) use

BVAR model, based on variables CPI, industrial added value growth, money supply M1 growth, and nominal effective exchange rate then added international energy prices, international food prices and international industrial raw material prices. After added the international prices, the prediction accuracy to CPI is higher, the international petroleum and food prices have effect in short term to CPI, and international raw materials prices has effect in middle or short term.

External shock mainly indicate the effects from foreign finance, currency and emergency events to domestic economy, the ways of external shock are by financial market and flow of commodity which is called international trade, sometimes also include talent and technology flow. Under open economy market, China is mainly effect by United States exchange rate, inflation and energy prices. Currently, most of the research about external shock and inflation are focus on raw material cost and energy prices.

2.7 Output Gap

Yu Wang (2004) use filter method estimated China`s potential output and output gap, and also by VAR model Granger vector autoregression model proved there is positive linear correlation between Chinese inflation and output gap. Yiping Huang & Xiuping Hua (2010) based on VECM and SVAR analyzed year on year and month on month data, find out that excessive liquidity and output gap are important factors to inflation, central bank should pay attention on assets price. Hongwu Zhang (2009) use 1997-2007 data, based on GRACH analyzed inflation and output gap variability, result shows the larger expected variance of output gap and smaller current period variance of inflation has correlation and is alternative two way relationship. The alternative two way relationship is asymmetric.

Hongbin Guo & Ping Chen (2010) analyzed quarter 1 1994 to quarter 4 2008 data, result shows during this period, China`s output gap suffered large and highly continue revise, which means China`s real time output gap is different with the revised data afterwards. Then by compare the real time output gap and final output gap and inflation Phillips curve, find out

that real time output gap is better than final output gap. Shenning Qv & Xianwu Jiang (2010) based on traditional Phillips Curve build up aggregate supply function, and then based on 1978 to 2007 yearly macroeconomic statistics estimated and identified aggregate supply function. The analysis shows output gap and inflation has positive correlation.

Transmission Mechanism

Output gap is the difference between actual output and potential output. Potential output is the highest output that can be reached in long term. Shaoyuan Xu (2005) gives two definition about output gap. First, the aggregate supply is stable, the reason of economic fluctuation is aggregate demand fluctuation, while the demand is not enough then there is excess resources, the unemployment rate is higher than the natural rate of unemployment. The different situation is all the factors in economics are fully good used, that output is potential output, and the estimate to potential output is based on production function. Second definition is based on neo-classic theory, the neo-classic believes the reason of macroeconomic change is technology innovation, technology changes can cause deviate of long term equilibrium and also can cause short term fluctuation. So Prescott propose to use Filtering theory to filter short term accidental factors. The potential output he refers is under certain constraint condition in that period, the maximum output that would not induce inflation.

3. EMPIRICAL STUDY

According to the theory analyze, this thesis give the hypothesis: inflation is determined by exchange rate, interest rate and money supply. Exchange rate is the CNY/USD rate (Exr); money supply take M2; interest rate take from Shanghai Interbank Offered rate (Shibor), also due to the data of Shibor is available from October 2006, so all the data collected are monthly data from October 2006 to December 2014. Figure 4 shows the original data trends. Exchange rate and M2 are both in a continuous increase trends, but CPI is in a big fluctuate and also Shibor rate.

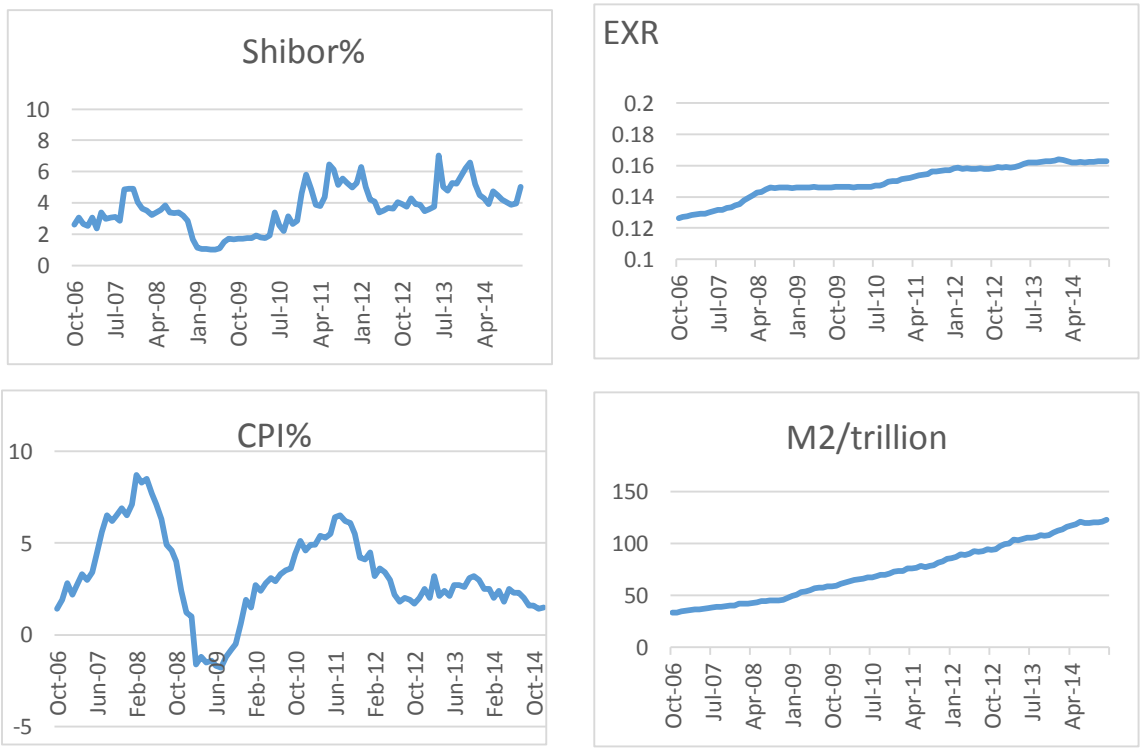

Figure 4. Time Trends of Variables

Table 2. Sum of variables

	CPI_	EXR	M2	SHIBOR_
Mean	3.213131	0.149963	73.57567	3.636924
Median	2.800000	0.150100	71.03390	3.628350
Maximum	8.700000	0.163900	122.8375	7.035684
Minimum	-1.800000	0.126400	33.27472	1.021495
Std. Dev.	2.337435	0.010734	27.72705	1.411232

The traditional way of hypothesis test and predict of macro-economic is through large macro econometric model. Usually, the process of identify and predict structural equation is estimate one equation one time and then combine all the equations to make overall macro econometric prediction. Besides, inducible equation also cited to economic analyze by monetarists. Sims (1980) compared two type of models and give his own opinion: the existed models have too much unreliable constraint condition, the research on macro-economic theories can be reached by one equation or several equations combination. So it need to test is it necessary to build a large model, and there should no accidental accumulation constraints condition trend. It is possible to consider large model as no constraint inducible form to estimate, and take all the variables as endogenous, which is Vector Auto regression Model (VAR). VAR model consider all variables as endogenous variable, all the variables depend on its own and other variables` history data. VAR models have been widely used in the empirical studies of macroeconomic, from relatively a theoretical exercises such as data description and forecasting, to tests of fully specified economic models (Tor, 1999).

The model expressed in this paper is:

$$X_t = A_0 + A_1 X_{t-1} + \varepsilon_t$$

X_t includes the growth rate of CPI, Exr, M2 and Shibor, A_0, A_1 are the correlation matrix. Sims (1980) proposed the estimation method to VAR. consider multi vectors regression equation:

$$X_t = A_0 + A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_p X_{t-p} + e_t$$

X_t indicate the vectors of variables included in VAR model; A_0 is the intercept; A_1, A_2, A_p are coefficient matrix; e_t is error term. The right side of the equation is predetermined variables, the variances are constant and there is no serial correlation, then OLS estimation can be used. There is problem to choose lag periods in VAR estimation, more lags would be better but if the lags are too big, there will be loose on freedom degree. Thus in empirical test, AIC and SIC rules can be used to decide lagged variables.

3.1. Unit Root Test

While doing test to time series data, it is necessary to test the stationary of data. Only if the time series is stationary, the explanatory variables observation variance can tend to constant, and time series does not include trend variables. So that the F- test and T-test can make sense and there is no spurious regression. There are several method can use to make stability test or unit root test such as Philips Test, Panel Test, LM Test and ADF Test. Here is the result of ADF Test.

Table 3. CPI Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.585518	0.1058
Test critical values:	1% level	-2.591813	
	5% level	-1.944574	
	10% level	-1.614315	

Table 4. Exchange Rate Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.468764	0.9642
Test critical values:	1% level	-2.589531	
	5% level	-1.944248	
	10% level	-1.614510	

Table 5. Money Supply Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.775754	0.9986
Test critical values:	1% level	-2.591204	
	5% level	-1.944487	
	10% level	-1.614367	

Table 6. Shibor Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.360368	0.5523
Test critical values:	1% level	-2.590622	
	5% level	-1.944404	
	10% level	-1.614417	

Table 3 to table 6 are the unit root test for original data of CPI, Exr, M2 and Shibor. According to the tables the t-statistic are all bigger than test critical value in 1%, 5%,10%, and the p value are bigger than 0.10, cannot reject the hypothesis that there is no unit root, so that means the data series are non-stationary.

Do unit root test by 1st difference and intercept. Table 7 to table 10 shows all the t-statistics are

smaller than the critical value in 1%, 5%, and 10%, also because all the variables are stationary after 1st difference, so they are integrated in order one, and next would be cointegration test.

Table 7. CPI1 Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.427384	0.0005
Test critical values:	1% level	-3.508326	
	5% level	-2.895512	
	10% level	-2.584952	

Table 8. EXR1 Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.38900	0.0001
Test critical values:	1% level	-3.500669	
	5% level	-2.892200	
	10% level	-2.583192	

Table 9. M21 Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.266100	0.0000
Test critical values:	1% level	-3.508326	
	5% level	-2.895512	
	10% level	-2.584952	

Table 10. Shibor1 Augmented Dickey-Fuller Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.279478	0.0000
Test critical values:	1% level	-3.508326	
	5% level	-2.895512	
	10% level	-2.584952	

3.2. Johansen Cointegration Test

Set cointegration test as Intercept (no trend) in CE and test. According to table 11 and table 12 can identify how many cointegrated vectors there are. The null hypothesis None means there is no integrated vector, the Trace Statistic is 98.69881, bigger than the 5% critical value 47.85613 and p value is 0.0000, so the null hypothesis can be rejected which means there is at least one integrated vector; because the integrated vectors cannot bigger than the number of variables, so there are four integrated vectors. And the result the Maximum Eigenvalue is consistent with Trace test.

Table 11. Cointegration Trace Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.378427	98.69881	47.85613	0.0000
At most 1 *	0.266515	53.52611	29.79707	0.0000
At most 2 *	0.161289	24.08103	15.49471	0.0020
At most 3 *	0.074661	7.371565	3.841466	0.0066

Table 12. Cointegration Eigenvalue Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.378427	45.17270	27.58434	0.0001
At most 1 *	0.266515	29.44509	21.13162	0.0027
At most 2 *	0.161289	16.70946	14.26460	0.0201
At most 3 *	0.074661	7.371565	3.841466	0.0066

Table 13. Cointegration Equation

1 Cointegrating Equation(s):		Log likelihood	664.4138
Normalized cointegrating coefficients (standard error in parentheses)			
CPI1	EXR1	M21	SHIBOR1
1.000000	-5.279861	12.17316	-2.183754
	(11.6269)	(6.18080)	(0.41973)

According to the table above, cointegration equation is:

CPI 1=-5.2799861EXR1+12.17316M21-2.183754Shibor1

There are negative relation between inflation and exchange rate and Shibor, exchange rate decline 5.2%, inflation will increase 1%; exchange rate decline2.18%, inflation rate will increase 1%. Money supply and inflation has positive relationship, every 12.17% money supply increase will have 1% inflation increase.

3.3 VAR and Granger-Causality Test

Table 14. Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	591.7023	NA	2.50e-11	-13.06005	-12.94895*	-13.01525*
1	613.2505	40.70230	2.21e-11	-13.18335	-12.62783	-12.95933
2	629.7528	29.70399	2.19e-11	-13.19451	-12.19458	-12.79128
3	647.9650	31.16324*	2.10e-11*	-13.24367*	-11.79933	-12.66123
4	660.9831	21.11816	2.27e-11	-13.17740	-11.28866	-12.41575
5	670.4389	14.49890	2.66e-11	-13.03198	-10.69882	-12.09111
6	678.6263	11.82621	3.25e-11	-12.85836	-10.08079	-11.73828
7	689.6193	14.90165	3.76e-11	-12.74709	-9.525118	-11.44780
8	704.2239	18.49913	4.07e-11	-12.71609	-9.049698	-11.23758

LR: sequential modified LR test statistic (each test at 5% level)

FPE- Final prediction error

AIC- Akaike information criterion

SC- Schwarz information criterion

HQ- Hannan-Quinn information criterion

Usually lag order is chosen based on AIC or SC rules, based on table 14, there are three third order and two zero order, so here take third order lag, so the VAR model is defined as third order VAR(3) model.

Table 5 the characteristic root test shows all the unit root are smaller than one, lines inside the unit circle, the VAR model is stationary.

Table 15. Characteristic root test

Root	Modulus
0.839665	0.839665
-0.377632 - 0.702535i	0.797597
-0.377632 + 0.702535i	0.797597
-0.616384	0.616384
-0.393563 - 0.280313i	0.483184
-0.393563 + 0.280313i	0.483184
-0.002924 - 0.476376i	0.476385
-0.002924 + 0.476376i	0.476385
0.413129 - 0.125754i	0.431845
0.413129 + 0.125754i	0.431845
0.391410	0.391410
0.128770	0.128770

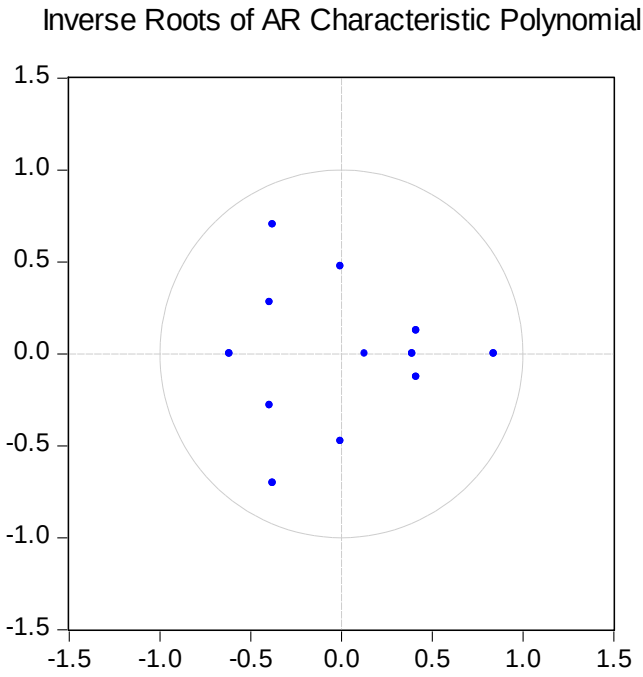

Figure 5. Inverse Root of AR Characteristic Polynomial

The dots in the circle are the inverse root of AR characteristics polynomial, if those dots are outside the circle that means the model is not stationary. The result in figure 5 is consistent with table 15. The VAR model passed the stationary test, model is stationary.

The aim of causality test is to make sure if one lagged variable is in another variable`s equation. The causality test in this paper is Granger-Causality Test, the form of X, Y are:

$$Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i Y_{t-i} + \sum_{i=1}^{m} \alpha_i X_{t-i}$$

$$X_t = \delta_0 + \sum_{i=1}^{m} \delta_i Y_{t-i} + \sum_{i=1}^{m} \lambda_i Y_{t-i}$$

Y_t, X_t are the time series of Y and X, $\beta_0, \beta_i, \alpha_i$, δ_0, δ_i and λ_i are the index of lagged value. Granger Causality test is accomplished by constraint F test, the hypothesis of the test is X does not Granger-cause Y, Y does not Granger-cause X.

For Y, H (0): $\alpha_1 = 0, \alpha_2 = 0, \cdots, \alpha_i = 0$

For X, H (0): $\delta_1 = 0, \delta_2 = 0, \cdots, \delta_i = 0$

According to the analysis of indexes, there can be four results: X has single way causality relation to Y; Y has single way causality relation to X; X and Y has no causality relation; X and Y has causality relation to each other.

From table 16 Granger-Causality Test, there is only one condition can reject the null hypothesis, exchange rate does Granger Cause M2. Others Prob. value are bigger than 5%, so we cannot reject the null hypothesis.

Table 16. Granger-Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
EXR1 does not Granger Cause CPI1	95	0.40357	0.7508
CPI1 does not Granger Cause EXR1		0.42290	0.7370
M21 does not Granger Cause CPI1	95	0.87441	0.4576
CPI1 does not Granger Cause M21		1.62991	0.1882
SHIBOR1 does not Granger Cause CPI1	95	1.25187	0.2959
CPI1 does not Granger Cause SHIBOR1		1.06662	0.3675
M21 does not Granger Cause EXR1	95	1.06640	0.3676
EXR1 does not Granger Cause M21		3.87465	0.0118

3.4 Impulse Response

Impulse responses trace out the response of current and future values of each of the variables to a one-unit increase (or to a one-standard deviation increase, when the scale matters) in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero.

The impulse response function can be expressed as (Wouter, 2011):

$$y_t = \sum_{j=1}^{J} A_j y_{t-j} + u_t$$

y_t is an $n \times 1$ vector of n variables, A_j is an $n \times n$ matrix.

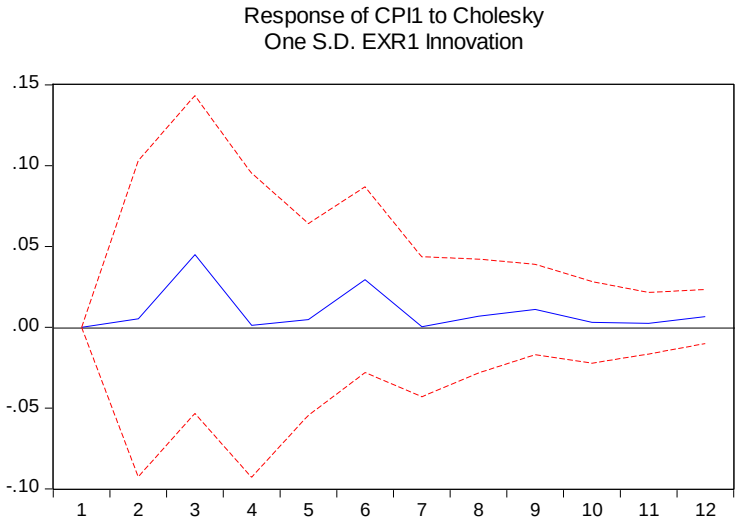

Figure 6. Impulse response of CPI1 to EXR

Figure 6 shows CPI1 response to one standard deviation EXR1 change, red line show response to two times standard deviation. The response of CPI1 start from the first period and in an increasing trend, reached the maximum value in third period and then start to decline, in period reached another high value but then gradually tend to stable.

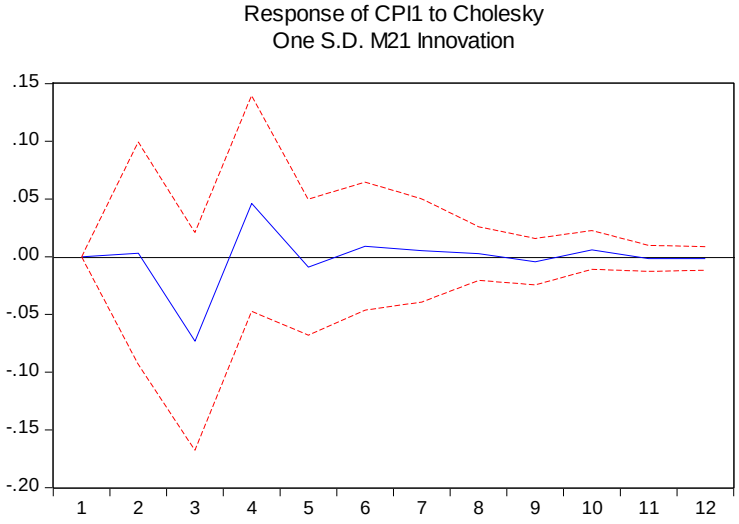

Figure 7. Impulse response of CPI1 to M21

Figure 7 shows the CPI1 response to one standard deviation M21 change. In period three response reached the minimum value then start to increase until reached maximum value in period four and then decline, gradually the response eliminated with time and tend to zero.

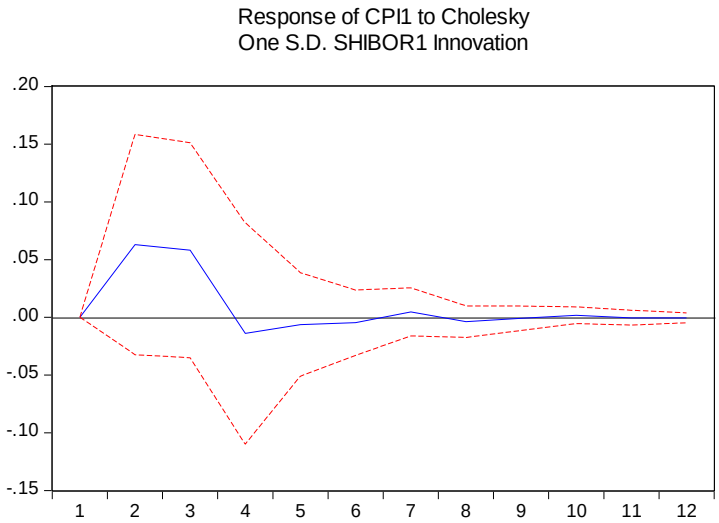

Figure 8. Response of CPI1 to Shibor

Figure 8 is the response of CPI1 to one standard deviation Shibor1 change. The response start with a positive trend and reached maximum in period 2 and start to decline, then goes to zero.

3.5 Variance Decomposition

In practical application, because VAR model is non-theoretical model, it does not need to do priori constraints to variables, so in the process of analyze VAR model it is not necessary to analyze the effect of one variable to another variable but instead analyze the change of error term, or in other words, the dynamic influence to model while there is shock, that is so called Impulse Response Function (IRF). IRF analyze the influence of one variable`s standard deviation change to another variable, however, variance decomposition is to analyze the

contribution degree of structural shock to endogenous variables, and therefore to evaluate the importance of different structural shock.

Table 17. Variance decomposition

Period	S.E.	CPI1	EXR1	M21	SHIBOR1
1	0.458495	100.0000	0.000000	0.000000	0.000000
2	0.469287	98.17888	0.012590	0.004238	1.804294
3	0.489827	93.84709	0.853686	2.235412	3.063812
4	0.492210	92.94470	0.846033	3.094752	3.114517
5	0.493077	92.91050	0.852119	3.117706	3.119670
6	0.494168	92.54420	1.203364	3.137789	3.114644
7	0.494250	92.52609	1.202991	3.148288	3.122635
8	0.494323	92.50048	1.221819	3.150220	3.127483
9	0.494492	92.44836	1.270069	3.155918	3.125655
10	0.494540	92.43091	1.273401	3.169403	3.126289
11	0.494557	92.42798	1.275702	3.170170	3.126143
12	0.494604	92.41070	1.293152	3.170527	3.125618

From table 3 variance decomposition of CPI showed, the influence of past inflation shocks is in dominant position in the short term but it is in a declining trend. In the second period, Shibor can explain 1.8% of inflation fluctuation and gradually increased to 3.12%. Exchange rate can explain a little part of inflation fluctuation. Money supply is in an increasing trend. Exchange rate percentage is low can indicate the inflation pressure brought by currency appreciation through cash flow effect can be neutralized by the deflation by import and export commodity shock channel due to the currency appreciation.

3.6 Empirical Test Conclusion

Under the frame of VAR model analyze, unit root test, impulse response function and variance decomposition methods are used to analysis the relationship between different variables and inflation. The test result are as following:

First, the result shows a strong self-correlation of inflation, in short term inflation is the largest factor can effect itself. That can be explained by Friedman`s expectation theory and Lucas`s rational expectation theory. If there is expectation to future price increase, the behavior will be influenced by expectation, such as, there is expect to increase salary, anthropogenic push aggregate supply curve will move to left side therefore the price and salary will goes up, expectation achieved.

Second, interest rate has influence to inflation. That is due to the high leverage ratio. The change of interest rate can influence investment of local government and enterprises. The low interest reduced investment risk and stimulate enterprise to invest more.

Thirdly, money supply can influence inflation. This can be explained by monetarist theory. Increase of money supply will lead to increase of investment, consumption and other assets, demand increase and eventually price increase.

Fourth, exchange rate has effect to inflation but not so much. The reason might because the appreciation of Chinese currency increased the assets price and therefore induced foreign capital flow into Chinese market and the capital inflow force central bank to intervene foreign currency market.

CONCLUSIONS

The thesis analyzed the inflation determinants in China, in order to understand different determinants, chapter two introduced relevant literatures and their conclusions, also introduced the transmission mechanism to deeply understand the determinants. Then analyzed China`s background from two period, since 1940 the founding of new China to 1979, the market is in planned economy and practice showed planned economy does not suitable for China. Then after the reform and opening up policy, Chinese market transferred to market economy and start to develop.

In chapter three there are four variables are tested by econometric method which include Consumption Price Index (CPI), Exchange Rate (Exr), Money Supply (M2) and Shanghai Interbank Offered Rate (Shibor). Firstly, because the four series are time series then they need to take stationary test through unit root test, after first difference all the series are stationary. Second step take Johansen Cointegration Test, according to the result, there are four cointegration vectors, also get the cointegration equation. Next is build up VAR model and the Granger-Causality Test result is Exchange Rate does Granger Cause Money supply, others cannot reject the null hypothesis. By characteristic root test, result shows the VAR model is stationary, all the unit roots are smaller than one. Fourth step tested impulse response. Analyzed the response of inflation to one unit standard deviation change of exchange rate, money supply and Shibor respectively. The response to exchange rate is fluctuate in the beginning periods and tend to stable from seventh period. The response to money supply and Shibor are all turn to zero eventually. Final step test the variance decomposition, the influence of past inflation shocks is in dominant position in the short term but it is in a declining trend.

Some recommendations from beforehand and afterwards of inflation. Beforehand, carry out inflation targeting regime, so that public can have rational expectation to inflation and the transparent can help to communicate with public therefore to improve the efficiency of economic department. For afterwards, because Chinese society has big inequality, so government can improve the social security system from social insurance, social relief and social assistance. So that can reduce the negative inflation effect to low income group.

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