Why Is the Growth of Economy and Welfare Different in China? A Theoretical and Empirical Study

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Abstract

Based on the hypothesis of consumption utility and capital utility, the paper testifies the existence of the sole point of equilibrium between consumption and investment, and constructs a resident micro-utility function. It further derives a general gross national utility function combining the function with Lorenz curve, and exploits it to simulate national utility function in China with the statistical data. Furthermore it calculates the national welfare growth over the years, and analyses the differences and reasons between national welfare growth and GNP growth. The result indicates that the GNP growth has not brought about corresponding resident welfare growth. It can attribute to the uneven distribution of wealth, the decease of the ratio of consumption to GNP, and the inflation of prices, etc.

Keywords: utility of fortune, distribution inequality, economic growth, national welfare

1. Introduction

Since reform and opening policy was implemented 30 years ago, the economic development in China has achieved great success, which attracts worldwide attention. GDP grows at the speed of two digits in consistent years and the total volume comes up to 9240.17 billion dollars, promoting China to be the second largest economy by exceeding Japan. The international competitiveness and influence of China are greatly increased. However, due to the guideline of “economic development as key link” all the time, China has been one-sided, emphasizing economic growth but neglecting the quality of economic growth. Rapid economic growth nearly conceals the reality that China is experiencing series of problems, such as waste of resources caused by high input and low output, the imbalance of national economic structure caused by export dependence and unequal income distribution, the exacerbating of urban-rural gap, the imbalance of development among regions caused by imperfect system. In reality, though the global value of economics in China grows, people don’t seem to enjoy the benefits brought by economic growth. The problems of high proportion of low-income groups and the low consumption level of nations are still constraints of economic and social development in China. On the basis of the above, the fifth session of the 17th central committee of the communist party of China again put forward the development view of "transformation of the mode of economic development", emphasizing that we should further narrow the gap in income distribution and improve the national living standard, enabling people to share the benefits of economic growth.

China’s development mode needs further investigation. Though economic growth is the major factor of national welfare growth, does economic growth certainly increase national welfare? Or does economic growth certainly bring us national welfare growth at the same time? If the economic growth is at the cost of destroying environment and it leads to the imbalance of distribution and severe differentiation of classes for which inharmonic situation in society happens, then what is the significance of economic growth? Ignoring national welfare growth is an important issue in China’s economic development, so it’s necessary to assess national welfare growth more accurately.

The ignorance of national welfare growth in China’s economic development, to some extent, is related to a lack of index in national welfare assessment. Generally speaking, the core indicator in national economics accounting system, GDP (or national income, GNP), may be an effective indicator for measuring economic growth, but one-sided for national welfare growth. Other indicators, such as GDP per capital, gini coefficient and public service

inputs are also used to measure economic quality or national welfare, but usually lose gravity and attention due to the too wide range. Therefore, exploring the establishment of an effective national welfare index is of great importance.

2. Literature Review

Pigou pointed out that welfare is a satisfaction of utility including two parts: The first one is economic welfare related to monetary measure, and the second one is the non-economic welfare which is not directly associated with money. Pigou considers economic welfare as equal to national income. He also argues that the change of economic growth will not necessarily cause the equal change of the general welfare level synchronously, which means that the economic welfare fails to be the measurable indicator or index of general welfare. Sen (1974) constructed a welfare index S=RY(1-G) in form of real income per capital and gini coefficient. Sen's index directly reflects the welfare level based on income and distribution, but fails to reflect residents' most direct source of utility and other sources that reflect residential utility. Daly and Cobb (1989) put forward a "sustainable economic welfare indicator (ISEW)", including a set of indicators that reflect national welfare and sustainable development, but it didn't get expansion due to the complexity and incomplete operationalization of the indicators. Chinese scholars research a lot on the national welfare index and green GDP. Yang (2009) came up with "a national welfare accounting based on externality" and "a construction theory of social welfare index". You et al. (2009) proposed a concept called 3D-GDP (green GDP, well-being GDP and government GDP). However, most of these welfare indexes are lack of micro theory foundation (like the maximum of residential utility).

Research on the national welfare index can date back to where residential utility comes from. The new classical economic model generally regards the maximum of consumption as the goal for individual to purse. People accumulate wealth for consumption, so consumption enters into utility function but wealth doesn't. Traditional economic growth model such as Ramsey-Cass-Koopman model and OLG model, both consider consumption utility as the unique source of residential utility, because consumers distribute their wealth in the long-run so as to maximize consumption utility. Yu (2001) and Sun (2002) made similar assumptions when researching on Chinese consumption function. There are weaknesses in the research above: one is failing to explain consistent steps that people pursue wealth by after accumulating lots of wealth that is enough for consumption; the other is consequence of failing to reach the maximum of utility in short-run (if consumption is the only source of utility), which contracts with the rational hypothesis of the economic man.

Kruz (1968) firstly introduces capital into utility function, after which economists began to investigate the influence of capital on utility in the following situations: one involves capitalistic spirits, and the other is social status. Zou (1994) demonstrated why wealth should be introduced into preference research .from the capitalistic spirit view, quoting views of Weber (1958), Keynes (1971), Marx (1977), Galbraith (1983) and Lord Acton (1988). He saw that utility was the function of consumption as well as capital, evidenced by the rapid economic growth of East Asia. Some scholars argue that social status is also a goal for individual to purse, for pure consumption maximization couldn't give explanation on why the rich still suffer great pressure and continue to work hardly (Cole et al., 1992). Except for accumulating wealth for consumption maximization, investors consistently accumulate wealth for improving social status (Bakshi and Chen, 1996).

When it comes to currency utility, Berneulli (1738) firstly came up with the concept of currency utility function and the theory of declining marginal utility of currency. Directly integrating currency into the utility model, Sidrauski (1967) put forward currency utility model (MIU), which is used mostly to discuss the relationship between currency and economic growth and it assumes that the marginal utility of the currency is positive. Imrohoroglu (1992) thought that if keeping currency is for insurance, currency will produce utility even though it has never been run out actually.

3. The Construction of Global National Utility Function

The construction of global function in economics generally needs corresponding microcosmic foundations. This article constructs global national utility exactly on the basis of maximizing residential utility. Firstly, according to the hypothesis of consumption utility and possession (wealth), there is a unique optimal equilibrium for the income distribution on consumption and investments from residential income. In this point, residential utility reaches the maximum. Furthermore, we can deduce a general form of the national utility function in use of the Lorentz curve.

There are two main approaches for residential income distribution: one is consumption and the other is investment. Therefore, this paper holds the view that the income utility of residents is also realized by consumption utility and asset utility. Whether in the short or long term, residents should maximize its utility on the distribution of income. In the long-run, residents maximize the utility by choosing the time periods of consumption, but in short-run by distributing consumption and assets. After the asset utility is introduced, the hypothesis of maximizing the utility can explain the residents' behavior of reducing consumption and accumulate wealth(increase investments), for which the conflicts between non-maximized utility in short-run and maximized utility in long-run for residents could be solved

in the condition of only considering consumption utility.

Generally speaking, consumption of goods is characterized by marginal utility declining and the marginal utility of consumption tends to be zero when the consumption is infinitely large in short-run. So we have hypothesis of consumption function U(c) as follows:

Hypothesis 1: $U(c) \geq 0, U(0) = 0; dU/dc > 0, d^2U/dc^2 < 0; du/dc(+\infty) = 0; dU/dc(0) = 1.$

c is the consumption of goods. Assuming that the money amount of consumption is *x*, *p* stands for the goods price, $x = p*c$, so utility function of currency is: $U(x) = U(pc)$, and it's easy to prove that *U(x)* has features as follows:

Hypothesis1':

$$U(x,p) \geq 0, U(0,p) = 0; \partial U/\partial x > 0, \partial^2 U/\partial x^2 < 0, \partial U/\partial p < 0; \partial u/\partial x(+\infty, p) = 0;\ \partial U/\partial x(0,p) = 1/p.$$

Another is the asset utility. The paper defines the general asset as stocks, bonds, bank savings, real estate and currency such kinds of assets. Assets utility firstly comes from wealth utility, which means that residents gain safety and satisfaction for possessions and feel honored for social status. Wealth utility is also marginally declining, and when wealth is infinite, its marginal utility tends to be zero; Secondly holding assets can acquire certain returns of investments, for which income increases and possibilities of consumption are gained in the future. Therefore, the revenues of assets investments can bring utility. Because investment has a fixed return without risks, the return utility of asset investment has constant features like marginal utility. We have hypothesis of asset utility function as follows:

Hypothesis 2: $V(m,r) \geq 0, V(0,r) = 0; \partial V/\partial m > 0, \partial^2 V/\partial M^2 < 0; \partial V/\partial m(0,r) = a_0;$

$$\partial V/\partial m(+\infty, r) = b_0 + c_0 r > 0$$

$m>0$ is the currency value of generalized assets; a_0, b_0 and c_0 are constant, which are exogenous variables. a_0 means the element that affects marginal utility of investment unit. Because we assume that the marginal effect of the first consumption unit is 1, parameter a_0 actually contains all the other exogenous variables that affect residents' distribution of investment and consumption like social security level, investment and consumption environment; r>0 is the deposit rate during this period, b_0, c_0 stands for the non-rate factors influencing investment return, such as rate of retrun of stocks and bonds, and the proportion of that currency deposit in total assets.

In the general situation, the first income unit residents get is spent on consumption, so we have hypothesis as follows:

Hypothesis 3: The consumption utility of individual's initial unit of income is higher than investment utility, namely: $\partial U/\partial x(0,p) > \partial V/\partial m(0,r)$, namely $1/p > a_0$.

This paper cares more on residents' optimal distribution of income between consumption and investment, and no matter what income level residents is on, preventive assets and currency should be generally retained. So we have another hypothesis:

Hypothesis 4: For any income level $y>0$, residents' investment m>0, namely the last unit of income is spent less on consumption utility than investment utility, that is to say: $\partial U/\partial x(y,p) < \partial V/\partial m(0,r)$.

Individual's income utility function can be expressed as following:

$$W(y) = U(x,p) + V(m,r), y = x + m$$

Then we prove the existence of the maximum of income utility and the uniqueness of the distribution between consumption and investment when the income utility is maximized. (Proposition 1 and 2)

Set y as individual's income in certain period, because $y=x+m$, we can use a concave figure (XM concave figure) to describe the relationship between marginal utility function of consumption $U'_x(x,p)$ and marginal utility function of investment $V'_m(m,r)$.

In Figure 1, the vertical axis in the left side is consumption utility, investment utility in the right side, and the horizontal axis means consumption and investment, the sum of which is income (the length of horizontal axis). Point P is in the situation of y as individual's income, the intersection of individual's consumption marginal utility curve $U'_x(x,p)$and investment marginal utility curve $V'_m(m,r)$, which means that the marginal rate of substitution of consumption utility and investment utility is 1, the uniqueness of which will be proved as follows and in this point, residents' utility reaches the maximum.

Proposition 1: For a given monetary income constant y0, Price of p and rate of r, there exists only one consumption point X_0, which makes: $U'_x(X_0,p) = V'_x(y_0 - X_0, r)$.

Prove: Let $F(x) = U'_x(x,p) - V'_x(y_0 - x, r)$, $x \in [0, y0]$. According to hypothesis 1' and hypothesis 3, we have: $F(0) = U'_x(0,p) - V'_x(y_0, r) > 0$; In terms of hypothesis 4, we have: $F(y_0) = U'_x(y_0, p) - V'_x(0, r) < 0$.

According to hypothesis 1' and 2, we have: $F'(x) = U''_x(x,p) - V''_x(y_0 - x, r) < 0$, namely *F(x)* is continuously differentiable and is strict declining function. According to the intermediate value theorem, there exists and only exists a constant X_0:$F(X_0) = 0$, namely $U'_x(X_0, p) - V'_x(y_0 - X_0, r) = 0$, namely $U'_x(X_0, p) = V'_x(y_0 - X_0, r)$, ended.

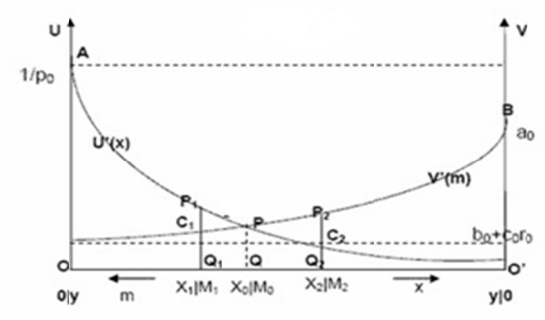


Figure 1. XM concave figure

Proposition 2: In the given income level of y0, Price of p and rate of r, when the marginal rate of substitution of consumption utility and investment utility is 1(namely (1) set up), the individual's income utility is maximum.

Prove: the Individual's utility function is:

$$W(y_0, p, r) = U(x, p) + V(y_0 - x, r),$$

then

$$\frac{\partial W}{\partial x}(y_0, p, r) = \frac{\partial U}{\partial x}(X_0, p) - \frac{\partial V}{\partial x}(y_0 - X_0, r) = 0,$$

so the X_0 is the only extreme point.

$$\frac{\partial^2 W}{\partial x^2}(y_0, p, r) = \frac{\partial^2 U}{\partial x^2}(X_0, p) + \frac{\partial^2 V}{\partial x^2}(y_0 - X_0, r) < 0,$$

so the X_0 is the only Max extreme point. ended.

Combined with the Lorentz curve of resident income, the gross national utility function is derived. Lorentz curve is come up by American statistician Lorentz to describe the distribution of social income. It is described by the percentage that certain number of population takes up in the total population and the percentage that their incomes takes up in the total incomes.

Assuming that L=L(z) is the Lorentz curve function, $0 \le z \le 1$ is the percentage of population, $0 \le L \le 1$ is the percentage of income.

Assuming that national income is Y, and population is N, among the population, the income of residents whose lowest rank i should be:

$$y_i = Y\left[L\left(\frac{i}{N}\right) - L\left(\frac{i-1}{N}\right)\right]$$

So the gross national income utility is:

$$W_0 = \sum_{i=1}^{N} W(y_i) = \sum_{i=1}^{N} W\left(Y\left[L\left(\frac{i}{N}\right) - L\left(\frac{i-1}{N}\right)\right]\right)$$

This formula shows that utility function of the individual and Lorentz curve can be used to compute the Gross National Utility per year.

From the Gross National Income Utility function, the consumption utility function and the investment utility function, we can get:

$$\frac{\partial W_0}{\partial Y} > 0;\ \frac{\partial W_0}{\partial P} < 0;\ \frac{\partial W_0}{\partial r} > 0.$$

It means the National Income and the capital return will enhance the National Utility, the inflation will reduce the National Utility.

And if we set G as the variable of income distribution, such as the Gini coefficient, we can know one Lorentz curve (function) is Corresponding to one Gini coefficient. We set the Lorentz curve function base Classic Pareto distribution as: $L(z) = 1 - (1 - z)^{\frac{1-G}{1+G}}$, Refer to Atkison's paper (1970), we can get: $\frac{\partial W_0}{\partial G} < 0$. It means income uneven(Gini coefficient) will reduce the National Utility.

4. The Estimation and Test of National Utility Function in China

In this section, statistical data in China will be used to estimate the parameter of national utility function and test. Due to the public statistical data in China separating urban residents from rural residents, for the sake of simplicity, this paper adopts the statistical data of urban residents to estimate.

Firstly, we estimate the resident income utility function. According to the hypothesis of the consumption utility function, we can regard resident micro consumption utility function as the natural logarithm form:

$U(x, p) = \mathrm{Log}\left(1 + \frac{x}{p}\right), x \geq 0$, p is annual price, so: $U(0, p) = 0, U'_x(0, p) > 0$, $U''_x(0, p) = -1/(p + x)^2 < 0$, $U'_x(0, p) = 1, U'_x(+\infty, p) = 0$, $U(x)$ matches hypothesis 1'.

In terms of the relationship between asset utility function and consumption function, we assume that asset utility function has a form:

$$V(m, r) = \int_0^m \frac{(a_0 + (b_0 + c_0 r)m)}{(1 + m)} dm = (b_0 + c_0 r)m + (a_0 - c_0 r)\mathrm{L0g}(1 + m)$$

Where $0<a_0<1/p$, $b_0>0$, *r is the annual deposit rate*, $0<b_0+c_0r<a_0$, So:

$V(0)=0$, $V'_m(m, r) = (a_0 + (b_0 + c_0 r)m)/(1 + m) > 0$, $V''_m(m, r) = (b_0 r - a_0)/(m + 1)^2 < 0$, $V'_m(0, r) = a_0 < 11$, $V'_m(+\infty, r) = b_0 + c_0 r > 0$.

It's obvious that function $U(x,p)$ and $V(m,r)$ satisfy hypothesis 2, 3 and 4.

Now let's make use of statistical data from 1990 to 2010 to estimate parameters a_0,b_0,c_0.

First of all, assuming that price P is the annual price index, r is the one-year bank deposit rates, and resident income y is substituted for urban residents' per capita disposable income in China, resident consumption x is substituted by urban residents' consuming expenditure, and the investment is calculated by $m = y\text{-}x$.

According to the model of the maximum of resident income utility before, consumption utility function and asset utility function satisfy:

$U'_x(x, p) = V'_m(m, r)$, namely:

$$1/(p+x) = (a_0+(b_0+c_0r)m)/(1+m) \approx b_0+c_0r+a_0/(1+m) \quad \text{(Note 1)} \qquad (2)$$

Let's take statistical data from 1990 to 2010 to conduct regression analysis. Firstly the ADF test of three sets of data sequences (variable): $1/p+x$,r,$1/(1+m)$. The results show that three sets of data are first-order single whole sequence, so we can conduct OLS regression analysis, the results of which are shown in Table 1.

Table 1. The results of regression analysis and test

	Coef.	S.D.	t-test	Prob.
Const(b_0)	0.000055	0.000003	16.5887	0.000000
X1(1/(1+m))	0.202248	0.003740	54.0741	0.000000
X2(r)	-0.000002	0.000001	-3.20858	0.006312
R-squared	0.997483	F-Test	2773.68	
Adjust R-squared	0.997123	Prob(F-Test)	0.00000	
S.E.	0.000007	D.W.	1.4361	

From Table 1 we can see that, three parameters satisfy the value range of asset utility function's parameters and model fitting results are very good; there is no residual test autocorrelation and heteroscedasticity of residual test, and ARCH reject the original hypothesis.

According to formal (2), the value of parameters and the income equation $y=x+m$, we can get the expression of consumption function: $x = f(y,p,r)$, and investment function: $m = y - f(y,p,r)$.

Put the price index p in 2011, income y and rate r into formal (2), we can get consumption expenditure per capital of Chinese urban residents in 2011: $x_{2011} = 12568$, the relative error with actual value is 3.43%, which has a high level of accuracy.

Based on the statement above, we can confirm that Chinese residents' asset utility function is:

$$V(y,r,p) =(b_0+c_0r)(y-f(y,p,r))+ (a_0-c_0r_0)Log(1+f(y,p,r))$$

$$= (0.000055 -0.000002*r)*(y-f(y,p,r)) + (0.202248 +0.000002*r)\ Log\ (1+f(y,p,r))$$

Chinese residents' consumption utility function is:

$$U(y,p,r) = Log\ (1+f(y,p,r)/p)$$

Chinese residents' income utility function is:

$$W_0(y,p,r) =U(y,p,r) + V(y,p,r)$$

Now let's estimate income Lorentz curve of Chinese urban residents through years. The functional form of Lorentz curve that this paper use is the fundamental form of Lorentz based on classical Pareto distribution given by Sarabia et.al (1999): $L(z)=1- (1-P)^B$,in which z is the proportion of population and L is proportion of income. According to grouping accumulated population proportion and accumulated income proportion (Table 2) which is gotten by sorting out grouping population proportion of urban residents in China. Using statistical data in 2010 to conduct aggression analysis, we can get the Lorentz curve equation in 2010: $L(z)= 1-(1-z)^{0.567}$ multiple correlation coefficient $R^2= 0.99$, under the condition of significant levels of alpha = 0.01, regression coefficient goes through the test.

Table 2. Chinese resident grouping population proportion and accumulated income proportion in 2010

Income Unit: RMB.

Groups	Residents proportion	Accumulated residents proportion	Average income	Income proportion	Accumulated income proportion
difficult	5%	5%	4198	1.14%	1.14%
lowest income	5%	10%	6309	1.71%	2.86%
low income	10%	20%	8162	4.44%	7.29%
low to middle income	20%	40%	11244	12.22%	19.52%
middle income	20%	60%	15400	16.74%	36.26%
middle to high income	20%	80%	21018	22.85%	59.11%
high income	10%	90%	28386	15.43%	74.54%
highest income	10%	100%	46826	25.46%	100.00%

Data source: China Statistical Yearbook; Data of accumulated income proportion is calculated by the author.

Using the same method to Estimate the parameters of Lorenz Curve from 1990 to 2009, we get the Table 3.

Table 3. The parameters of Lorentz curve for Chinese urban residents' annual income

	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
B	0.683	0.664	0.648	0.586	0.572	0.562	0.559	0.562	0.567	0.560	0.566	0.567
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

After getting the parameters of both the resident income utility and Lorentz curve of the national income, we can get the specific form of total national utility function.

5. The Difference and Reason Analysis of Economic Growth and National Utility Growth

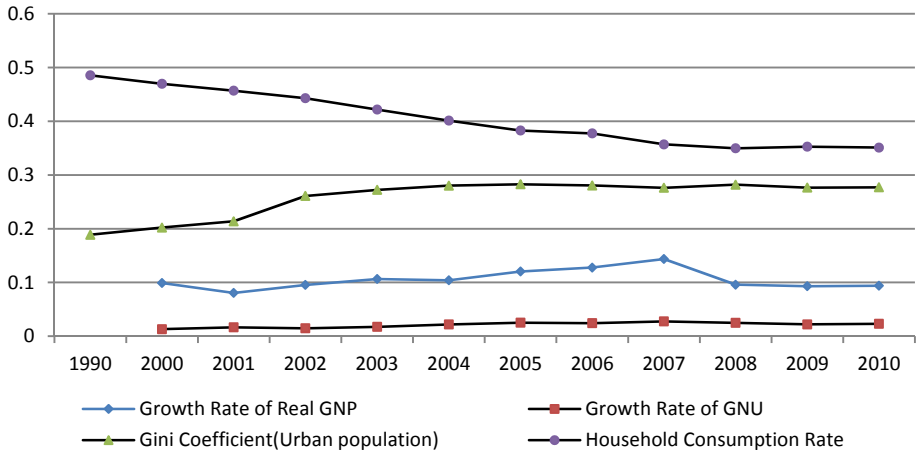
In this section, national utility function is used to calculate the growth of global national utility through years, which we compared with GNP growth and analyzed their difference and reasons. We use urban resident income utility function to represent resident income utility function, which integrates with global national utility function gotten in the last section to calculate Chinese GNU and the growth rate. In order to make GNU and GNP more comparable, the income of GNU function we set is GNP, which means not considering the change of resident welfare caused by the expenditure of government; Price index and the weighted interest rate are shown in appendix 2. The use of maple software to calculate global national utility is shown as follows (Table 4):

Table 4. Nominal national income (GNP) and Gross National Utility (1990-2010)

	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Population	11.72	12.67	12.76	12.85	12.92	13.00	13.08	13.14	13.21	13.28	13.35	13.41
GNP	2.69	9.80	10.81	11.91	13.52	15.96	18.58	21.75	26.78	31.62	34.35	37.58
GNU	104.82	132.54	134.73	136.72	139.11	142.16	145.72	149.24	153.29	156.93	160.57	164.26

Population: hundred million; GNP: trillion; GNU: hundred million.

Furthermore, we calculate the growth rate of Chinese GNU and compare it with Chinese GNP growth rate. (Figure 2). In 2010, the real growth rate of Chinese GNP was 9.4%, but the growth rate of GNU was just 2.3%, a difference of 7.1%. From the situation through years, although the growth of GNP remains 10% in every years, but the growth rate of GNU gets stuck to 2%, a difference of 8%.Therefore, GNU growth and GNP growth through years is not synchronized. What's more, the change of GNU growth rate and the change of GNP growth is not synchronized as well. For instance, the growth rate of GNP in 2007 was 14.4% which is higher than that of 2006 by 1.6%, but the growth rate of GNU in 2007 was 2.7%, which was higher than that of 2006 by only 0.3%.



Data source: China Statistical Yearbook; some are calculated by the author.

Figure 2. The comparison of GNP growth rate and GNU growth rate through years

We can come to the conclusion that the growth of national income could bring neither the synchronous growth of national utility nor the change of national utility growth. Besides the Diminishing of marginal utility of income, the continuous decline of Chinese resident global consumption rate and the rise of uneven income distribution (Gini Coefficient) are the important reasons, which are shown from the changes of the global consumption ratio trend line and Gini coefficient trend line in Figure 2.

The decline of the resident consumption ratio means the rise of resident investment ratio. Theoretically, the reasons why residents reduce consumption ratio and increase the investment ratio might be that the imperfect construction of social security makes residents increase savings to deal with the expenditure of education, medical treatment, hygiene, pension, housing such kinds of potential expenditure, but in the model of resident utility, we assume that these elements are exogenous variables (parameters a_0,b_0,c_0) of resident utility, and next we analyze mostly the

influence of endogenous variables.

The decline of total resident consumption ratio and the non-synchronization of national utility growth rate and national growth rate result firstly from the uneven resident income distribution (in the model it indicates the change of parameter B in Lorentz curve, the smaller the B is, the more uneven the distribution is). According to consumption function $x=f(p,r,y)$, when the speed of price raising p and the speed of interest rate raising r remain unchanged, the higher the y is, the smaller the individual consumption ratio x/y is. When the distribution becomes more uneven, the total consumption ratio will absolutely decline relatively. On the other hand, the change of the uneven degree of resident income distribution affects the relative income level of residential individual, because resident utility function is formed by consumption utility function and asset utility function, the change of the individuals' income level influences the structure of consumption and asset, after which the resident individuals' relative utility level is affected. Therefore, the increase of the uneven degree of income distribution results in the relative decrease of global national utility, which further makes the growth of national global utility be lower than the growing speed of national income.

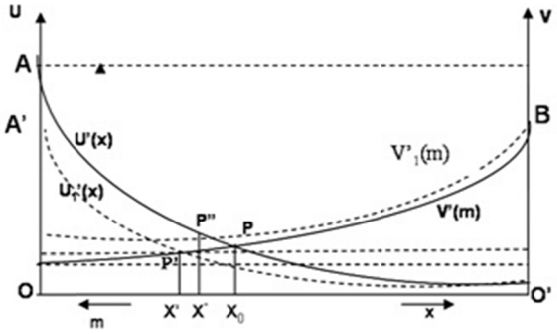


Figure 3. The change of concave figure

The speed of price rising is higher than the speed of interest rate rising, which results in the decline of resident global consumption ratio , and the slow growth of national global utility relative to the national income. From the consumption marginal utility function $U'(x)=Log(1+x/p)$ we can see that consumption marginal utility is reduction function of price index. When the price index rises, in XM concave figure (figure 3) ,*U'(x)* curve goes down and the degree of concave towards left side increase , the intersection of consumption marginal utility curve *U'(x)* and the investment marginal utility curve *V'(m)* moves to the left side, the weight of consumption declines, residents' total utility declines (the area below two curves). From the form of asset marginal utility curve *V'(m)* function we can see that, it is the increasing function of interest rate index. When the interest rate index rises, it is indicated in the XM concave figure that *V'(x)* curve does up (zero unchanged, limit point rising), and the degree of concave towards right side, the intersection of consumption marginal utility curve $U'(x)$ and investment marginal utility curve *V'(m)* moves to the left side, the weight of consumption declines but the global utility rises. When price index and interest rate index change in the same direction, the effecting direction of resident global utility is not sure. But if the price index rises relative to the change of interest rate index reaches to some extent, the extent of the consumption marginal curve goes down and the change of concave towards the left side is bigger than the extent of the asset marginal utility goes up and the decrease of concave towards the right side, for which the weight of resident consumption declines and the resident utility decreases at the same time. Figure 4 reflects the change above.

The decline of the weight of resident consumption and the increase of global national utility through these years are much smaller than the speed of national income growth. Except from the reason of severing the uneven distribution degree, another important reason is the rise of price index is much bigger than the rise of interest index.

6. Conclusion

1) Theoretical model shows that residents realize the effective income distribution in the condition of maximizing the individual utility. At certain income level, residents have unique and optimal equilibrium on the distribution of consumption and investment and elements that could affect this point include income, the increase of price level and the increase of interest rate and so on.

2) The empirical analysis from Chinese statistics shows that economic growth cannot bring the synchronous growth of national welfare. And the change of the speed of economic growth in China could not cause the synchronous change of speed of national utility growth.

3) Based on the hypothesis of the model (the hypothesis of endogenous variables), the elements that affect the change of national utility are national income, the average extent of income distribution, the speed of interest rate growth and price growth. In the condition that national income remains unchanged, the uneven degree of distribution increases, national utility decreases; when the speed of price growth is unchanged, the speed of interest rate growth declines, national utility declines; when the speed of interest rate growth remains unchanged, price increases quickly and the national utility declines; when the speed of price growth is higher than that of interest rate growth to some extent, national utility declines.

4) In order to realize the synchronous growth of national welfare and national income, the uneven degree of resident income distribution must be narrowed and further increase the weight of resident consumption, keeping the relative stability of price (speed of growth) and interest rate (speed of growth).

5) When loosing the hypothesis of model and turning exogenous variables (model parameter) into endogenous variables, elements that affect national utility may include social security system, consumption environment, investment environment etc. which have an influence on model parameters; so as to realize the synchronous growth of national welfare and national income, we should also perfect the construction of social security system, optimize consumption environment and investment environment.

6) When adopting other forms of consumption utility function thatmatch the hypothesis (namely also the natural logarithm function that are not hypothesis from this paper), so the absolute growth speed of national utility is not completely the same as the results calculated in this paper. But through our calculation, even though we adopt other forms of consumption utility function, the growth rate of national utility is still much smaller than that of national income in China, which has no effects on the conclusion in this article.

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Note

Note 1. m >1000, so we let m/1+m ≈1.