Recalculation of China's Total Factor Productivity Based on Capital Stock

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Abstract: Based on the ten classifications of assets, we use different hyperbolic efficiency decreasing parameters and average service life, respectively simulate the age-efficiency function, age-price function and age-depreciation rate function of the ten major asset groups to estimate the *net* capital stock of China, and then recalculate the total factor productivity. This study finds that since 1978, China's *net* capital stock has increased significantly, it has increased from 497.7 billion yuan in 1978 to 15,847.6 billion yuan in 2016, with an average annual growth rate of 9.5%. And the growth rate of TFP has been declining in general since 1992, then it has gradually stabilized at more than two percentage points around 2012, and the average contribution rate has remained above 30%.Compared with other studies using the gross capital stock to overestimate the TFP, the results of this paper can help to understand the real situation of TFP in China. This study promotes the capital accounting from the *gross* accounting to the *net* accounting, and is of great significance for the preparation of national and local balance sheets.

1. Introduction

1.1 Background

In the neoclassical growth model, capital is an input element of the production function.Many researchers,such as Solow [1] have used capital stock as the capital input in the produce progress.Therefore, the first thing to measure TFP is to accurately measure capital investment.However, China's capital statistics are very weak and the data gap is large. Existing data is difficult to meet the estimation of capital stock in terms of concept, caliber, scope, precision, etc. In China's economic growth and related research, how to accurately calculate China's capital stock has always been a problem that plagues researchers.And in recent years, more and more researchers have begun to explore methods and techniques for measuring capital stocks,such as Zhizhuang Zou [2], Jun Zhang et al[3] and so on.

1.2 Limitations of Existing Research

When measuring TFP, most researchers use the total capital stock as a capital input.From the point of view of calculation methods,domestic scholars are generally adopt the simplified formula of *Perpetual Inventory Mothed* proposed by Goldsmith [4] ,and the measurement result is called the *gross* capital stock. Under the hypothesis of geometric efficiency diminution, the capital replacement rate is equal to the depreciation rate and is simply constant. The formula can be simplified as:

$$K_t = I_t + (1-\delta_t)K_{t-1} = \sum_{i=0}^{t-1}(1-\delta_t)^i I_{t-i} + (1-\delta_t)^t K_0 \quad (1)$$

Among them, K_0 is the *gross* capital stock of the initial year, I_t is the investment over the years and δ_t is reset rate. Because different researchers deal with the indicators above differently, the estimation results vary greatly. From the calculation formula alone, you can find the following problems:

In the strict sense of formula (1), δ_t is the capital replacement rate rather than the depreciation rate. Most of the literature confuses this point. A few scholars such as Ruoen Ren et al[5]have made a strict distinction. The two will be equal only when the relative efficiency of the asset obeys the geometric decay mode. In addition, when using formula (1) to estimate the capital stock, the depreciation rate is constant,it may not conform to the law of capital value change.

Formula (1) does not completely solve the problem of retired capital. In the calculation formula, the initial stock K_0 and the early investment will always exist in the *gross* stock of the current period K_t, but the longer the period from the initial year, and the smaller the impact of the early investment, but it must exist in the calculation, so the algorithm is biased.

1.3 The Purposes and Innovations of This Paper

This paper takes the TFP as the research object,and replace capital input by remeasurable *net* capital stock rather than the *gross* capital stock. The innovations and contributions mainly include:

First, the *net* capital stock is the remainder of the *gross* capital stock after deducting capital consumption. The *net* capital stock is used instead of the *gross* capital stock as the capital input item, which can measure TFP more accurately.

The second is based on the full breakdown of asset classes. Different types of capital have different average service life and efficiency decay characteristics. Compared with the existing literature on *equipment*, *construction and installation engineering* and *other cost* three classification methods, this paper uses Wei Wang et al[6]classification method to divided fixed assets into *agricultural capital goods*, *furniture sports and entertainment facilities*, *metal products*, *machinery equipment* (*general and purpose*), *transportation equipment*, *electrical equipment*, *computer and communication equipment*, *instrumentation*, *buildings and real estate* and *intangible fixed assets*, a total of ten categories.The *net* capital stock and *capital consumption* will be more accurately estimated.

The third is to adopt a hyperbolic efficiency decay mode that is more in line with the law of attenuation of capital efficiency. The geometric attenuation mode emphasizes that the initial use of the capital is attenuated quickly, and the later decay is slow, which is not in line with the law of attenuation of asset use efficiency. The hyperbolic decay mode is just the opposite. It describes the characteristics of slow decline in the early period and fast decline in the later period.

The rest of the paper is organized as follows: The second part details the theoretical framework of *net* capital stock and TFP estimation; the third part introduces data sources and estimation results; the fourth part compares with other studies based on the estimation results of this paper;finally, summarize the full text.

2. Estimation Theory

2.1 Average Age-efficiency Function and Average Age-price Function of the Asset Group

An asset investment occurs in the middle of the year t and is valued at the mid-term price. Abandonment and payment occur at the end of the period. Recorded n as the age of the asset, then n=0 indicates the new asset, n=0.5 indicates the first year of service. Let f_n^t be the unit user cost of the n-year old asset in year t, under the market conditions, capital goods with higher unit user cost should have higher production efficiency, and the efficiency function of single capital under different ages is:

$$g_n = f_n^t \,/\, f_0^t, n = 0, 0.5, 1.5, 2.5... \tag{2}$$

This paper draws on the practice of the *US Bureau of Labor Statistics* and the *Australian Bureau of Statistics* to select the hyperbolic efficiency decay mode. The function is $g_n = (T-n)/(T-b*n)$,T is the service life of the capital, b is the efficiency attenuation parameter. For buildings and real estate, the efficiency attenuation parameter b=0.75, other assets b=0.5. In reality, producers often have multiple types and amounts of capital of different ages. Capitals of different ages can be replaced by each other, and producers who aim at minimizing market conditions under market conditions will use capital goods of different ages. The same type of assets are grouped into asset groups. Some of the capital is replaced by new capital and is no longer used in the production process, it is called retirement of capital. The most common mode of retirement is bell-shaped . This article draws on the practice of the *Canada Bureau of Statistics*, using a normal distribution retirement model.

Then the average age-efficiency function of the asset group is:

$$h_n = \sum_{T=n}^{T^{MAX}} g_n(T)F(T),\ n = 0,\ 0.5,\ 1.5 \ldots T^{MAX} \tag{3}$$

Let tB, tE denote the beginning and end of year *t*, P_n^{tB}, P_n^{tE} denote the *n*-year old asset price , and define the average age-price function of asset in year *t* as:

$$\psi_n = P_n^{tB} \big/ P_0^{tB},\ n = 0.5,\ 1.5,\ 2.5 \ldots \tag{4}$$

Under the equilibrium of capital markets, the average age-price function of the asset group has the following relationship with the average age-efficiency function:

$$\psi_n = \frac{P_n^{tB}}{P_0^{tB}} = \frac{h_n + h_{n+1}(1+i)(1+r)^{-1} + h_{n+2}(1+i)^2(1+r)^{-2} + \ldots}{1 + h_1(1+i)(1+r)^{-1} + h_2(1+i)^2(1+r)^{-2} + \ldots} \tag{5}$$

Among them, *i*,*r* are holding profit and loss ratio and return on assets. In addition, according to the meaning of *capital consumption*, the depreciation rate is: $\delta_n = (P_n^{tB} - P_{n+1}^{tB}) / P_n^{tB},\ n = 0.5,\ 1.5,\ 2.5 \ldots$

2.2 *Net* Capital Stock and *Capital Consumption*

The I^t, W^{tB}, W^{tE} indicate the capital investment, the beginning and ending capital stocks of year *t*, respectively. According to the average age-price function of the asset group,when the various asset investments are served to year *t*, the beginning and ending *net* capital stocks or capital wealth that are calculated at the base period price of year *t* are:

$$W^{tB} = \psi_{0.5} I^{t-1} + \psi_{1.5} I^{t-2} + \psi_{2.5} I^{t-3} + \ldots + \psi_{T.5} I^{t-T} \tag{6}$$

$$W^{tE} = \psi_{0.5} I^{t} + \psi_{1.5} I^{t-1} + \psi_{2.5} I^{t-2} + \ldots + \psi_{T.5} I^{t-T} \tag{7}$$

The *net* annual average capital stock is a simple average at the beginning and end of the period. Since the new investment occurs in the interim period, half of the investment in year *t* is depreciated, then the *t*-year *capital consumption* calculated at the average price of *t* is:

$$D^t = P_0^t \delta_0 I^t / 2 + P_{0.5}^t \delta_{0.5} I^{t-1} + P_{1.5}^t \delta_{1.5} I^{t-2} + \ldots + P_{T.5}^t \delta_{T.5} I^{t-T} \tag{8}$$

2.3 Total Factor Productivity

We use the Solow residual method to estimate TFP.The basic idea is to estimate the TFP growth after estimating the total production function and using the output growth rate to deduct the growth rate of each factor input.Under the assumption that the scale returns are constant and Hicks technology is neutral:

$$g = \alpha g_K + \beta g_L + g_A \tag{9}$$

Among them,*g* is the output growth rate, g_K is the capital investment growth rate, g_L is the labor input growth rate, and g_A is the TFP growth rate.We estimate their marginal elasticity α and β through the share method according to the net capital stock and labor input data.Finally， the TFP growth rate can be obtained by simply calculating the above formula.

3. Data Sources and Results Estimation

3.1 Indicator Selection and Missing Data Processing

The *net* capital stock is the cumulative after the investment has been decommissioned and the efficiency is reduced over the years. Therefore, the estimated *net* capital stock must first face the problem of investment indicator selection. Taking into account the actual situation, this paper uses the fixed capital formation total to calculate the *net* capital stock.

Capital accounting should be based on a fully segmented asset class to ensure that the average life expectancy and decay laws within the asset group are similar. This article follows the ten classification practices of Wei Wang et al and the data from 1978-2016. In order to accurately calculate the *net* capital stock, we calculate the proportion of average value of each type of asset investment in the average of the corresponding total investment amount in the three years from 1979 to 1981, and then ,we use these proportions to devide the amount of fixed capital formation from 1952 to 1978 that obtained from the *China Statistical Yearbook* into ten categories. Finally, the amount of investment in various assets from 1952 to1978 at current prices was obtained.

For the price index, the data from 1978 to 2016 also adopts Wei Wang et al. For the period 1952-1978,we use the retail price index to convert investment amount of various assets at the current price to the investment amount at the constant price of 1978. Finally, we get a sequence of fixed capital formations at the constant price of 1978 ranging from 1952 to 2016.

3.2 Determination of the Average Service Life of Various Assets

About asset service life Yuequn Cao et al[7]suggested that the longest service life of a building is 40 years, the equipment is 16 years, and the other expenses are 20 years. We believe that with the economic take-off after the reform and opening up, the cycle of capital change has been greatly shortened, and with the advancement of urbanization, various types of construction equipment have been retired in advance, shortening the life of assets. Therefore, according to the *Depreciation Year of Fixed Assets Classification of State-Owned Enterprise*s issued by the *Ministry of Financ*e in 1994 and the minimum depreciation period stipulated in the *Regulations on the Implementation of the Enterprise Income Tax Law of the People's Republic of China* issued by the *State Council* in 2008, the average service life of the ten types of fixed assets in this paper is set as follows: *furniture sports and entertainment facilities*, *computer and communication equipment* are 4 years; *agricultural capital products* is 5 years; *instrumentation* and *intangible fixed assets* are 6 years; *transportation equipment* and *electrical equipment* are 7 years; *metal products* is 8 years;*mechanical equipment (general purpose)* is 9 years; *buildings and real estate* is 20 years. The longest service life of all types of assets is twice the average service life.

3.3 Asset Holding-loss Rate and Return on Capital

The holding profit-loss rate i and return rate of various assets r are important parameters for estimating the average age-price function. For i ,this paper uses the geometric average growth rate of the 1978-2016 investment price index series to approximate. For r, it is assumed that the return of various assets remain unchanged during the accounting period, and draw on the research ideas of Peiwen Bai et al[8] , considering the very different distribution of ten types of fixed assets (excluding intangible fixed assets) in various trades. In the actual situation of disparity, we use the return on capital of the three properties to approximate the return of the ten types of assets.

Among them, since intangible fixed assets investment will exist in three properties, based on the research results of Min Zhao[9]on the intangible assets industry characteristics of listed companies, we first consider the proportion of intangible assets in the three properties, and use these proportions as the weight to sum the eight-year simple average return rate of the three properties. The estimated results are shown in Table 1.

Table 1 Average return rate r and holding profit-loss ratio i of ten assets

	Holding profit-loss ratio i	Average return rate r
Agricultural capital goods	0.051	0.090
Furniture sports and entertainment facilities	0.032	0.1763
Metal products	0.035	0.1763
Machinery equipment	0.042	0.1763
Transportation equipment	0.028	0.1119
Electrical equipment	0.038	0.1763
Computer and communication equipment	-0.021	0.1119

Instrumentation	0.034	0.1763
Buildings and real estate	0.073	0.1763
Intangible fixed assets	0.095	0.1436

3.4 Labour Input Data

In the estimation of the total amount of input of labor factors, labor input can be replaced by the value of labor value. At the same time, it has the dual attributes of quantity and price. Labor time is used as the quantity of labor input, labor price index is the labor input price, and the research ideas of Yuezhou Cai[10] are used for reference. And the estimation method, the total amount of labor input is shown in the following Table 2:

Table 2 Labour input :1978-2016 (constant price of year 2012 , unit:100 million yuan)

year	Labour value	Labor time	year	Labour value	Labor time
1978	2121.79	178039.23	1998	44329.20	297661.76
1979	2352.63	183663.69	1999	47165.80	300549.03
1980	2618.77	186910.57	2000	52282.40	305104.74
1981	2803.51	191648.22	2001	57575.70	273918.47
1982	3035.10	196797.60	2002	64524.40	274200.93
1983	3381.81	199835.79	2003	71722.30	271422.68
1984	4066.65	205515.74	2004	80898.42	276499.62
1985	5059.73	211008.25	2005	93023.51	272428.67
1986	5735.73	215711.68	2006	106210.40	278324.75
1987	6695.27	221028.27	2007	127588.90	288096.19
1988	8307.30	226605.72	2008	150067.19	290581.19
1989	9333.21	229771.14	2009	166469.00	292043.97
1990	10197.81	267562.12	2010	190044.90	265331.31
1991	11833.77	269143.87	2011	221458.20	259793.98
1992	14696.70	270490.58	2012	255599.50	255599.50
1993	18173.40	272188.87	2013	289526.93	251405.02
1994	25206.00	274415.51	2014	313116.03	247210.54
1995	32087.40	277155.13	2015	346559.62	243119.88
1996	37085.80	293028.76	2016	379159.94	239080.27
1997	41856.60	291880.52			

According to the above accounting method and related indicator data, this paper estimates the *net* capital stock and TFP of China. The estimated results are shown in Table 3 and Table 4.

Table 3 China's capital stocks measured by ten types of assets:1978-2016 (1978 constant-price,Unit: 100 million yuan)

	Agricultural capital goods	Furniture and-entertainment facilities	Metal products	Machinery equipment	Transportation-equipment	Electrical equipment	Computer andcommunication-equipment	Instrumentation	Buildings	Intangible fixed assets	National
1978	70.26	1.63	9.87	723.37	106.00	26.20	21.30	11.10	4007.33	0.00	4977.07
1979	71.34	1.63	10.30	759.90	109.32	27.08	20.98	11.46	4296.40	0.00	5308.40

1980	69.32	1.54	10.36	771.76	108.54	26.95	19.77	11.33	4518.83	0.00	5538.41
1981	71.52	1.64	10.58	787.79	111.52	27.63	21.40	11.53	4732.80	0.00	5776.41
1982	77.14	1.89	10.98	809.46	118.30	29.15	25.39	12.04	4940.64	0.00	6025.00
1983	85.18	2.25	11.56	837.96	128.82	31.53	31.28	12.85	5144.94	0.00	6286.37
1984	93.49	2.71	13.76	874.21	142.99	34.75	38.89	13.92	5348.54	0.00	6563.25
1985	101.58	3.27	17.73	923.81	159.97	39.60	50.82	15.73	5554.66	0.00	6867.17
1986	111.60	3.96	21.75	986.32	187.20	46.09	67.78	18.27	5766.85	0.00	7209.80
1987	118.66	5.21	24.57	1066.91	235.80	54.73	80.69	21.74	5980.75	0.00	7589.07
1988	119.45	6.81	26.44	1153.52	283.23	65.64	87.37	24.39	6166.64	0.00	7933.49
1989	116.58	8.10	27.97	1210.87	302.90	74.47	92.21	23.99	6302.85	0.00	8159.95
1990	113.60	9.13	29.44	1245.29	302.75	82.73	97.81	21.98	6404.88	0.00	8307.61
1991	119.83	9.18	31.50	1329.72	321.89	90.88	115.26	22.37	6561.93	1.62	8604.18
1992	137.83	7.91	33.89	1493.21	381.63	93.72	147.24	27.24	6803.67	5.68	9132.04
1993	164.73	9.16	39.66	1677.43	465.06	97.42	256.93	33.46	7126.00	12.28	9882.12
1994	192.83	14.48	51.70	1863.54	568.60	107.99	465.73	38.68	7606.69	20.72	10930.94
1995	209.96	21.27	69.33	2070.84	691.84	122.97	698.60	42.64	8289.75	29.08	12246.28
1996	218.08	33.53	88.76	2275.27	825.86	147.75	875.68	45.93	9127.60	35.50	13673.97
1997	228.21	54.38	106.41	2460.77	971.51	188.21	977.55	49.74	10070.99	39.12	15146.90
1998	246.55	74.49	123.47	2625.12	1141.00	253.24	1103.69	56.29	11126.11	40.80	16790.76
1999	272.35	87.52	141.71	2758.36	1336.84	351.63	1295.28	66.99	12289.65	41.14	18641.48
2000	300.26	96.21	160.59	2865.42	1553.65	478.49	1520.21	80.84	13529.34	40.64	20625.66
2001	324.83	102.06	184.13	3075.00	1766.82	574.07	2110.73	95.32	14882.89	39.46	23155.32
2002	343.74	107.43	217.22	3503.98	1957.38	589.75	3322.50	108.52	16411.78	37.89	26600.19
2003	376.29	125.47	275.62	4232.07	2185.50	622.74	5046.29	160.02	18173.40	37.20	31234.59
2004	426.17	161.79	365.07	5287.22	2497.78	745.77	7157.08	280.17	20134.93	37.90	37093.87
2005	476.16	206.46	473.06	6573.94	2874.65	931.25	9523.30	451.55	22281.92	39.15	43831.43
2006	498.74	315.53	578.78	7935.09	3594.81	1218.13	11128.17	598.72	24831.34	41.43	50740.73
2007	472.03	525.31	662.67	9225.80	4870.09	1636.35	11292.90	663.61	27797.74	44.64	57191.13
2008	466.12	750.20	698.99	10561.76	6743.10	2189.68	11500.75	696.98	31008.61	51.51	64667.69
2009	552.80	934.07	678.85	12132.70	9257.85	2920.87	12875.66	744.01	34818.20	64.40	74979.42
2010	710.67	1086.85	619.53	13940.03	12237.33	3764.07	15023.85	808.46	39315.51	79.91	87586.21
2011	825.18	1124.97	673.22	15953.35	15256.50	4421.43	16533.82	847.75	44084.78	166.48	99887.50
2012	840.07	1003.95	973.74	18214.40	18028.58	4763.24	16667.99	826.30	49256.18	362.29	110936.74
2013	834.29	890.46	1376.20	20436.98	20427.07	4979.89	16750.45	792.46	55003.40	627.25	122118.44
2014	859.88	886.58	1748.72	22337.42	22344.04	5188.17	17617.49	785.35	61230.58	930.88	133929.11
2015	913.78	949.23	2091.81	23979.68	23908.33	5413.99	18963.00	801.85	68068.82	1233.78	146324.28
2016	970.36	1010.17	2505.61	25388.73	25237.60	5644.08	19905.12	822.88	75487.47	1504.49	158476.52

Table 4 China's TFP growth and contribution rate (Unit:%)

year	GDP growth	TFP growth	TFP contribution	year	GDP growth	TFP growth	TFP contribution
1992	14.2	10.93	76.94	2005	11.4	6.37	55.87
1993	13.9	10.24	73.70	2006	12.7	5.35	42.15
1994	13	8.88	68.34	2007	14.2	6.05	42.61
1995	11	6.43	58.43	2008	9.7	3.00	30.92
1996	9.9	2.24	22.64	2009	9.4	2.31	24.56
1997	9.2	5.31	57.71	2010	10.6	8.46	79.83
1998	7.8	2.39	30.61	2011	9.5	3.96	41.70

1999	7.7	2.86	37.17	2012	7.9	2.34	29.57
2000	8.5	3.48	40.97	2013	7.8	2.58	33.09
2001	8.3	10.14	122.14	2014	7.3	2.41	33.03
2002	9.1	4.70	51.66	2015	6.9	2.34	33.91
2003	10	5.62	56.19	2016	6.7	2.47	36.82
2004	10.1	3.41	33.73				

4. The Analysis of Estimated Results

4.1 Comparison of Net Capital Stock and Other Studies

This paper compares the estimated results with the *gross* capital stock estimated by Yuequn Cao et al , Lisheng Shen et al[11] , Wei Wang et al, Mingming Gu[12]. The study of Yuequn Cao et al includes the *gross* capital stock at constant price (hereinafter referred to as Cao Yuequn 1) and the *net* capital stock at constant price (hereinafter referred to as Cao Yuequn 2).

As shown in Figure 1, measured by 1978 price,the trend of the *net* capital stock measured in this paper is basically consistent with the trend of the *gross* capital stock measured in other researches. However, in terms of the total scale, the results of this paper are significantly lower than the results of Cao Yuequn 1, Lisheng Shen et al and Wei Wang et al. The main reasons are as follows: First, the measurement of this article is the *net* capital stock, considering in as the age of service increases, the efficiency of use decreases, and also leads to a decrease in the unit use cost (ie, price) . However, these factors are not considered in other literatures. Second,the calculation method in the existing literatures implies that the life of capital service is infinitely long, and the decommissioned capital is not completely deducted. As mentioned earlier, this will result in the initial year stock and early investment will be included in the current stock with a certain share, so that the current capital stock is overvalued. However, the calculation method of this article completely deducts the decommissioned assets, which is another important reason for the difference in results.

As for the results of this paper, which is lower than Cao Yuequn 2, the first reason is to consider the actual situation of accelerating capital renewal. As mentioned above, this paper selects the actual service life for each type of capital, which shows the acceleration of *capital consumption* and the amount retained and counted in the current period becomes less. Second, Yuequn Cao et al used the 1990-2010 national fixed asset investment price index as the price index for the three types of fixed assets in the corresponding year, however, according to the results of Wei Wang et al, various asset price indices are generally higher than the national fixed asset investment price index. Considering that the latter is a price index estimated on the basis of segmented assets, therefore, it is reasonable to believe that the practice of Yuequn Cao et al and others actually underestimated the price index, resulting in a higher *net* price capital stock.

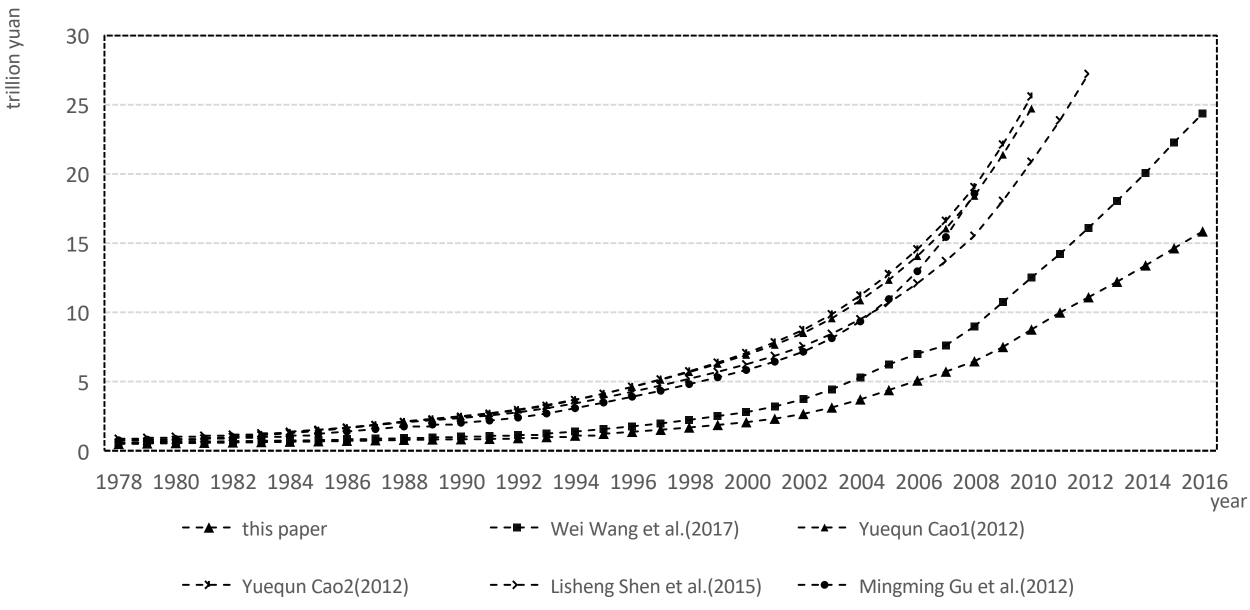

Fig. 1 China's capital stock measured by different researchers

4.2 The Analysis of TFP

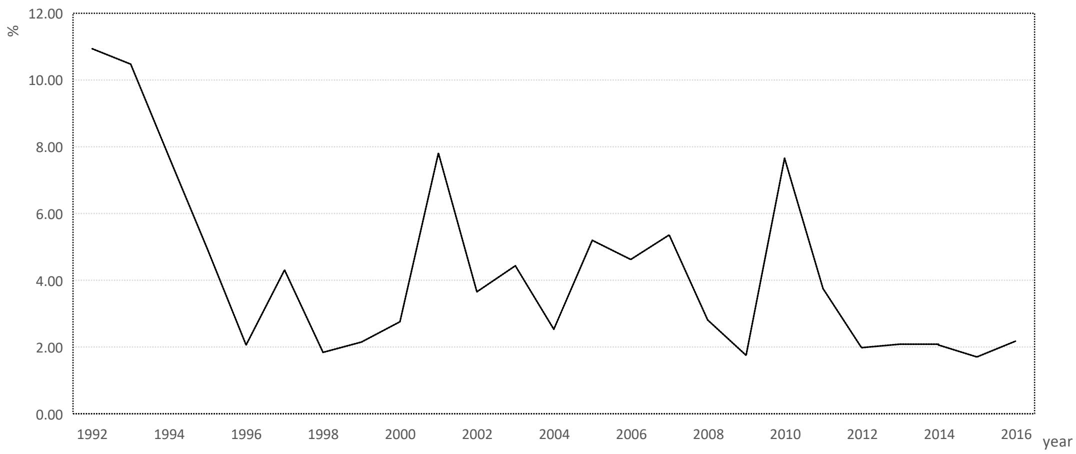

Fig.2 China's TFP growth rate changes：1992-2016

The growth rate of TFP has been declining in general since 1992, and it has gradually stabilized at more than two percentage points around 2012, and the average contribution rate has remained above 30%. The main reason is that as the macro economy gradually cools down the overall overcapacity of China's economy, the reduction of state-owned enterprises and the excessive deepening of capital further aggravate the low-level utilization of labor, long-term low-level public education expenditures and scientific research expenditures.

Besides,by comparing other research results, we can find that the TFP growth rate measured in this paper is generally high. We conclude that the most important reason for the difference between the results of this paper and other studies is the estimation of capital investment. Specifically, other studies generally use the *gross* capital stock as a capital input item. Compared with the *net* capital stock data instead of capital investment, their research overestimates the amount of capital investment in China to a certain extent, thus overestimating the capital factor. Under the same labor input, this bias will drive down the TFP growth rate. The calculation results of this paper also question Paul Krugman (1991)'s "East Asia without miracles" argument, and think that the calculation results of "Asian Four Little Dragons" TFP are also certain underestimation.

5. Summary

Based on the top ten classifications of assets such as Wei Wang et al, this paper analyzes the shortcomings of the traditional measured *gross* capital stock, proposes a method for estimating the *net* capital stock and recaluculates the TFP of China. The results show that the *net* capital stock of China has increased from 497.7billion yuan in 1978 to 15,847.6 billion yuan in 2016, with an average annual growth rate of 9.5%. And the growth rate of TFP has been declining in general since 1992, and it has gradually stabilized at more than two percentage points around 2012, and the average contribution rate has remained above 30%.

On the other hand, changes in TFP reflect not only technological advances, but also changes in management, institutional changes, and factor quality. Appropriate use of total factor productivity will help to enhance understanding of China's economic growth. However, if we analyze the quality of economic growth according to the change of total factor productivity, the one-sided pursuit of the improvement of total factor productivity or the so-called transformation of economic growth mode cannot guarantee the effective use of China's capital and labor resources. For economic growth, the effective allocation of resources is the most important. Making our limited resources fully and effectively used should be our preferred way to achieve economic growth.

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