The Measurement of Capital Stock of China

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Abstract— Capital stock is an important indicator in economics, it is an important indicator to measure the social and economic development status. But the research of capital stock is not wildly contributed. This paper is to measure capital stock and forecast future capital stock with time series models. The author conducts empirical methods based on the measurement methods of previous scholars. The paper concludes that the capital stock is growing stably, and with established new mathematical models and time series models, and combined with the latest data, measures the capital stock of China.

1 Introduction

Capital stock is an important indicator in economics, especially for economists who focus on economic growth. There is a lot of classical models containing the capital stock. for example, but up to now, there is no Sophisticated and generally-accepted standard accounting method. The capital stock is an important indicator to measure the social and economic development status.

The research of capital stock is not wildly contributed. The data is hard to get, this research gap will take a lot of time of scholars to measure the stock during their work. There are no recent data for provincial capital stock, and the data is usually stop 2018, because the statistics bureau did not provide new data. This paper is to measure capital stock for the recent 24 years' capital stock of 31 provinces.

In this paper, the capital stock data of 31 provinces on the mainland was remeasured the author's models. At the same time, the paper makes a forecast for the next 5 years until 2022. these data will benefit other scholars whose research contains the capital stock elements.

2 Critical Literature Review

Chen (2012) measures the depreciation rate and capital stock [1]. Chen uses a new econometric model to estimate the depreciation rate, uses four models, uses the maximum likelihood estimation method, and uses the Monte Carlo method to ensuring accuracy at the same time. The depreciation rate is related to the economic growth rate. At the same time, China's economic structure is constantly changing with economic reforms, and the capital stock is also constantly changing. This article refers to its measurement model section to measure the depreciation rate, and the conclusions about the depreciation rate and economic growth rate are applied to the base period stock estimate.

Liu (2016) measures the state-own capital stock, Capital stock and capital services are the basis for measuring the total amount of capital [2]. Therefore, this paper measure the scale and accounting of China's state-owned fixed capital stock, and adopts the perpetual inventory method and Harrod-Domar model to provide important data support and methods for the subsequent research of China's state-owned capital. Provide the data and methods supports for scholars.

Based on the calculation of the depreciation rate, the depreciation of fixed capital in various regions is theoretically derived [3]. With these outcomes, Li (2016) adopts the depreciation of fixed capital in various regions from 1993 to 2012, and calculates the depreciation of fixed capital in China from 1993 to 2012. The capital coefficient is slowly increasing, which further validates the previous research. Using the depreciation of China 's fixed capital, the estimated depreciation rate of China 's fixed capital during 1992-2012 was about 5%. Based on the estimated fixed capital depreciation rate, the capital stock of China from 1993 to 2012 is calculated, and its value is between the capital stock estimated by previous research.

Zhang and Cao (2019) studied the capital stock data and measured economic data using the perpetual inventory method [4]. At the same time, it compares the data of other authors and provides a reference benchmark for the conclusion of the article.

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3   mthodology

The paper adopts a different capital perpetual inventory method compared the previous research, the model comes from Solow Growth Model.

$$K_t = I + (1 - \delta)K_{t-1} \tag{1}$$

$$I = sY \tag{2}$$

Combine (2) and (3). We have function (4).

$$K_t = sY + (1 - \delta)K_{t-1} \tag{4}$$

$$h = s \cdot (1 - o - j) \tag{5}$$

The h is the adjusted saving rate, o is the rate of the population who are under 15 years old, j o is the rate of the population who are over 65 years old, these parts of people are more intended to consume rather than saving.

$$K_t = hY + (1 - \delta)K_{t-1} \tag{6}$$

About the uncomplete investment data, we use averaged h (past 2 years and future 2 years) to measure.

$$I = Y \cdot h \tag{7}$$

About the year of benchmark.

$$I = k_t - (1 - \delta)k_{t-1} \tag{8}$$

$$K_t = I_{t+1} - \delta K_t \tag{9}$$

$$q = \frac{K_t}{Y_t} \tag{10}$$

$$K_t = \frac{I_{t+1} - \Delta K}{\delta_t} = \frac{I_{t+1}}{\delta_t + \frac{\Delta K}{K_t}} \tag{11}$$

The capital stock growth rate is similar with the economic growth rate.

$$K_t = \frac{I_{t+1}}{\delta_t + GR_t} \tag{12}$$

GR is the economic growth rate.

$$K_0 = \frac{I_1}{\delta_0 + GR_0} \tag{13}$$

Thus, the first periods capital original reserve can be measured.

About the depreciation rate.

$$= \sum_{i=0}^{t-1} I_{t-1}(1 - \delta_t) + (1 - \delta_t)K_0 \tag{14}$$

$$Y = AK^\alpha L^{1-\alpha} \tag{15}$$

$$ln(Y) = ln(A) + \alpha \, ln(L) + (1 - \alpha) \, ln(k) \tag{16}$$

$$\delta_t = \delta_1 + \delta_2 x_{2t} \tag{17}$$

According to Chen, the depreciation express as above, can be shown as above.

TABLE I.   THE OUTCOME OF EMPIRTICAL STUDY

	Coefficient
α	0.40
Intercpt	0.7
δ_1	0.058
δ_2	-0.02

After measurement of capital stocks, adopt ARIMA model to analyze the future quantities. The all result will be illustrated in chapter IV.

4   Rseults

TABLE II.   THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	BEIJING	*TIANJING*	*HEBEI*	*SHANXI*
1994	1838.907	716.675	2224.3	777.7369
1995	2486.707	1060.694	3118.253	1031.496
1996	2798.649	1409.545	4242.114	1345.686
1997	3484.102	1821.602	5546.26	1692.105
1998	4198.884	2239.545	6940.415	2145.321
1999	4899.278	2654.502	8376.764	2471.652
2000	5600.269	3126.893	9934.797	2817.938
2001	7049.797	3721.998	11552.33	3353.801
2002	8736.378	4397.546	13286.46	3974.852
2003	10687.71	5264.132	15316.6	4828.287
2004	13119.48	6414.092	18020.23	5986.458
2005	15130.79	7931.905	21337.05	7330.321
2006	17470.43	9614.159	25033.02	8865.983
2007	20361.2	11561.66	29498.29	10940.13
2008	23352.41	14267.85	34842.51	13583.44
2009	26506.38	17199.56	40460.52	15861.91
2010	30225.24	20825.05	47286.25	18959.63
2011	34180.25	25190.81	55652.42	22822.15
2012	38266.46	30063.11	64035.37	26660.82
2013	42634.97	35307.73	72590.27	30223.63
2014	46727.13	40985.31	80851.71	33476.57
2015	50850.33	46119.78	88321.49	35989.46
2016	56030.42	51333.57	95982.62	38314.82
2017	61823.52	56607.93	103287.2	41312.38
2018	67616.62	61932.47	110385.2	44621.03
2019	73409.72	67296.75	117363.5	47929.67
2020	79202.83	72693.3	124272.5	51238.32
2021	84995.93	78115.68	131141.4	54546.97
2022	90789.03	83558.91	137986.9	57855.61

TABLE III. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	I MOGNOLIA	*LIAONING*	*JILIN*	*HEILONG JIANG*
1994	599.9531	3201.848	729.3189	1081.83
1995	815.4261	3969.137	1007.723	1603.76
1996	1035.681	4805.956	1338.031	2369.76
1997	1306.064	5744.817	1650.716	3103.45
1998	1617.31	6734.582	2002.93	3833.78
1999	1925.143	7748.185	2378.178	4502.4
2000	2269.665	8900.071	2742.931	5305.4
2001	2720.625	10111.38	3206.239	6006.53
2002	3206.15	11413.02	3739.655	6735.99
2003	3919.656	13033.99	4316.111	7633.49
2004	4935.347	14919.2	5064.345	8749.71
2005	6340.197	17380.65	6145.114	10511.9
2006	8174.719	20435.69	7490.324	12490.2
2007	10663.05	24395.66	9215.995	14638.1
2008	14198.29	29414.62	11396.17	17069
2009	17980.36	34806.65	13862.83	19201.5
2010	22645.95	41524.81	16992.7	22095.7
2011	28366.46	49981.51	21014.33	25669.9
2012	34360.77	59072.74	25405.78	29402.7
2013	40281.62	68370.37	29923.52	32982.7
2014	46369.75	77343.68	34819.38	36087.1
2015	51996.92	85183.18	39463.47	38941.6
2016	56891.73	87587.84	44324.53	41413.3
2017	59761.31	90183.82	48878.07	43694.8
2018	60902.66	92779.81	53421.28	45895.3
2019	60569.22	95375.79	57828.83	48061.2
2020	58977.27	97971.77	62186.23	50212.5
2021	56311.36	100567.8	66468.43	52357.4
2022	52728.98	103163.7	70703.73	54499.8

2011	45798.87	108015.2	71625.32	24491.14
2012	50307.52	125647.9	82169.03	29430.12
2013	55117.22	143748.7	93524	35077.84
2014	59770.44	161263.4	104371.8	40839.55
2015	64564.75	178286.9	115425.9	46522.02
2016	70258.37	196405.6	127802.9	52419.14
2017	76395.06	216895	140343.1	58878.06
2018	82563.43	239318.5	153299.7	65794.85
2019	88731.81	263320	166652.1	73084.81
2020	94900.18	288608.8	180380.4	80678.91
2021	101068.6	314947.9	194465.7	88520.89
2022	107236.9	342143.8	208890.2	96564.91

TABLE V. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	FUJIAN	*JIANGXI*	*SHANDONG*	*HENAN*
1994	848.3136	618.7282	3025.103	1721.948
1995	1398.962	835.5369	4557.576	2541.622
1996	2085.426	1192.534	6382.923	3553.271
1997	2879.072	1580.808	8386.037	4649.127
1998	3795.824	1997.438	10483.18	5820.931
1999	4756.783	2422.75	12652.53	7005.969
2000	5790.643	2789.406	15154.05	8248.529
2001	6802.977	3199.557	17706.86	9475.913
2002	7881.461	3722.653	20587.58	10775.79
2003	9127.929	4435.732	24135.89	12250.92
2004	10643.75	5288.396	28951.02	14345.83
2005	12452.26	6308.85	35252.22	17307.64
2006	14556.94	7650.626	42663.74	20829.12
2007	17387.75	9319.559	51269.5	25649.12
2008	20676.57	11409.29	61589.67	31679.6
2009	24699.29	13701.57	73414.28	37656.57
2010	29858.58	16497.89	87118.86	44749.84
2011	35947.74	19928.89	102527.2	53090.23
2012	42915.48	23608.76	118796.5	61724.88
2013	50738.21	27523.32	136271.6	70357.65
2014	58898.86	32069.54	154453.7	79160.06
2015	67025.85	36125.28	172633	87626.13
2016	75873.04	40492.67	188426	96460.16
2017	85918.35	45204.82	203521.5	105867.8
2018	97045.6	49633.93	218082.3	115634.9
2019	109149.9	54358.05	232233.1	125627.4
2020	122136.5	59235.19	246069.6	135761.2
2021	135919.8	63975.42	259665.1	145983.4
2022	150422.7	68951.37	273075.9	156261.2

TABLE IV. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	SHANGHAI	*JIANGSU*	*ZHEJIANG*	*ANHUI*
1994	2266.375	4065.224	2401.491	826.6986
1995	3157.202	5864.498	3726.934	1203.114
1996	4112.249	7842.31	5046.602	1929.74
1997	5302.724	9964.981	6678.231	2524.166
1998	6596.873	12273.94	8338.787	3142.055
1999	7952.282	14698.11	10057.73	3682.408
2000	9468.402	17370.48	11874.54	4223.908
2001	11291.01	20135.58	13850.15	4770.65
2002	13153.96	23232.89	16205.74	5398.893
2003	15435.72	27084.97	19333.12	6093.354
2004	18424.96	31792.6	23405.94	7057.696
2005	21195.64	38298.9	27453.57	8280.427
2006	24350.92	45780.43	32194.46	9715.894
2007	28188.6	54693.87	38107.08	11540.47
2008	32239.53	65353.54	44994.31	13770.14
2009	36483.22	77018.94	52099.02	16514.3
2010	41051.26	91389.63	61217.58	20038.79

TABLE VI. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	HUBEI	*HUNAN*	*GUANG DONG*	*GUANGXI*
1994	1140.264	924.9485	4715.446	556.9698
1995	1596.26	1368.51	6124.73	820.2908
1996	2427.17	1880.31	7505.707	1202.766
1997	3441.904	2489.395	9149.137	1593.171

1998	4453.775	3148.773	10946.34	1894.59
1999	5490.003	3756.022	12938.81	2197.299
2000	6646.726	4473.412	15098.43	2488.551
2001	7298.833	5146.381	18458.27	2830.141
2002	8009.314	5870.181	21933.52	3253.004
2003	8831.33	6850.196	26318.98	3766.718
2004	9854.522	8144.694	32116.17	4471.498
2005	11491.37	9543.782	38434.19	5272.392
2006	13356.13	11282.74	46475.5	6333.347
2007	15910.63	13677.76	56312.75	7747.02
2008	19169.43	16805.59	67749.4	9535.467
2009	23167.44	20513.78	79998.65	11391
2010	28429.87	25473.38	94463.92	14021.25
2011	34973.62	31563.72	110284.3	17448.62
2012	42349.46	38431.1	125624.1	21041.41
2013	50172.64	45854.39	141790.4	24761.22
2014	58431.46	53693.18	160281.2	28517.22
2015	66841.17	60753.19	178737.7	32478.63
2016	75845.35	68262.43	199463.5	36535.31
2017	85057.55	75431.61	222307.4	40071.18
2018	94438.06	82690.36	246461.3	43287.64
2019	103954.7	89827.59	271425.5	46308.21
2020	113581.6	96965.48	296890.7	49208.64
2021	123297.6	104049.9	322665.8	52035.38
2022	133085.7	111117.5	348632.6	54816.93

TABLE VII. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	HAINAN	*CHONGQING*	*SICHUAN*	*GUIZHOU*
1994	338.5799	671.704	527.0835	285.4371
1995	428.1644	927.1505	670.8957	351.3644
1996	515.962	1180.728	1410.842	372.1962
1997	608.7761	1478.362	2204.957	445.211
1998	706.3939	1786.644	3060.551	524.9209
1999	808.1047	2075.172	3905.107	619.8773
2000	919.4052	2380.28	4729.253	731.1904
2001	1043.344	2744.638	5607.271	890.5565
2002	1186.309	3147.993	6617.163	1078.519
2003	1355.586	3562.449	7827.639	1345.288
2004	1553.229	4136.029	9132.74	1649.612
2005	1768.177	5068.056	10734.58	1807.167
2006	2022.253	6091.824	12869.84	2043.474
2007	2333.157	7300.179	15673.74	2429.211
2008	2720.227	8452.632	19126.54	3171.831
2009	3185.671	10375.52	23057.66	3900.806
2010	3831.247	12771.6	27997.22	4839.726
2011	4617.985	15893.38	34150.7	6120.698
2012	5448.796	19336.68	40795.76	7789.528
2013	6324.98	23106.66	47837.19	9817.821
2014	7267.247	27220.45	55286.3	12008.58
2015	7935.639	31583.65	62416.32	14470.92
2016	8643.107	36363.9	70152.49	17167.51
2017	9408.017	41399.42	78547.07	20270.76
2018	10172.93	46727.89	87447.16	23690.91
2019	10937.84	52282.96	96735.37	27358.03
2020	11702.75	58060.16	106321.5	31217.62

2021	12467.66	64025.4	116136.5	35227.2
2022	13232.57	70164.69	126127.1	39353.68

TABLE VIII. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

TABL	*YUNAN*	*TIBET*	*SHANXI*	*GANSU*
1994	894.6017	28.55579	616.0704	338.9347
1995	1194.005	38.71065	820.2293	441.3241
1996	1541.989	50.34965	1092.412	561.0226
1997	1900.566	65.90091	1326.885	708.6972
1998	2262.618	85.66882	1577.642	900.4719
1999	2541.148	110.2398	1887.656	1113.079
2000	2724.763	137.5414	2267.975	1330.472
2001	3066.253	173.4907	2849.108	1573.972
2002	3442.201	208.9636	3515.435	1879.849
2003	3929.777	212.4208	4345.256	2243.842
2004	4538.004	223.337	5437.09	2671.808
2005	5094.321	255.8383	6783.475	3038.382
2006	5786.832	343.1998	8522.798	3513.519
2007	6786.796	396.725	10504.2	4102.282
2008	8375.208	471.3951	13138.35	4771.756
2009	9662.479	544.0434	15666.64	5458.301
2010	11286.82	645.8367	19077.66	6421.506
2011	13322.9	780.3174	23391.94	7606.851
2012	15501.31	916.9672	28216.29	8929.09
2013	17915.85	1076.427	33547	10436.32
2014	20310.79	1250.009	39145.16	11946.27
2015	22674.88	1330.611	44391.78	13082.45
2016	25255.43	1436.397	49825.39	14159.37
2017	28171.28	1548.805	56301.47	15056.54
2018	31087.14	1661.213	63397.29	15871.71
2019	34003	1773.621	70861.55	16649.48
2020	36918.86	1886.03	78544.84	17410.18
2021	39834.72	1998.438	86358.35	18163.1
2022	42750.58	2110.846	94249.28	18912.47

TABLE X. THE CAPITITAL STOCK OF PROVINCES (100 MILLIONS)

	QINGHAI	*NINGXIA*	*XINIJINAG*	
1994	101.4988	75.44193	485.471	
1995	133.3783	111.8227	672.5178	
1996	161.6134	151.6054	870.6068	
1997	199.6279	196.6673	1090.928	
1998	243.4022	243.746	1333.134	
1999	289.2717	289.732	1552.529	
2000	339.4236	327.8698	1789.535	
2001	391.8861	388.6555	2135.358	
2002	454.0116	455.1194	2486.421	
2003	528.6393	546.4427	2963.679	
2004	615.669	666.3147	3548.056	
2005	711.8535	786.2229	4308.635	
2006	834.2191	935.4726	5129.593	

2007	995.8739	1162.53	6003.874	
2008	1249.664	1509.466	7084.834	
2009	1522.265	1939.684	8175.183	
2010	1908.829	2473.955	9633.287	
2011	2394.976	3122.64	11373.27	
2012	2922.664	3799.189	13134.68	
2013	3569.517	4508.429	15210.63	
2014	4218.259	5201.935	17427.97	
2015	4676.213	5798.834	19098.11	
2016	5075.436	6427.549	20532.02	
2017	5397.652	7032.714	21984.71	
2018	5683.081	7622.884	23419.09	
2019	5950.937	8203.503	24853.47	
2020	6210.399	8778.041	26287.86	
2021	6465.852	9348.706	27722.24	
2022	6719.389	9916.905	29156.62	

5   Conclusion

The data illustrates that the Chinese capital stock is stably growing, here are the capital stocks, and with forecast.

Reference

1. C. Chen , "Estimation of variable depreciation rate and mearsurement of capital stock," Journal of Economics and Research, vol. 12, pp. 72–85, 2014.

2. C. Liu, "Research on Estimation of China's State-owned Fixed Capital Stock," 2016.

3. Z. Li , "Estimation of variable depreciation rate and mearsurement of capital stock," Journal of Economics Research Guide, vol. 30, pp. 104–106, 2016.

4. C.Zhang and T. Cao, "Measurement of capital stock (K)," Journal of Finance Research, Vol 10, pp. 63–76, 2019.