Capital Stock Estimates for China's Regional Economies: Results and Analyses

Yanrui Wu

Abstract

The lack of capital stock statistics for empirical research on the Chinese economy has for a long time been one of the major impediments. Though many authors have attempted to derive their own data series, most authors have focused on investigations at the national level and their findings are not without controversies. Few studies have provided estimates of capital stock for China's regional economies. This paper adds to the literature in several ways. First, it presents a critical review of the methods and findings in the existing literature. Second, it proposes an alternative approach to estimate China's regional capital stock values. Finally, the derived capital stock series are applied to examine growth, disparity and convergence in China's regional economies.

Key words Capital stock estimates, Chinese economy, perpetual inventory approach

JEL codes E01, O18, O11

Capital Stock Estimates for China's Regional Economies: Results and Analyses

China's continuingly high growth for almost three decades has attracted a lot of attention. As a result, a vast literature has emerged.[1] While working on China's economic statistics, researchers have confronted a major problem, ie. no capital stock data are reported in the Chinese statistical system. Subsequently, researchers have attempted to derive China's capital stock data by themselves. Earlier works include Zhang (1991), He (1992), Chow (1993), Li et al (1995), Hu and Khan (1997) and the World Bank (1997). In these studies, the methods involved vary considerably and so do their results.[2] The objective of this study is to review previous methods as well as findings and propose an alternative approach. In particular, this paper employs the recently released national accounts figures to derive capital stock series for China's thirty-one regions. A review of the literature is presented in Section 1. This is followed by discussion of the existing methods and description of an alternative approach in Section 2. New capital stock estimates for China's regional economies together with the preliminary analysis are reported in Section 3. The relationship between capital formation and growth in China's regional economies is examined in Section 4. Finally summary comments are presented in the concluding section (Section 5).

1 Literature Review

Zhang (1991), He (1992) and Chow (1993) are examples of earlier studies on capital stock estimates and economic growth in China. Zhang and He represent two of the pioneering studies conducted by scholars inside China. Their capital stock estimates are based on the statistics of "accumulation" defined under the traditional Material Product System (MPS) in China.[3] The latter was replaced by the UN-adopted System of National Accounts (SNA) in the earlier 1990s and subsequently reporting of the "accumulation" information was discontinued in 1993. Chow (1993) is one of the earlier studies published in English. His study covered the period of 1952-1985. He derived capital stock series for five economic sectors ie. agriculture, industry, construction, transportation and commerce. Chow's empirical estimations were based on data of national income, accumulation of fixed assets and circulating funds. He also derived an estimate of capital stock in agriculture by using data of the original value of fixed assets. The problem with the data on "accumulation" or "original value" of fixed assets is well known (eg. Chen et al. 1988). Li et al. (1995) derived capital stock series by using the values of fixed and current assets. Their estimates suffer from the same problem as that in Chow (1993). Subsequently, Borensztein and Ostry (1996) and Woo (1998) applied the same database compiled by Li et al. (1995).

Recent works include Hu and Khan (1997), World Bank (1997) and Maddison (1998). Hu and Khan (1997) derived their own capital stock series following the conventional perpetual

[1] Examples include the World Bank (1997), Maddison (1998), Woo (1998), Bramall (2000), Wang and Fan (2000), Young (2003), Wu (2004) and Garnaut and Song (2004, 2005).
[2] Refer to Zhang and Zhang (2003) and Holz (2006a) for a brief review.
[3] Zhang and Zhang (2003) also used the accumulation data. Wu (1993) presented some discussion comparing MPS with SNA (System of National Accounts).

inventory approach. They used Chow's estimates of the initial value of capital stock. World Bank (1997) used the database derived by Nehru and Dhareshwar (1993). The latter also applied the perpetual inventory method. The initial value of capital stock was derived by assuming that the rates of growth of capital and output are equal if capital-output ratio is constant in a given period. Maddison (1998) derived gross fixed capital stock by "cumulating the increments in investment" and assuming that capital had a life span of 25 years which effectively implies a rate of depreciation as high as 17 per cent.[4]

More recent studies include Chow and Li (2002) and Holz (2006a). Chow and Li extended the work by Chow (1993) and derived China's capital stock values up to 1998. They employed regional depreciation values for the 1990s and worked out a rate of depreciation of 5.4 per cent for aggregate capital stock in the nation. This is certainly problematic as there is inconsistency between national aggregate and the sum of regional values which is discussed in Section 3 of this paper. Holz's work begins with the discussion of conceptual issues associated with "fixed assets", "net investment" and "capital formation". He questioned the direct use of raw data of these variables in empirical studies and hence, by introducing an alternative approach, reconstructed economy-wide fixed asset values for the period of 1953-2003. His results are however not without questions (Chow 2006, Holz 2006b).

Those studies surveyed so far mainly focused on capital stock estimates at the national level. There is a lack of investigation at the regional and sector levels.[5] Regional studies are limited for a long time probably due to the paucity of investment data, rates of depreciation and price deflators at the regional level. Wu (2004) and Zhang et al. (2007) are two exceptions.[6] Wu presented a survey of the main approaches and estimated regional capital stock by assuming a rate of depreciation of 7 per cent for all regions. Zhang et al. also reported their estimates of China's regional capital stock by employing an identical rate of depreciation of 9.6 per cent for all regions. Apparently, the main weakness in the studies by Wu and Zhang et al. is the assumption of the same rate of depreciation for all regions in China. The present paper aims to overcome the above-mentioned problem in the existing literature and derive new estimates of capital stock for the Chinese regions. Especially, it employs region-specific rates of depreciation and does not need the estimation of the initial values of capital stock. The estimation technique is documented in the following section.

[4] This implies that, after 25 years, less than 1% of the original value remains.

[5] Chow (1993) did report estimates for five sectors (agriculture, industry, construction, transportation and commerce) and Wu (1995) considered three sectors (agriculture, urban state and rural industry).

[6] Qian and Smyth (2006) also estimated regional capital stock with 1990 being treated as the initial year. They summed up "fixed assets accumulation" for all years from 1949 to 1989 as the initial value of capital stock and then assumed a rate of depreciation of 5% to estimate regional capital stock up to the year 2000.

2 Capital Stock Estimation Methods

The general technique of estimating capital stock values in this study belongs to the category of the conventional perpetual inventory approach. The value of capital stock is estimated from gross investment in each year. Symbolically, the estimation technique can be expressed as

$$K_{i,t} = (1-\delta)K_{i,t-1} + \Delta K_{i,t} \qquad (1)$$

where $K_{i,t}$ is the real value of capital stock for the ith region or economy in the tth year, $\Delta K_{i,t}$ the real value of incremental capital stock and δ the rate of depreciation. It is clear in Equation (1) that the value of capital stock can be computed if the rate of depreciation, δ, and the initial value are known. Assume that the initial capital stock was $K_{i,0}$ for the ith region or economy, Equation (1) can then be converted into

$$K_{i,t} = \Sigma_0^t (1-\delta)^j \Delta K_{i,t-j} + K_{i,0}(1-\delta)^t \qquad (2)$$

In the above formula, the only unknown is the initial value of capital stock ($K_{i,0}$), given the rate of depreciation. For the latter, researchers have resorted to various sources such as national accounts, accounting records at the firm level, findings in the existing literature and ad hoc assumptions. As a result, different rates of depreciation have been used, ranging from 3.6 to 17.0 per cent (Table 1). Thus, the choice of the rate of depreciation is itself controversial. This paper proposes an alternative approach to derive the rates of depreciation for the Chinese regions. In particular, this paper allows a different rate for each of China's regional economies. This is the first of its kind in the literature.

As for the derivation of the initial value of capital stock, various approaches have been employed as well. Subsequently, different results have been derived (Table 1). While Chow (1993) provided detailed information and conducted sensitivity analysis, Li et al. (1995) and Maddison (1998) did not elaborate how they estimated the initial value, to cite a few. The main approaches employed in the literature are surveyed in the following section.

Table 1 Selected Rates of Depreciation and Initial Values of Capital Stock

Authors	Depreciation rates (%)	Initial value in 1952 (billion yuan in 1952 prices)
Zhang (1991)	n.a.	200.0[b]
He (1992)	n.a.	50.8[b]
Chow (1993)	n.a.	175.0
Hu and Khan (1997)	3.6	175.0
World Bank (1997)	4.0	n.a.
Perkins (1988)	5.0	200.6
Woo (1998)	5.0	n.a.
Meng and Wang (2000)	5.0	180.0[c]
Wang and Yao (2003)	5.0	175.0
Chow and Li (2002)	5.4[a]	221.3
Young (2003)	6.0	n.a.
Maddison (1998)	17.0	n.a.
Wu (2004)[d]	7.0	n.a.
Zhang et al (2007)[d]	9.6	n.a.

Notes [a] This rate was applied for the period of 1978-1998 only.
[b] These numbers are cited in Zhang et al. (2007).
[c] This is 1953 value in 1980 prices.
[d] Wu and Zhang et al are regional studies. Wu's approach is similar to this paper. Thus no initial values of capital stock are needed. Zhang et al. assume that the initial value of capital stock in 1952 is equal to the value of fixed investment divided by 10%.
n.a. = not available.

2.1 The Conventional Approaches

In general, the existing literature has used three approaches in estimating the initial value of capital stock. They are here called the integral, the growth rate and other approaches, respectively.

The Integral Approach

The core of this technique is that the capital stock in the initial year is assumed to be the sum of all past investments. Symbolically,

$$K_{i,0} = \int_{-\infty}^{0} \Delta K_{i,t} dt = \frac{\Delta K_{i,0} e^{\theta}}{\theta} \tag{3}$$

where $\Delta K_{i,t} = \Delta K_{i,0} e^{\theta(t+1)}$, and θ and $\Delta K_{i,0}$ are estimated by linear regressions using the investment series available. Among the existing studies, Wu (2000) adopted this approach. Obviously, capital decay is not taken into consideration in the integral approach of estimating the initial value of capital stock. In practice, this approach tends to overestimate the growth of capital stock. For example, Wu (2000) derived an average real rate of growth of 21.5 per cent during the period of 1981-1995. This figure is twice as big as the estimates derived by other authors. It is 8.86 per cent during 1978-1995 according to Maddison (1998) and 7.90 per cent during 1979-1995 according to the World Bank (1997), for instance. Furthermore, in order to apply this approach, one must have investment data which are suitable for regression analysis. This could be difficult in some cases.

The Growth Rate Approach

This approach is based on the assumption that the function of investment is to replace depreciation of old capital and create new capital to maintain growth (Harberger 1978). Thus, the following equations are obtained

$$\Delta K_{i,1} = (\delta + g) K_{i,0} \qquad \text{or} \tag{4}$$

$$K_{i,0} = \frac{\Delta K_{i,1}}{(\delta + g)} \tag{5}$$

Equation (4) implies that the incremental capital stock or realized investment in period 1 is the sum of the depreciated capital stock from period 0 and new capital stock created. The latter is assumed to grow at the constant rate of g which is often replaced by the average growth rate of the incremental capital stock in the initial period, say, five years. In practice, authors have also used the rate of growth of investment or GDP when incremental capital stock data are not available. Young (2003) and Islam et al (2006) followed this approach for his work on China.[7] Other applications include Nadiri and Prucha (1996) on the US and Miyagawa et al (2004) on Japan. The main advantage of this approach is its simplicity.

Other Approaches

Apart from the integral and growth rate approaches, several other methods have also been proposed in the literature and are broadly called "other approaches" here. Examples include Perkins (1988) who assumed that the capital-output ratio was three in the year 1953, and Chow (1993) who relied on the statistics of "accumulation of fixed assets". He (1992) and Zhang and Zhang (2003) employed similar raw data as Chow (1993) did.[8] In addition, Holz (2006a) applied official depreciation values and rates of depreciation to generate capital stock series for the period of 1978-2003.

[7] Islam et al (2006) also assumed the rate of depreciation to be 3% during 1952-1978, 4% during 1979-1992 and 5% during 1993-2002.

[8] Detailed descriptions are available in Zhang et al (2007).

Though there are some capital stock estimates for China at the national level, data at the regional level are rare. Thus, this study presents an alternative approach to estimate capital stock series for the Chinese regions.

2.2 An Alternative Approach

The main problem associated with the conventional approaches reviewed in the preceding section is the ad hoc nature dealing with the rate of depreciation and the initial value of capital stock. To overcome these problems, this section proposes an alternative approach which is here called the "backcasting approach" and which is employed to derive capital stock estimates for China's regions in the rest of the paper. The results are also compared to those derived following the conventional approaches. In general, the backcasting approach involves three tasks, that is, the choice of deflators, determination of the initial value of capital stock and estimates of region-specific rates of depreciation.

Choice of Deflators

The first task is to find a time-varying, region-specific price index which is used to convert investment values into real terms. Such an index is not available in the official statistics until recent years.[9] For this purpose, region-specific price indices since the 1950s are obtained using the following formulae

$$P_{it}^{constant} = \frac{Y_{it}^{current}}{Y_{it}^{constant}} \tag{6}$$

where $P_{it}^{constant}$, $Y_{it}^{current}$ and $Y_{it}^{constant}$ represent price indices in constant prices, income in current prices and income in constant prices for the i[th] region at period t. $Y_{it}^{constant}$ is defined as

$$Y_{it}^{constant} = Y_{i0}^{current} \prod_{0}^{t} (1+r)^{k} \tag{7}$$

where r is the real rate of growth in income which is available from 1953 onwards for all regions and $Y_{i0}^{current}$ the initial income at current prices for the i[th] region. The derived regional price indices can be used for the estimation of capital stock in each region. As a result, GDP and capital stock data are expressed in 1953 constant prices.[10]

[9] Several price indices such as regional CPI are available from 1978 onwards while this study needs information from 1953 onwards.

[10] It is noted that researchers have attempted to derive their own deflators for samples which are much smaller than the one used in this chapter and which involve either sectoral or nation-wide statistics only (eg. Chen et al. 1988 and Woo et al. 1994). Zhang et al. (2007) derived price deflators using implicit deflators of fixed capital formation. The latter has however many missing observations which have to be filled by using other price indices as Zhang et al did.

The derived national price indices are plotted in Figure 1. Several observations are worth noting. First, because of the price controls under the central planning system, prices fluctuated modestly in China during the pre-reform era (1953-1977). The only exception was the hyperinflation in 1961 due to the severe shortage of food and other goods. Second, the movement of prices has been more volatile during the reform period as the economy has been transformed towards a market-oriented system. This is particularly so during the ten years immediately after urban reforms began in 1985. Finally, the standard deviation of regional price deflators shows the existence of price differentiation among the regions. Thus, empirical analyses applying a single deflator for all regions can be distorted. Over time, however, regional disparity in inflation tends to decline according to Figure 1.

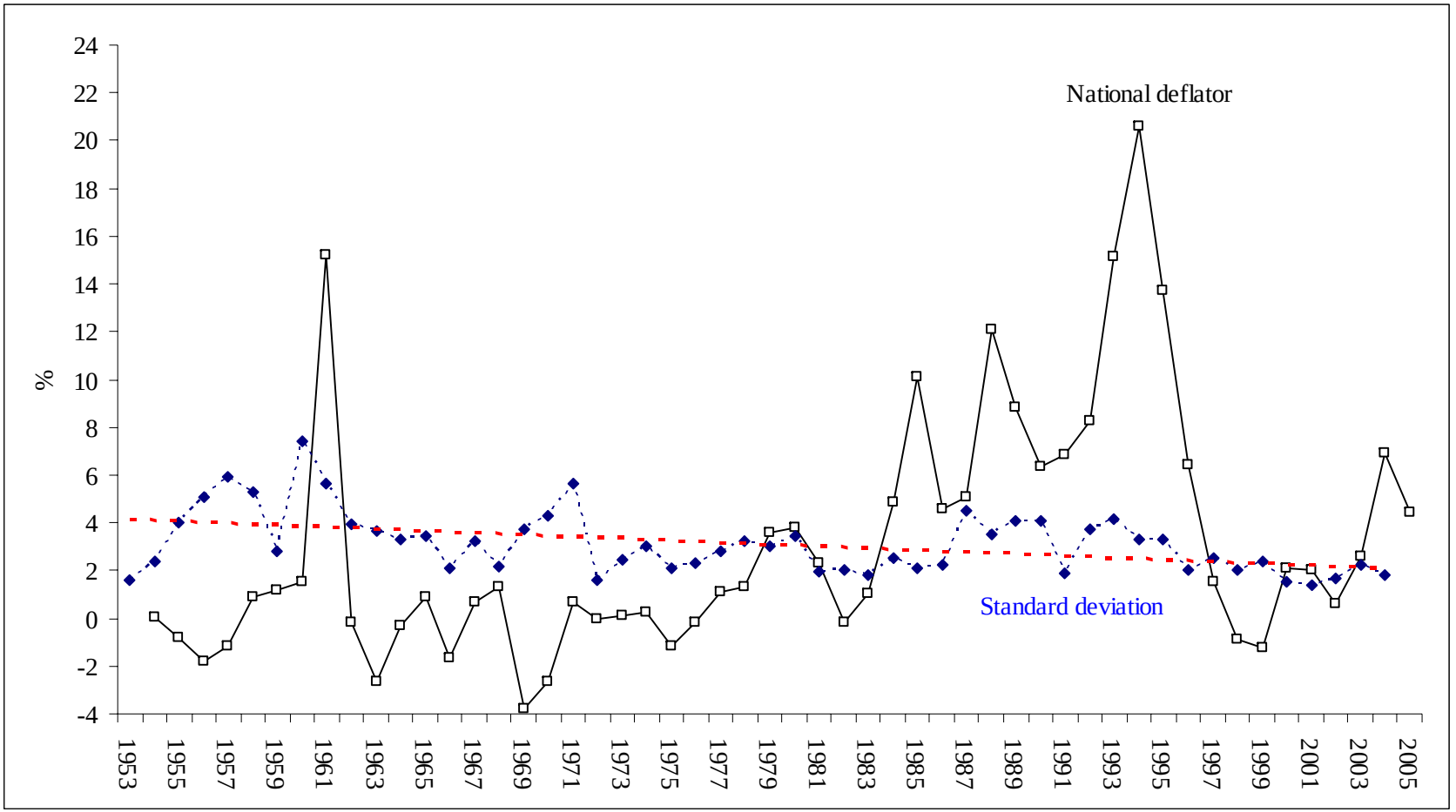


Figure 1 National Deflator and Standard Deviation of Regional Deflators, 1953-2005

Initial Value of Capital Stock

The second task deals with the estimation of the initial value of capital stock. For this purpose, the data series for $\Delta K_{i,t}$ available since 1953 are backcasted to the year 1900 and thus the time-series sample has more than 100 observations. Accordingly, Equation (2) is expanded to

$$K_{i,t} = \Sigma_0^{t-1901}(1-\delta)^k \Delta K_{i,t-k} + (1-\delta)^{t-1900} K_{i,1900} \quad (8)$$

Equation (8) implies that, given the value of capital stock in 1900, $K_{i,1900}$, and an appropriate rate of depreciation, a capital stock series for each region or economy can be derived. Due to capital decay and the long time horizon, $K_{i,1900}$ can be assumed to be zero. This is reasonable as the life span of capital is far shorter than 100 years and, in particular, as most studies of the Chinese economy only cover the recent decades ie. the reform period. Thus, extending the data series avoids the estimation of the initial value of capital stock.

Region-specific Rates of Depreciation

The third task is then to derive an appropriate rate of depreciation. The latter has been assumed to be the same for all regions in the existing literature. To remove this assumption, a simulation process is here adopted to generate different rates of depreciation for the regions. This is the first of such exercise in the literature. The National Bureau of Statistics (various issues) has released the values of depreciation for each region since 1978. The simulation process begins by assuming a rate of depreciation for each region and then searches for an optimal rate (via repetitive computations) so that the estimated values of depreciation (using the optimal rate) match the actual values of depreciation.[11] The final simulation results are presented in Table 2. In general, the rate of depreciation is high in the more developed regions and low in the less developed regions The three municipal cities also show relatively low rates of depreciation. This may be due to the fact that these cities have relatively large service sectors. It is interesting to note that the mean of the regional rates of depreciation is about 4 per cent which is close to the rate used by Hu and Khan (1997) and the World Bank (1997). Thus, the application of a rate of depreciation of 7 per cent in Wu (2004) and 17 per cent in Maddison (1998) would lead to the underestimation of China's capital stock.

[11] The searching process stops when the two sets of values converge. For example, in this paper, the process stops when the difference of two values is less than 0.001%. It should be noted that the simulation process could introduce a time dimension allowing for time-varying rates of depreciation. This is more complicated and beyond the scope of this study.

3 Estimation Results

Capital Stock Series

The derived capital stock series for China and its regions are presented in the appendix. According to the estimates, China enjoyed rapid capital accumulation immediately after the foundation of the People's Republic in 1949 (with an average rate of growth of 11.9 per cent during 1951-1960). But, the growth was interrupted due to political campaigns and a major famine in the 60s (with an average rate of growth of 4.9 per cent during 1961-1970). Fortunately, rapid growth has resumed since the early 1970s, maintaining an average rate of growth of 8.3, 9.1 and 10.2 per cent in the 1970s, 1980s and 1990s, respectively. Among the 31 Chinese regions, in terms of the value of capital stock, Shanghai, Jiangsu and Shandong are the top three regions, followed by Zhejiang, Hebei, Guangdong, Beijing and Liaoning. Other regions are much smaller. As expected, Guangdong has recorded the highest average rate (16.50 per cent) of capital accumulation during 1953-2005. Behind Guangdong are Shanghai (13.28 per cent), Fujian (12.29 per cent), Zhejiang (12.21 per cent) and Jiangsu (12.13 per cent).

Table 2 Regional Rates of Depreciation

Codes	Regions	Rates of depreciation (%)
1	Beijing	3.4
2	Tianjin	3.7
3	Hebei	4.3
4	Shanxi	4.0
5	Inner Mongolia	4.3
6	Liaoning	5.8
7	Jilin	5.1
8	Heilongjiang	6.0
9	Shanghai	3.4
10	Jiangsu	4.2
11	Zhejiang	4.0
12	Anhui	5.0
13	Fujian	4.5
14	Jiangxi	3.7
15	Shandong	5.0
16	Henan	4.1
17	Hubei	4.5
18	Hunan	4.5
19	Guangdong	6.9
20	Guangxi	3.3
21	Hainan	2.2
22	Chongqing	5.0
23	Sichuan	4.6
24	Guizhou	2.8
25	Yunnan	2.7
26	Tibet	4.2
27	Shaanxi	3.3
28	Gansu	2.7
29	Qinghai	2.4
30	Ningxia	2.8
31	Xinjiang	2.6

Source: author's owner estimates.

National vs Regional Capital Stock

Economists specializing in the Chinese economy have been puzzled by the discrepancy between national and regional data. Capital stock estimates in this paper offer some insights into this debate. In general, the sum of regional capital stock values tended to underestimate the national total reported by the NSB during 1953-1996 while this trend is reversed after 1996 as shown in Figure 2. This is consistent with gross capital formation figures which show that the sum of regional values underestimated the national total reported by the NSB during 1953-1993 while the opposite occurred after 1993. One possible explanation is that since the mid 1990s capital has become very mobile in China and a lot of cross-regional investment has taken place. As a result, some investment and hence capital formation have been claimed by both the home and hosting regions. The same reason can be applied to explain the discrepancy between the sum of regional GDP and national GDP reported by the NSB. The former tends to overestimate the latter after 1996 while the opposite is true for data of the period 1953-1996. This discrepancy may be a genuine error rather than deliberate data-manipulation as accused in the literature (Rawski 2001). Overall, the value of capital stock in 1952 was 133.8 billion yuan which is higher than the popularly cited one (175 billion yuan including land value of 72 billion yuan) derived by Chow (1993).

Comparison with Other Estimates

For a comparison with the estimates by other authors, the growth rates of the derived capital stock in some periods are illustrated in Table 3. According to this table, the estimate of capital stock in this paper is higher than others cited with the exception of Zhang el al. (2007). It should be pointed out that the numbers in both Zhang et al. and this

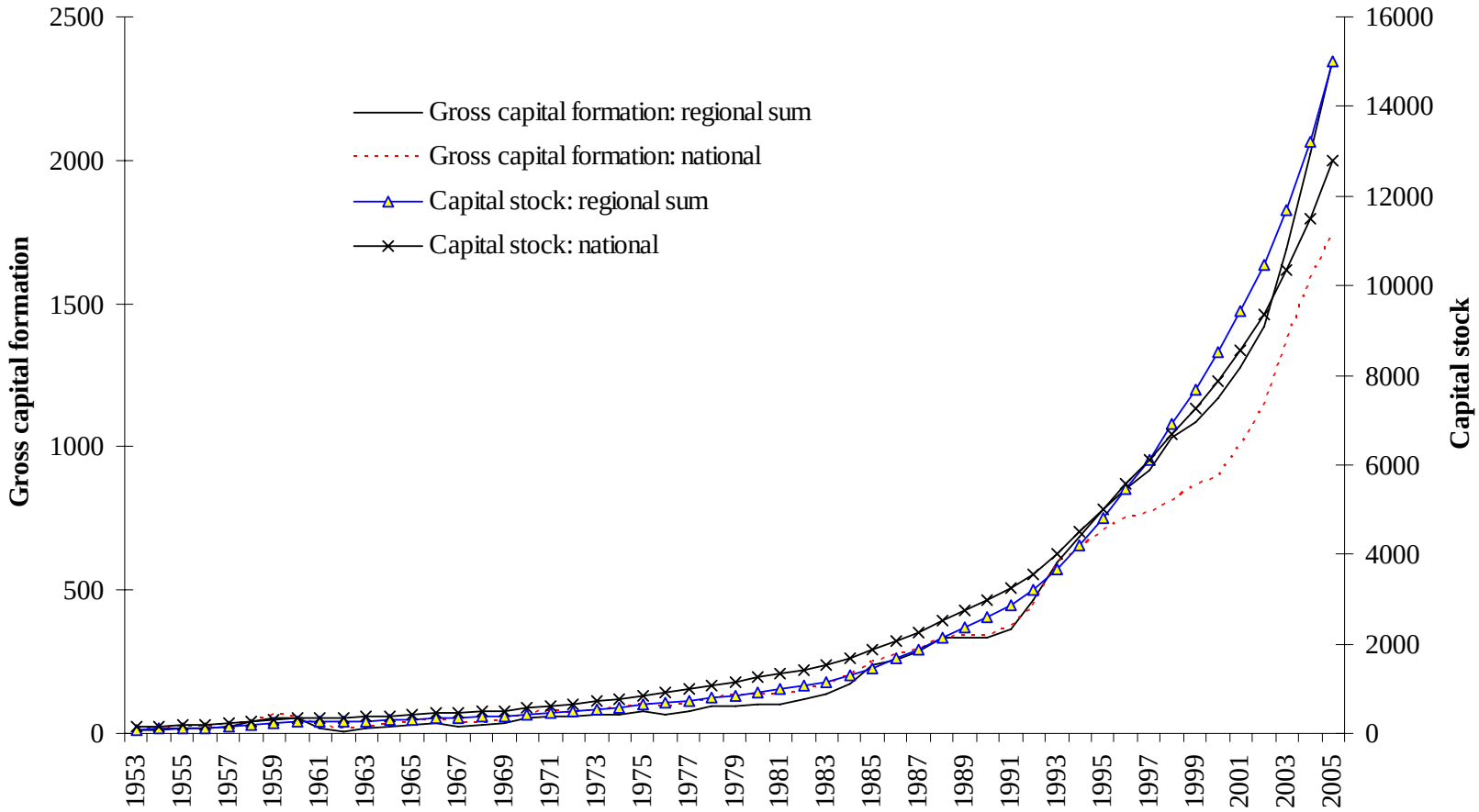


Figure 2 National Aggregate Vs Regional Sum

Table 3 Growth Rates of China's Capital Stock

Sources	Periods	Growth rate (%)
Li et al. (1995)	1979-90	9.15
Hu and Khan (1997)	1979-94	7.70
World Bank (1997)	1979-95	7.90
Maddison (1998)	1978-95	8.86*
Zhang et al. (2007)	1979-90	10.27
	1979-95	10.85
	1979-05	11.79
This paper	1979-90	10.08
	1979-95	10.68.
	1979-05	11.05

* Non-residential capital only.

paper are based on the arithmetic means of the estimates of regional capital stock data. However, the estimated rate of growth per annum is still below the rate of 11.5 per cent for Singapore, 13.7 per cent for South Korea and 12.3 per cent for Taiwan during the period of 1966-90 (Dougherty and Jorgenson 1996). The lower estimates derived by other authors are debatable. The explanation may lie in the estimation of the initial capital stock value and the choice of the rate of depreciation. For example, while the World Bank (1997) used a rate of 4 per cent, Maddison (1998) assumed an average asset life of 25 years, equivalent to an annual rate of depreciation of 17 per cent.

In terms of the capital-output ratio which has been used popularly for the estimates of capital stock, it is generally close to three with the exception of a few years during 1952-1958 when the ratio is under two. These findings support the argument made by Perkins (1988) who assumed that the ratio should be three. They are however higher than those derived by Holz (2006a) and Chow and Li (2002), which may imply that capital stock estimates by the latter authors may be biased downwards due to the use of higher rates of depreciation.

4 Capital Formation and Regional Growth

Given the estimates of regional capital stock, this section presents some preliminary analysis. A simple growth accounting exercise is conducted first. This is followed by an examination of regional disparity and convergence.

Accounting for Growth

The role of capital formation in economic growth is a classical topic.[12] The objective here is not to be exhaustive but to present some preliminary analysis of the relationship between capital formation and economic growth in China. Figure 3 demonstrates the close movement between the growth rates of China's capital stock and GDP during the past decades. The association between the two indicators is very clear in the 1980s and 1990s. One can thus speculate that capital accumulation has been an important contributor to China's growth in the past two decades.

A more formal investigation is illustrated in Table 4 which shows the estimation results of a simple Cobb-Douglas production function using regional data over the period of 1985-2005. The results from similar exercises by Chow and Li (2002) and Chow (2006) using time series data are also presented for the purpose of comparison. While this study derives an average rate of technological progress of 2.33 per cent during 1985-2005, the other two sets of results show an average rate of 2.62 per cent during 1978-1998 and 4.86 per cent during 1978-2003. Chow (2006) raised questions about the relatively higher rate of technological progress and the low capital share derived using Holz's data. The capital

[12] See, for example, Jorgenson (1989) for a detailed survey of the literature.

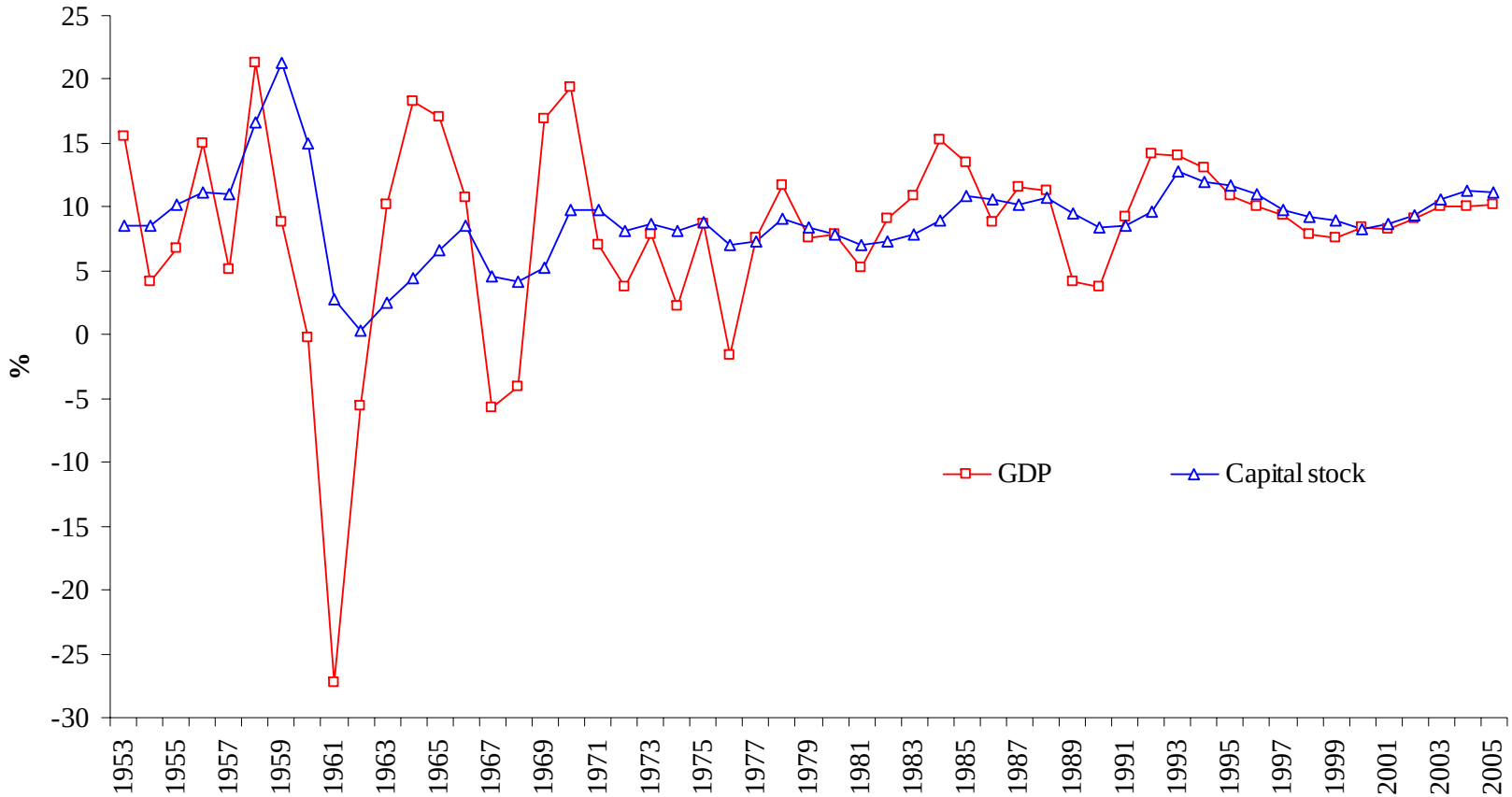


Figure 3 Growth Rates of Capital Stock and Gross Domestic Products (GDP), 1953-2005

Table 4 Results of Production Function Estimation (Fixed Effect Model)

Variables	This paper	Chow and Li (2002)	Holz (2006a)
ln(Capital)	0.6724 (32.212)	0.6284 (24.357)	0.3228 (20.050)
ln(Labour)	0.3276 (15.692)	0.3716 (14.403)	0.6772 (42.062)
Time trend	0.0233 (11.176)	0.0262 (10.917)	0.0486 (25.579)
Intercept		1.6612 (8.476)	-1.9554 (-53.868)
Sample size	651 (1985-2005)	47 (1952-1998)	51 (1953-2003)
$\bar{R}^2$	0.9955	0.9946	0.9935

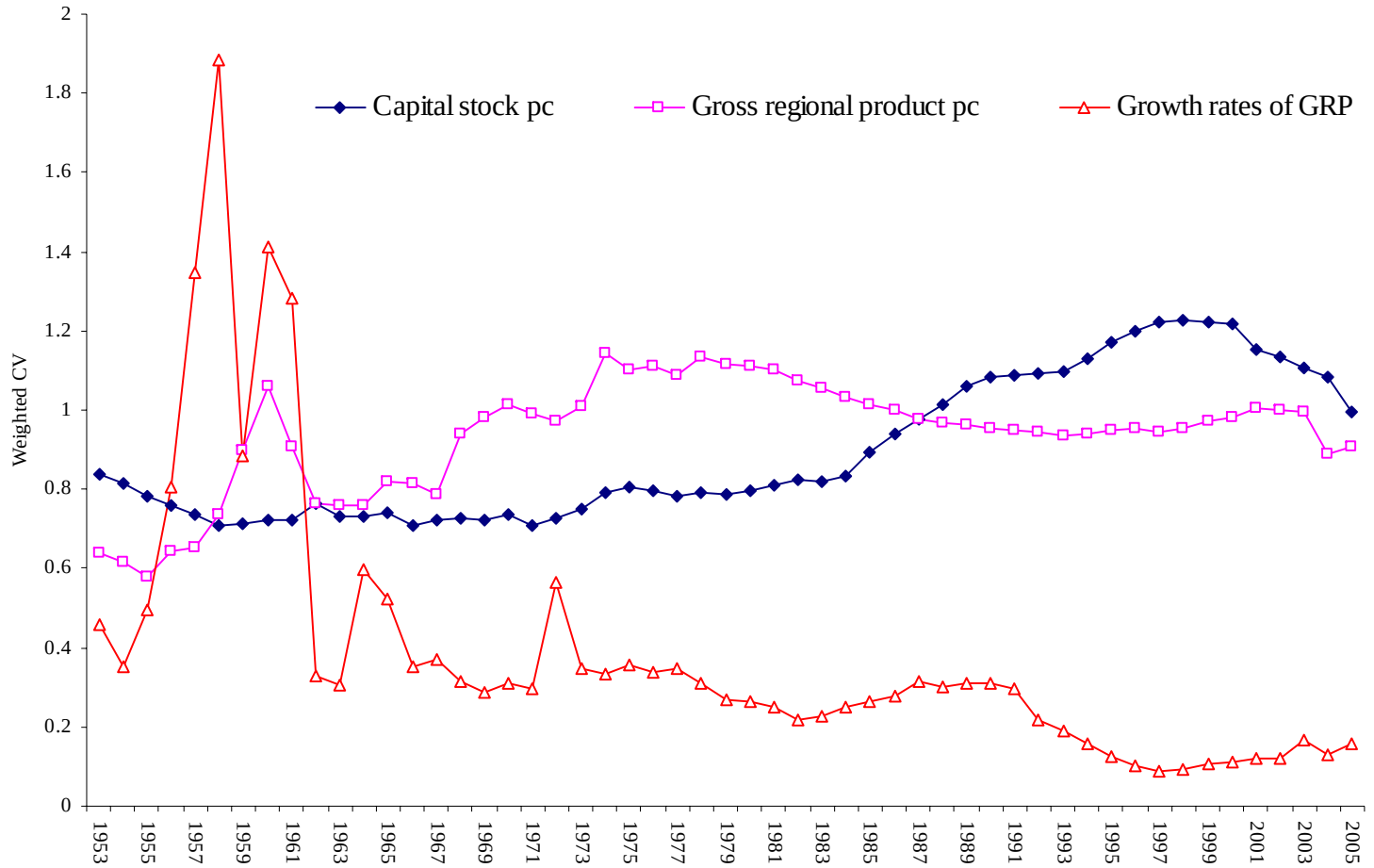
Notes The numbers in parentheses are t-ratios. The results for Holz (2006a) are derived by Chow (2006). The time trend for Chow and Li (2002) and Holz (2006a) covers the period of 1978 and onwards.

share estimated in this paper is slightly higher than that reported by Chow and Li. Overall, technological progress accounts for about 22.1 per cent of the average growth (10.5 per cent) during 1986-2005. The rest is attributed to changes in factor inputs, i.e. growth in capital and labour. Thus, factor inputs, in particular capital, do play the main role in China's growth in the past decades. In the meantime, technological progress has also made a substantial contribution which provides the foundation for sustained growth of the Chinese economy.

Regional Disparity and Convergence

Regional disparity and hence convergence have for years been a hotly debated question in China. This question can also be explored in terms of capital stock formation among the regions. Figure 4 illustrates the movement of population-weighted coefficients of variation for gross regional product per capita, regional capital stock per capita and growth rates of gross regional product during 1953-2005. Several points are worthy to be mentioned. First, disparity in regional income became worse off before the initiative of economic reforms while regional inequality in terms of capital stock per head remained almost the same during the same period. Thus, it might be efficiency that enlarged the regional gap in development as the coefficients of variation in terms of growth rates were high and fluctuated considerably. Second, during the period of economic reforms (from 1978 to 2005, regional income disparity remains high and tends to decline modestly. This is in sharp contrast to the general perception that regional inequality has deteriorated since the beginning of economic reforms. Third, regional disparity in capital formation increased continuously during 1979-1998 and then headed to the opposite direction after 1999. One key development since 1999 has been the "go-west" program. The latter has boosted investment in the relatively less developed areas and may have contributed to the decline in regional inequality in terms of capital stock per head.[13]

[13] The "go-west" program was initiated in 1999 and covers China's 12 administrative areas i.e. five autonomous regions (Guangxi, Inner Mongolia, Ningxia, Tibet and Xinjiang), six provinces (Gansu, Guizhou, Qinghai, Shaanxi, Sichuan and Yunnan) and one municipality (Chongqing).



Note: Growth rates are based on five-year moving average starting in 1953. Annual rates of growth are used for the years of 2002-2005.

Figure 4 Changing Regional Disparity, 1953-2005

Finally, during the reform period of 1978-2005, it seems that all regions enjoyed high economic growth as the coefficients of variations in terms of GRP growth rates were small and showed a declining trend.

5 Conclusions

In summary, this paper presents a review of the literature estimating China's capital stock data and introduces an alternative approach to estimate capital stock series for China's thirty-one regional economies. This approach overcomes the problem in the existing literature of assuming ad hoc rates of depreciation and initial values of capital stock. In particular, it allows for different depreciation rates for the regions. The derived capital stock data series are important resources for research on the Chinese economy.

Preliminary analyses indicate a close association between capital stock formation and economic growth in China, implying a potentially dominant role of capital stock in economic growth. This is confirmed by the results of production function analysis using regional data. In addition, technological progress is also found to play an important role in China's growth in the past two decades.

Furthermore, the estimated capital stock series can also shed some light on the debate of regional disparity in China. It is found that regional disparity in terms of income per capita became worse off well before the initiative of economic reform in 1978. This may be attributed to the variation in regional growth during that period rather than differences in capital formation. In contrast to the popular perception that economic reforms have been responsible for the deterioration of regional disparity, since 1978, regional disparity remains stable with a modest declining trend. However, regional disparity in terms of capital endowment has deteriorated since the mid 1980s. This has however been offset by the falling disparity in economic growth rates. In particular, since 1999 when China's "go-west" program was initiated, disparity in capital endowment has fallen. Whether this trend is to continue and make a contribution in closing the gap in regional income is yet to be observed in the coming years.

References

Borensztein, E. and J.D. Ostry (1996), "Accounting for China's Growth Performance", American Economic Review (Papers and Proceedings) 86, 225-28.

Bramall, C. (2000), Sources of Chinese Economic Growth, 1978-1996, Oxford and New York: Oxford University Press.

Chen, K., H.C. Wang, Y.X. Zheng, G.H. Jefferson and T.G. Rawski (1988), "Productivity Change in Chinese Industry, 1953-85", Journal of Comparative Economics 12, 570-91.

Chow, G.C. (1993), "Capital Formation and Economic Growth in China", Quarterly Journal of Economics 108, 809-42.

Chow, G.C. (2006), "New Capital Estimates for China: Comments", China Economic Review 17, 186-92.

Chow, G.C. and Kui-Wai Li (2002), "China's Economic Growth: 1952-2010", Economic Development and Cultural Change 51, 247-56.

Dougherty, C. and D.W. Jorgenson (1996), "International Comparisons of the Sources of Economic Growth", American Economic Review (Papers and Proceedings) 86 (2), 25-9.

Garnaut, Ross and Ligang Song (eds) (2004), China: Is Rapid Growth Sustainable? Canberra: Asia Pacific Press.

Garnaut, Ross and Ligang Song (eds) (2005), The China Boom and Its Discontents, Canberra: ANU E Press and Asia Pacific Press.

Harberger, A.C. (1978), "Perspectives on Capital and Technology in Less developed Countries" in Contemporary Economic Analysis edited by M. J. Artis and A. R. Nobay, London: Croom Helm.

He, Juhuang (1992), "Estimates of Our Country's Capital", (Shuliang Jingji yu Jishu Jingji Yanjiu) Quantitative and Technical Economics 8, 24-7.

Holz, C.A. (2006a), "New Capital Estimates for China", China Economic Review 17, 142-85.

Holz, C.A. (2006b), "Response to Gregory C. Chow's 'New Capital Estimates for China: Comments'", China Economic Review 17, 193-97.

Hu, Zuliu. F. and Mohsin S. Khan (1997), "Why Is China Growing So Fast?", IMF Staff Papers 44, 103-31.

Islam, N., E. Dai and H. Sakamoto (2006), "Sources of Growth" in Economic Growth, Transition and Globalization in China edited by Yanrui Wu, Cheltenham and Northampton: Edward Elgar Publishing.

Jorgenson, D.W. (1989), "Capital as a Factor of Production", in Technology and Capital Formation edited by D.W. Jorgenson and R. Landau, Cambridge and London: The MIT Press.

Li, Jingwen, Gong Feihong and Zheng Yisheng (1995), "Productivity and China's economic growth, 1953-1990", in Productivity, Efficiency and Reform in China's Economy edited by K.Y. Tsui, T.T. Hsueh and Thomas G. Rawski, Hong Kong: Chinese University of Hong Kong.

Maddison, A. (1998), Chinese Economic Performance in the Long Run, Paris: OECD Development Centre.

Meng, L. and Xiaolu Wang (2000), "Assessment of the Reliability of China's Economic Growth Statistics", monograph, National Economic Research Institute, Beijing.

Miyagawa, T., Y. Ito and N. Harada (2004), "The IT Revolution and Productivity Growth in Japan", Journal of the Japanese and International Economies 18, 362-89.
Nadiri, M. I. and I. R. Prucha (1996), "Estimation of the Depreciation Rate of Physical and R&D Capital in the U.S. Total Manufacturing Sector", Economic Inquiry 34, 43-56.
National Bureau of Statistics (2006), China Statistical Yearbook 2006, Beijing: Statistical Publishing House of China.
National Bureau of Statistics (various issues), China Statistical Yearbook, Beijing: Statistical Publishing House of China.
Nehru, V. and A.M. Dhareshwar (1993), "A New Database on Physical Capital Stock: Sources, Methodology and Results", Revista de Analisis Economico 8, 37-59.
Perkins, D. (1988), "Reforming China's Economic System", Journal of Economic Literature 26, 601-45.
Qian, Xiaolei and Russell Smyth (2006), "Growth Accounting for the Chinese Provinces 1990-2000: Incorporating Human Capital Accumulation", Journal of Chinese Economic and Business Studies 4(1), 21-38.
Rawski, T.G. (2001), "What Is Happening to China's GDP Statistics?" China Economic Review 12(4), 347-54.
Wang, X.L. and Gang Fan (eds) (2000), The Sustainability of China's Economic Growth, Beijing: Economic Sciences Press.
Wang, Y. and Y.D. Yao (2003), "Sources of China's Economic Growth 1952–1999: Incorporating Human Capital Accumulation", China Economic Review 14, 32–52.
Woo, W.T. (1998), "Chinese Economic Growth: Sources and Prospects", in The Chinese Economy edited by M. Fouquin and F. Lemoine, Economica Ltd, Paris.
Woo, Wing Thye, Wen Hai, Yibiao Jin and Gang Fan (1994), "How Successful Has Chinese Enterprise Reform Been? Pitfalls in Opposite Biases and Focus", Journal of Comparative Economics 18, 410-37.
World Bank (1997), China 2020: Development Challenges in the New Century, the World Bank, Washington, DC.
Wu, Harry X (1993), "The 'Real' Chinese Gross Domestic Product (GDP) for the Pre-reform Period 1952-77", Review of Income and Wealth 39, 63-86.
Wu, Y.R. (1995), "Productivity growth, Technological Progress and Technical Efficiency Change in China: A Three-Sector Analysis", Journal of Comparative Economics 21, 207-29.
Wu, Y.R. (2000), "Is China's Economic Growth Sustainable: A Productivity Analysis", China Economic Review 11, 278-96.
Wu, Y.R. (2004), China's Economic Growth: A Miracle with Chinese Characteristics, London and New York: RoutledgeCurzon Press Limited.
Young, A. (2003), "Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period", Journal of Political Economy 111, 1220-61.
Zhang Jun and Yuan Zhang (2003), "Reestimates of China's Capital Stock", (Jingji Yanjiu) Journal of Economic Research 7, 35-43.
Zhang, Jun, Guiying Wu and Jipeng Zhang (2007), "Estimation of China's Provincial Capital Stock Series", paper presented at Productivity and Efficiency Workshop, Tsinghua University, January 13-14.
Zhang, Junkuo (1991), "Systemic Analysis of Economic Efficiency during the 5th Five Year Plan", (Jingji Yanjiu) Journal of Economic Research 4, 8-17.

Appendix: China's Regional Capital Stock

Capital stock data reported as follows are expressed in billion yuan and in 1953 constant prices and are available in excel format from the author upon request (the price deflators are also available from the author). The national aggregate figures are presented under the column "k0" and are not equal to the sum of the regional statistics (refer to the text for an explanation). The regions are coded from 1 to 31 and follow the same order as in Table 2 where the rates of depreciation are listed.

Years	k0	k1	k2	k3	k4	k5	k6	k7	k8	k9	k10
1952	133.8	3.0	1.3	4.9	4.2	2.6	6.8	2.9	4.0	2.5	3.4
1953	145.2	3.3	1.4	5.3	4.5	2.8	7.4	3.2	4.4	2.8	3.8
1954	157.7	3.6	1.6	5.8	4.9	3.0	8.1	3.4	4.7	3.1	4.2
1955	173.6	4.2	1.8	6.9	5.3	3.1	8.7	4.0	5.4	3.7	5.2
1956	193.0	5.2	1.8	7.9	6.1	3.5	9.6	4.4	5.7	3.8	6.2
1957	214.3	6.2	2.4	9.2	7.2	4.0	11.1	4.8	6.6	5.3	7.1
1958	250.1	7.8	3.3	11.8	9.2	5.5	14.5	5.6	8.5	7.5	8.3
1959	303.2	10.4	4.9	14.5	11.5	7.5	19.0	6.7	10.7	11.2	9.7
1960	348.5	12.9	5.8	17.4	13.6	9.2	23.9	7.5	13.1	14.6	11.1
1961	358.3	13.4	5.7	18.2	13.8	9.5	23.3	7.8	13.1	15.3	11.6
1962	359.3	13.3	5.6	17.3	13.5	9.4	21.7	7.8	12.7	14.6	11.7
1963	368.5	13.1	5.5	17.5	13.5	9.6	22.4	8.0	13.1	15.3	12.2
1964	385.1	13.4	5.7	18.0	13.6	10.0	23.6	8.3	13.4	16.4	13.2
1965	410.6	14.0	6.3	18.7	14.3	10.6	25.1	8.7	13.7	16.7	14.3
1966	445.6	14.8	7.0	19.2	15.0	11.2	26.2	9.1	13.9	18.9	15.8
1967	465.8	15.2	7.4	20.1	15.2	11.2	26.9	9.4	13.8	19.2	16.5
1968	485.4	15.6	7.8	20.9	15.3	11.3	27.7	9.7	13.8	21.3	17.3
1969	510.6	16.6	8.3	22.1	15.9	11.4	28.9	10.1	14.4	21.5	18.2
1970	560.5	17.5	9.1	24.0	16.9	11.9	31.0	10.8	15.3	22.9	20.1
1971	614.9	19.4	10.2	26.5	18.7	12.5	34.2	11.8	15.9	25.3	22.4
1972	664.5	20.5	11.5	28.7	20.5	13.1	36.4	12.7	16.7	28.8	24.6
1973	722.5	23.0	13.2	31.0	21.8	13.8	39.3	13.8	17.7	32.5	27.2
1974	781.1	25.3	15.5	33.5	23.3	14.6	42.9	14.9	18.9	36.8	29.5
1975	850.3	27.0	17.4	36.8	24.7	15.5	47.8	16.5	20.5	40.6	32.2
1976	910.1	27.8	18.9	39.9	25.8	16.6	52.4	17.2	22.0	42.9	34.9
1977	976.5	29.4	20.7	43.5	27.6	17.6	55.1	18.1	23.2	45.3	37.6
1978	1064.9	32.1	22.5	48.1	29.6	19.1	59.2	20.1	25.6	49.6	41.8
1979	1154.4	35.3	24.9	52.7	31.2	20.7	63.3	21.4	28.0	53.3	46.0
1980	1245.8	38.9	27.4	56.3	32.7	21.6	65.8	22.8	30.3	59.7	50.7
1981	1333.1	41.8	28.8	58.5	33.9	22.5	67.7	23.9	33.2	67.2	55.3
1982	1430.1	44.0	31.0	62.7	35.9	24.0	70.6	25.4	37.4	76.6	62.0
1983	1542.8	48.1	33.8	68.1	38.8	26.3	75.1	27.1	42.6	83.6	69.1
1984	1681.1	54.5	37.1	75.2	43.3	29.2	83.1	30.0	48.3	94.4	79.4
1985	1863.5	70.6	43.6	84.9	49.6	32.9	94.3	34.2	55.2	115.3	92.8
1986	2061.1	82.6	50.4	94.1	55.7	36.1	107.4	38.1	62.8	140.3	109.4
1987	2271.8	98.1	56.0	103.0	62.5	39.5	122.2	42.9	70.6	165.0	127.4
1988	2514.9	114.5	64.1	113.6	68.9	44.6	140.3	48.2	78.2	197.5	148.5
1989	2755.3	132.6	70.8	125.3	75.1	49.5	156.3	53.4	86.0	229.0	167.1
1990	2986.5	149.9	76.8	138.2	81.4	54.6	172.7	59.6	94.3	254.6	187.2
1991	3239.7	165.8	84.1	151.7	86.5	59.8	190.2	65.7	101.4	277.8	209.9
1992	3551.7	186.2	94.0	168.5	93.4	67.6	210.3	71.8	109.5	310.6	245.5
1993	4007.6	215.2	106.0	191.0	102.3	77.9	240.3	79.3	118.4	354.3	291.5
1994	4488.8	254.0	120.1	217.1	112.2	87.6	269.8	88.6	127.8	416.2	340.9
1995	5015.5	301.4	135.4	249.3	120.8	97.0	296.1	98.0	138.7	493.1	396.6
1996	5564.7	337.7	152.4	287.8	130.2	107.8	320.4	111.2	150.9	584.9	454.6
1997	6111.0	376.8	171.6	332.8	141.3	118.9	345.3	122.2	163.1	675.3	514.0
1998	6676.8	420.7	191.7	384.9	159.6	131.2	371.5	134.6	179.7	760.9	584.3
1999	7273.2	469.5	211.2	439.6	175.2	144.2	397.8	148.0	193.1	841.7	661.0
2000	7876.6	514.6	233.0	496.6	191.9	158.5	428.1	161.6	205.6	928.2	744.8
2001	8561.9	566.7	258.0	555.1	210.1	172.3	462.8	177.2	220.6	1023.2	832.6
2002	9359.1	622.7	286.7	616.3	231.0	193.2	504.3	194.9	240.3	1122.7	932.1
2003	10349.2	683.6	322.0	686.9	258.4	226.5	563.2	216.9	258.0	1243.3	1060.5
2004	11512.9	752.1	365.8	771.7	292.1	275.0	655.9	243.3	281.6	1384.5	1223.0
2005	12790.2	846.0	415.6	864.6	337.9	346.6	761.5	279.4	308.8	1546.1	1396.9

Years	k11	k12	k13	k14	k15	k16	k17	k18	k19	k20	k21
1952	2.1	2.1	1.2	2.4	4.8	4.6	3.3	2.6	0.3	3.0	0.5
1953	2.4	2.3	1.3	2.6	5.3	5.0	3.5	2.8	0.3	3.2	0.6
1954	2.6	2.5	1.4	2.8	5.8	5.5	3.9	3.1	0.4	3.5	0.6
1955	3.0	3.0	1.7	2.9	7.1	6.3	4.3	3.4	0.4	3.8	0.7
1956	3.4	3.5	2.5	3.1	8.5	7.3	5.0	3.8	0.5	4.3	0.8
1957	4.0	4.0	3.0	3.9	9.9	8.6	6.0	4.4	0.6	4.6	0.9
1958	5.3	5.1	4.0	4.9	11.7	11.0	7.6	5.9	0.7	5.2	1.0
1959	6.9	6.2	5.3	6.2	14.0	13.9	9.3	7.9	0.8	6.1	1.1
1960	8.1	7.0	6.6	8.1	15.8	15.8	10.6	9.3	0.9	6.8	1.2
1961	8.3	7.1	6.5	8.3	16.0	15.5	10.6	9.2	1.1	7.0	1.4
1962	8.5	6.9	6.2	8.4	15.9	15.1	10.5	8.9	1.3	7.1	1.5
1963	8.8	6.8	5.9	8.5	16.0	15.3	10.7	9.0	1.5	7.5	1.7
1964	9.3	7.1	6.2	8.6	16.3	15.7	10.7	9.4	1.8	7.8	1.9
1965	10.0	7.5	6.5	8.9	17.4	16.3	11.2	9.9	2.1	8.2	2.1
1966	10.7	7.8	7.0	9.4	19.0	17.5	11.8	10.7	2.4	8.9	2.3
1967	11.3	7.9	6.8	9.7	20.3	18.4	12.0	11.2	2.8	9.1	2.5
1968	11.8	8.0	6.7	10.1	21.3	18.9	12.1	11.6	3.3	9.5	2.8
1969	12.7	8.2	6.7	10.5	22.9	20.0	12.8	12.3	3.9	10.3	3.1
1970	13.7	8.8	7.3	11.6	24.8	22.3	14.7	13.7	4.6	11.2	3.5
1971	14.8	9.5	8.3	13.0	26.8	24.1	17.0	15.6	5.4	12.3	3.9
1972	16.1	10.2	9.1	13.9	29.0	25.9	18.2	17.0	6.3	13.4	4.3
1973	17.4	11.0	9.8	14.7	31.8	27.9	19.8	18.3	7.4	14.6	4.8
1974	18.6	11.8	10.2	15.4	33.1	30.0	21.2	19.2	8.7	15.7	5.3
1975	19.6	12.5	10.7	15.9	36.8	32.3	23.6	20.3	10.1	17.2	5.9
1976	20.6	13.3	10.8	16.6	40.6	33.9	26.0	21.1	11.9	18.7	6.6
1977	22.1	14.0	11.2	17.2	44.9	36.4	28.6	22.2	13.9	20.3	7.3
1978	23.9	14.7	12.6	18.7	49.2	38.8	30.3	24.4	16.9	22.1	8.2
1979	25.8	15.4	13.9	20.5	53.3	41.3	32.0	26.1	19.5	23.5	9.1
1980	28.5	16.1	15.5	22.0	58.0	44.0	33.2	27.5	22.5	25.1	10.1
1981	31.2	16.6	17.1	23.3	62.1	47.1	34.8	28.9	26.7	26.6	11.2
1982	34.4	17.9	18.9	24.8	67.6	49.7	37.4	30.7	31.4	28.0	12.4
1983	37.3	19.7	20.7	26.4	73.7	54.9	40.1	32.8	35.9	29.4	13.8
1984	42.8	22.4	22.9	28.6	81.9	60.7	44.1	34.9	41.3	31.0	15.4
1985	50.5	26.2	26.2	31.4	92.7	68.1	50.0	38.4	50.0	33.9	17.1
1986	59.8	30.4	30.2	34.6	104.1	75.2	55.8	42.7	58.7	37.1	19.0
1987	70.7	34.5	34.5	38.2	119.0	83.5	61.9	47.6	68.4	40.3	21.1
1988	82.6	38.7	38.9	42.7	135.4	94.1	69.2	53.3	80.3	43.6	23.5
1989	92.6	42.2	43.1	46.9	152.1	104.7	74.4	57.7	92.2	46.4	26.1
1990	99.9	46.0	47.3	50.1	169.7	114.9	81.0	61.7	104.4	48.6	28.3
1991	110.2	49.6	52.6	53.9	191.9	126.2	87.6	66.6	118.3	51.6	30.7
1992	127.2	54.6	60.0	59.9	220.3	141.2	96.0	73.4	141.8	57.2	35.2
1993	153.7	62.2	71.7	67.6	257.4	157.0	107.3	82.0	176.9	65.3	40.5
1994	183.2	72.0	88.5	75.6	296.6	174.2	122.3	92.2	216.6	74.4	46.8
1995	223.4	83.5	108.3	84.3	339.8	195.4	140.4	104.4	258.2	85.1	52.4
1996	266.2	96.8	130.8	93.5	390.0	219.2	160.6	116.8	299.4	95.3	56.9
1997	312.4	110.9	155.9	104.8	448.1	246.1	185.2	130.7	337.4	105.6	61.2
1998	364.2	125.8	184.7	117.0	512.0	276.3	213.0	146.4	380.3	117.3	66.1
1999	416.2	139.7	215.6	130.1	580.2	308.4	244.4	162.4	426.6	129.3	71.5
2000	469.3	154.5	247.6	143.0	658.1	342.5	277.0	180.0	472.6	142.0	77.3
2001	525.1	170.5	281.5	157.6	739.6	378.2	308.3	200.1	523.7	156.6	82.6
2002	591.0	188.5	318.2	176.0	827.8	417.4	339.1	222.4	577.9	173.3	88.2
2003	677.4	208.0	359.8	201.9	927.9	460.2	370.5	246.1	649.9	192.9	94.8
2004	780.3	234.4	407.3	232.7	1054.4	515.5	408.6	275.5	735.6	216.9	102.1
2005	891.6	266.0	453.9	266.0	1198.5	582.6	448.5	307.9	849.8	247.4	110.6

Years	k22	k23	k24	k25	k26	k27	k28	k29	k30	k31
1952	0.4	4.0	2.0	2.8	0.0	2.9	7.7	1.0	0.8	1.8
1953	0.4	4.4	2.1	3.1	0.1	3.2	8.2	1.1	0.9	1.9
1954	0.5	4.8	2.3	3.3	0.1	3.4	8.6	1.2	0.9	2.1
1955	0.5	5.6	2.4	3.6	0.1	4.0	9.5	1.4	1.0	2.4
1956	0.6	6.6	2.6	4.0	0.1	4.5	10.3	1.8	1.1	2.7
1957	0.7	7.8	3.0	4.4	0.1	4.9	11.1	2.1	1.2	3.0
1958	0.8	9.6	4.0	5.2	0.1	5.7	11.7	2.2	1.4	3.5
1959	0.9	12.5	4.8	6.3	0.1	7.2	12.7	2.7	1.8	4.2
1960	1.0	14.3	5.3	7.5	0.1	8.6	13.7	3.3	2.2	5.1
1961	1.1	13.5	5.2	7.7	0.1	8.7	14.3	3.2	2.3	5.6
1962	1.3	12.4	5.1	7.7	0.1	8.6	14.8	3.2	2.3	5.8
1963	1.4	12.2	5.2	7.8	0.2	8.6	15.3	3.2	2.4	6.1
1964	1.6	12.5	5.5	8.2	0.2	8.9	16.0	3.2	2.5	6.6
1965	1.8	14.2	6.3	8.9	0.2	9.5	16.7	3.3	2.8	7.1
1966	2.0	17.2	7.0	9.9	0.2	10.6	17.3	3.5	3.1	7.6
1967	2.3	17.9	7.3	10.4	0.3	11.0	17.9	3.6	3.4	7.9
1968	2.6	17.4	7.6	10.8	0.3	11.3	18.5	3.7	3.6	8.2
1969	2.9	18.7	8.0	11.7	0.3	12.5	19.3	3.9	3.9	8.6
1970	3.3	21.8	9.2	12.8	0.4	14.4	20.2	4.1	4.4	9.2
1971	3.7	24.0	10.8	13.8	0.4	17.0	21.2	4.4	5.0	9.9
1972	4.2	26.0	11.7	14.8	0.5	19.4	22.3	5.2	5.6	10.5
1973	4.7	27.8	12.6	16.0	0.5	21.0	23.5	5.5	6.2	11.3
1974	5.3	29.0	13.0	17.1	0.6	22.5	24.9	5.7	6.7	12.1
1975	6.0	31.8	13.3	18.3	0.7	24.0	26.6	6.0	7.5	13.0
1976	6.8	32.5	13.6	18.9	0.7	25.1	28.1	6.3	8.1	13.8
1977	7.6	34.7	14.2	20.0	0.8	26.7	29.5	6.8	8.9	14.7
1978	8.6	37.9	15.3	21.7	0.9	28.8	31.1	7.5	9.7	16.1
1979	9.7	41.2	16.3	23.4	1.1	31.0	32.6	8.3	10.5	17.6
1980	11.0	44.4	17.0	25.0	1.2	32.6	33.5	8.9	11.1	19.1
1981	12.4	46.5	17.5	26.4	1.3	34.4	34.2	9.3	11.5	20.7
1982	14.0	49.0	18.2	28.3	1.5	37.0	35.2	10.0	12.0	22.7
1983	15.8	51.8	19.0	30.0	1.7	39.4	36.4	10.6	12.8	24.7
1984	17.8	55.5	20.2	32.5	1.9	42.8	37.9	11.3	13.7	27.4
1985	20.1	60.4	21.8	35.5	2.1	48.8	40.0	12.5	15.2	30.9
1986	22.6	65.1	23.5	38.5	2.4	55.0	42.9	13.5	16.9	34.4
1987	25.5	70.9	25.3	41.3	2.6	61.7	45.7	14.8	18.7	38.2
1988	28.8	77.4	27.3	44.9	3.0	69.6	49.0	16.0	20.6	42.7
1989	32.5	81.7	29.4	48.7	3.3	78.7	52.9	16.9	22.4	47.9
1990	36.7	85.6	31.2	52.4	3.7	85.9	57.1	17.7	24.3	53.3
1991	41.3	90.3	33.1	57.6	4.2	93.4	61.4	18.6	26.3	59.3
1992	46.6	96.7	35.4	64.5	4.7	100.3	66.1	19.7	28.3	68.1
1993	52.6	107.2	38.2	73.5	5.3	112.1	71.3	20.9	30.8	79.3
1994	59.4	119.0	40.7	82.8	6.0	124.5	76.9	22.1	33.0	92.1
1995	66.5	132.0	44.4	92.0	7.1	137.8	83.2	23.6	35.3	104.8
1996	74.3	153.9	48.4	102.2	7.9	151.5	90.0	25.4	37.9	114.6
1997	84.8	167.1	53.2	114.1	8.7	164.2	98.1	27.7	40.6	125.7
1998	96.9	183.0	59.0	126.7	9.6	180.6	107.2	30.3	44.2	139.8
1999	108.7	199.6	65.8	139.0	10.6	198.2	117.5	33.1	48.3	151.1
2000	122.8	215.3	73.8	150.8	11.7	220.7	128.8	36.3	53.3	161.4
2001	133.1	240.7	83.5	166.8	12.7	246.1	140.2	40.5	59.4	175.6
2002	145.9	270.2	93.8	181.7	14.3	274.9	154.4	45.4	66.7	191.6
2003	163.8	304.3	105.4	201.4	16.8	312.8	170.1	51.2	76.0	212.0
2004	185.4	342.6	117.9	224.6	21.0	357.6	187.5	57.1	86.4	235.9
2005	210.5	389.0	131.8	256.7	25.2	407.1	209.4	63.6	98.9	262.4