Appendix C

Growth and Level of Chinese Gross Domestic Product

For 1820–90 estimates of Chinese GDP can only be very rough judgements. However, it seems safe to assume that the 1890 level was below that of 1820. In the nineteenth century there were several important revolts, a major civil war, and important military clashes with foreign powers, particularly the United Kingdom, Japan, Russia and France, who sought extraterritorial rights and financial indemnities from China. The Taiping rebellion devastated the most prosperous areas in the 1850s. The administrative apparatus was in disarray and there was important damage to major waterways. The Grand Canal fell out of use; the Yellow River burst its banks and changed its course. Between 1820 and 1890 population showed no net growth, whereas it had increased by almost half from 1750–1820.

For 1890–1952, GDP estimates for selected benchmark years (1890, 1913, 1933 and 1952) are feasible with a breakdown for 13 sectors (see Table C.1) in 1933 prices. For 1952–94, Table C.2 presents estimates for 12 branches for benchmark years (1952, 1957, 1978, 1987 and 1994) at 1987 prices. Table C.3 presents rougher and more aggregative annual estimates for 1952–95. These were constructed by filling gaps between the more reliable benchmark years with official (or adjusted official) sectoral indicators which are particularly shaky for the years of the "Great Leap Forward" and its aftermath (1958 to mid–1960s).

The benchmarks were chosen because they represented significant turning points in economic policy, were useful for purposes of international comparison, or for contingent reasons of statistical availability. 1890 was the starting point because it was the first year for which sectoral estimates were feasible. 1913 is a significant point for international comparison, as the last normal year before a world conflict. 1933 is by far the best documented prewar year and was investigated in detail by Ou (1947), Liu and Yeh (1965), Chang (1969) and Rawski (1989). It would be a bizarre benchmark for most Western countries, as it was the worst year of the world depression, but it was not a depressed year for China, and the 1933 level of per capita income was higher than that of 1952. 1952 is the starting year for most long–term series of the Chinese statistical office. 1957 is also a useful turning point. Before that, policy had concentrated on agrarian reform, and inauguration of a planned economy. Thereafter, came a quick and drastic collectivisation of agriculture, elimination of private industrial enterprise, the turbulence of the Great Leap Forward and the collapse of the Chinese statistical system. 1978 is another major turning point. Policies changed drastically and growth accelerated a good deal whatever measures are used. 1987 is important as a weighting year because of the availability of detailed and sophisticated input–output tables for that year, which throw more light on the structure of the economy than any other source. 1994 is the latest year for which figures were available for industry. The GDP estimate for 1995 is provisional.

Derivation of the Benchmark Estimates for 1890–1952 in Constant Yuan

Table C.1 presents estimates for 1890–1952, expressed in 1933 yuan. The sources are indicated in the footnotes. The 1933 value added weights are virtually all from Liu and Yeh (1965). For 1933–52 the movement of agricultural output is from Table A.3, and for other sectors from Liu and Yeh (1965) with some adjustment. For 1890–1933 movements I relied mainly on Yeh (1979), with some input from Chang (1969) and Rawski (1989) as indicated in the notes to Table C.1.

Official Chinese Measures of GDP for 1952–95

The Chinese State Statistical Bureau (SSB) has published aggregate estimates of Chinese economic performance on an annual basis back to 1952.

For years before 1978, they were constructed according to the material product system (MPS) devised by Soviet statisticians. There were *two* main aggregates: *i)* "total output of society", and *ii)* "net material product". Each of these was disaggregated into five components: agriculture, industry, construction, transportation and commerce. These magnitudes were shown in current yuan and as volume indices at "comparable" (quasi–constant) prices. Neither measure included so–called "non–productive" services: i.e. banking and insurance, housing, passenger transport, social services, health, education, entertainment, personal services, R&D, government and party organisations, police and military. The coverage of the estimates was thus significantly smaller than in the standardised national accounts (SNA) system used by all OECD countries. Very recently, a special study of the Chinese statistical authorities and Hitotsubashi University provided GDP estimates on an SNA basis for all years 1952–95 (SSB/Hitotsubashi, 1997).

The "total output of society" measure referred to the aggregate gross output of five component sectors. This involved a good deal of double counting because each of the component sectors has significant inputs from the others. The net material product measure (which the Chinese call "national income") was much better as it deducted most inputs used in production. However, inputs of "non–productive" services were not deducted.

An important difference between Western practice and that of statistical offices using the MPS system was the notion of "comparable" prices. In communist countries a large proportion of the basic statistical reporting came from comprehensive returns by state enterprises. The system led firms to exaggerate quality improvements when new products were introduced, and they did not always distinguish clearly between current and "comparable" prices. The reporting problem is still very serious in the industry sector where the range of products is enormous, and product characteristics change substantially over time (see Appendix B). For this reason "comparable" price estimates for industry are particularly likely to understate inflation, whereas the problem is not significant for agriculture. In Western countries, statistical offices normally ask a sample of firms for quantity and value information and calculate their own price indices. In China, as in the former USSR, they still emerge by aggregation of enterprise returns.

In the 1980s, China began to shift gradually to the standardised system of national accounts (SNA) used by Western countries. The coverage of the system is now in principle the same as in the SNA, and there have been several upward revisions in the level of the estimates as better survey material became available e.g. from the 1993 census of services and the 1995 industrial census. The official 1987 input/output table was a major step forward in clarifying the empirical differences between the MPS and SNA systems of classification, and provides by far the best weighting basis for measuring the longer run performance of China. Official estimates of Gross National Product and Gross Domestic Product are now available for the years since 1952. These now include the "non–

productive" services, plus the five traditional sectors. However, the new system is still something of a hybrid. The notion of "comparable" prices is still used. The volume measures for industrial output and non–productive services still understate inflation.

There are still some problems of classification which are not a major issue. Until 197l, the estimates for village industry were included in "primary industry", i.e. with farming, fishery and forestry. After 1971 village industry was classified as part of "secondary industry". Rural handicrafts, hunting and gathering are still classified with agriculture. The Chinese concept of industry still seems to conform to the old Soviet definition as it includes logging activity and repair and maintenance. The first of these would normally be included with forestry and the latter are generally treated as service activities in Western countries.

Maddison Modifications of the Official Estimates for 1952–95

My own estimates of Chinese GDP for five benchmark years can be found in Table C.2 disaggregated by 12 sectors. The notes to the table explain my procedures in detail. Table C.3 shows my annual estimates for all the years 1952–95 disaggregated by six sectors. The notes show the sources used to fill the gaps between benchmark years. So far as possible, my estimates are based on the measurement conventions of the SNA. The main differences from the official estimates are:

i) I made my own detailed estimate of gross value added for farming, as described in Appendix A above, using price and quantity data for 125 crop and livestock items, with adjustment for changes in the proportion of farm and non–farm inputs over time. I used the official Chinese series for fishery, forestry and sidelines. My estimate for agriculture as a whole showed slightly faster growth than the official estimates and a significantly higher level of value added;

ii) I used Wu's (1997) estimates of gross value added in industry, which show substantially slower growth than the official estimates for this sector (see Appendix B);

iii) The official estimates for non–productive services imply an improbably high growth of labour productivity. I have assumed, in line with the practice of many OECD countries, that there was no increase in productivity and used employment as an indicator of output. I also increased the 1987 weight of this "non–productive" sector by a third as the official coverage appears to be inadequate. It substantially undervalues housing and military outlays and it probably does not cover welfare benefits in kind which are supplied free to employees of state enterprises;

iv) I used 1987 gross value added weights throughout. The official estimates are constructed in five linked segments with weights of 1952, 1957, 1970, 1980 and 1990 respectively;

v) For transport and communications, commerce and restaurants I used official sources for 1957–95 linked to Liu and Yeh (1965) for 1952–7. For construction I used official estimates throughout.

Table C.6 permits a summary confrontation of my estimates with the official figures for selected years in the period 1952–95. Panel A shows my volume indices by sector (derived from Table C.3). Panel B shows the sector volume indices used in the official estimates. For 1952–78, my overall GDP measure shows an average compound growth rate of 4.4 per cent a year compared with the official growth rate of 6.1 per cent. For 1978–95, my GDP measure shows average annual growth of 7.5 per cent compared with the official 9.9 per cent.

It is obvious from the implicit official deflators (shown in Panel C of Table C.6) that the price structure changed drastically over the 43 years under survey. In 1952 agricultural prices were kept very low and industrial prices were relatively high. By 1987 (my weighting year), farm prices had

risen more than threefold, but the official deflator suggests that industrial prices had actually fallen. My use of 1987 prices gives a much bigger weight to the slow–growing agricultural sector than if I had used 1952 weights. In fact I chose 1987 as a weighting year for two reasons: *i)* the Chinese economy was by then subject to market forces to a much greater extent than in earlier years of very tight control and regulation; *ii)* the 1987 input–output table provided a wealth of detailed information which permitted much clearer definitions of gross value added by sector than for earlier years — this is why I selected 1987 as the weighting year for my detailed estimates for agriculture, and it is why Wu (1997) made the same choice in his industry estimates.

It is possible to reweight the official volume indices, using 1987 levels of value added, as I have done in Tables C.9 and C.10. With these 1987 weights, the official measures show GDP growth of 4.7 per cent a year for 1952–78 compared with 6.1 per cent with the official segmented weights. For 1978–95, the reweighted figure shows a growth rate of 9.8 per cent a year — virtually identical with the official GDP growth rate of 9.9 per cent.

It is clear that for 1952–95 as a whole, my measure differs from the official estimates for two main reasons: differing techniques for measuring sectoral volume change, and use of different weights.

Figure C.1 provides an index number of my GDP estimates for 1952–95 (bottom line). The intermediate line provides an index number of the official GDP estimates reestimated with 1987 weights (derived from Table C.10). The top line shows an index of the official GDP measure with segmented weights (these official estimates are only available in index form).

Comparison of my GDP Level with that of SSB

My estimate of the 1987 benchmark level of GDP was 10.3 per cent (123 billion yuan) above that in the official national accounts. For agriculture, it was 61 billion yuan (19 per cent) higher; for "non–productive" services 60 billion (one–third) higher, and for industry 2 billion (about 0.5 per cent) higher — here the difference was due to use of the input–output benchmark rather than the official national accounts. The difference in level between my estimates and the official figures is larger the further back one goes in time. For 1952 my GDP level is twice as high as the official estimates (shown in Table C.8). In 1978 it was 31 per cent higher, but as one advances in time, the situation is reversed, and for 1995 my estimate is 10.1 per cent lower (see Figure 3.2).

My upward adjustment for the 1987 GDP level is modest compared with that of Keidel (1992), who made a number of very detailed proposals to justify his 55 per cent upward adjustment of the level of the official Chinese estimates. These were of three types: a coverage adjustment of 251 billion yuan; a valuation adjustment of the same size; and a consistency adjustment of 64 billion. The latter involved reassignment of sector economic activity, but was also in part a valuation adjustment. The impact of these changes would have been biggest in services, substantial in agriculture and zero for value added in industry.

My adjustments for services and agriculture are similar in character to those of Keidel, but he proposed a large number of other changes in an ambitious attempt to remove "distortions" in the Chinese price system. He reestimated profit rates in all sectors to reflect a more uniform rate of return on productive assets and land, he reallocated the impact of subsidies etc. Keidel's objective in this respect resembled that of Bergson (1961) who modified prevailing Soviet prices to an adjusted factor cost basis to get a better picture of real costs of production in the USSR. As Chinese accounting conventions were similar to those in the USSR, this is an interesting exercise, but there is a big risk that extensive price imputations will produce further distortions given our inadequate knowledge, e.g.

of the size of the capital stock by sector. In this huge economy, whose price and allocation mechanisms are still undergoing major change, it is probably unrealistic to try to create a counterfactual estimate of what prices would be if the economy were run on capitalist lines. A full–fledged adoption of the Keidel level adjustments would make new alternative measures of growth very difficult to construct and interpret, and it would make it difficult to use the presently available purchasing power parity estimates which are based on the prevailing price system. In fact, Keidel (1994) modified his earlier estimate in terms of both scope and valuation, suggesting a smaller upward adjustment of the official GDP in yuan by 34 per cent. His suggestion was adopted in the World Bank's *1994 World Tables* which included an upward revision of the Chinese GDP series by 34 per cent, but the 1995 edition reverted to use of the official estimates.

It should be noted that Griffin and Zhao (1993, p. 35) also found it necessary to adjust SSB estimates upwards in their study of income levels for 1988.

Conversion of Chinese GDP Estimates in Yuan into "International" Dollars

For purposes of international comparison, it is necessary to convert the yuan estimates into a numeraire which is available for other countries. Exchange rates are a misleading indicator of comparative real values. The most appropriate and convenient measure is a 1990 purchasing power comparison in terms of US dollars, which has been constructed for 49 countries by the International Comparison Programme (ICP) of the United Nations, and is available for most other countries in proxy form in the Penn World Tables (PWT) of Robert Summers and Alan Heston. China did not participate in the 1990 ICP exercise and in Maddison (1995*a*), pp. 167–69, I opted for the PWT (5.5) converter, which, updated to 1990 in 1990 dollars produced an estimate of $2 700 per capita.

Since then, Ren (1997) has produced a new ICP–type estimate of comparative Chinese/US real expenditure levels for 1986. Here I use Ren's new estimates, instead of the Penn World Tables, which in their latest version (5.6) have been revised drastically downwards, and now seem to be based on Ren's work.

Several adjustments are necessary to the Ren estimates to put them on a comparable basis to the 1990 multilateral (Geary–Khamis) purchasing power parities I used in Maddison (1995a) for other countries. Ren (1997, p. 37) has three expenditure PPP estimates for his benchmark year 1986: a Laspeyres measure with US quantity weights, a Paasche measure with Chinese quantity weights and a geometric (Fisher) average of the two binary measures. The Laspeyres PPP is the least favourable (1.5091 yuan to the dollar), the Paasche the most favourable (0.5895 to the dollar). He prefers the geometric average of 0.9432 yuan to the dollar. These are all bilateral measures, but for a multi–country comparison it is better to have a multilateral PPP which produces transitive results for all countries. Kravis (1981) who created the ICP approach and made the first ICP–type estimate for China, adjusted his Chinese/US Fisher PPP by 19 per cent as an approximation to his preferred multilateral (Geary–Khamis) converter. This was in fact the average Fisher/Geary–Khamis spread for five Asian countries in the 1980 ICP exercise (see Maddison, 1995, p. 176). I made the same proportionate adjustment to the Fisher estimate of Ren to derive a proxy Geary–Khamis PPP for China/United States of .7926 for 1986. This compares with an exchange rate of 3.45 yuan to the dollar in that year (see Maddison, 1995, pp. 162–78, for a discussion of these issues and examples of the range between the different kinds of PPP measure).

Ren used the official estimate of Chinese GDP for 1986 of l 020 220 million yuan, whereas my estimate for 1986 (adjusted to 1986 prices) was 13.35 percent above the official estimate (i.e. 1 156 400 million yuan) because of the coverage adjustments mentioned above. Converting this into 1986 dollars with the Geary–Khamis converter yields an estimate of $1 458 996 million. This

needs to be updated to 1990 by my estimate of the increase in volume of Chinese GDP (23.82 per cent), and adjusted for the 16.77 per cent rise in dollar prices (US GDP deflator). These two adjustments yield a 1990 internationally comparable dollar estimate of $2 l09 400 million. The 1990 conversion coefficient was then applied to all other years as can be seen by comparing the second and third columns of Table C.4. As the estimate for China in US dollars are not derived from exchange rate conversion, I refer to them as "int." (international) dollars.

The Analytical Relevance of PPP Conversion

For valid international comparisons, it is a fundamental necessity to use the same type of converter for all the countries under consideration. I believe the adjusted Ren PPP estimate is the best that is presently available, and makes much more sense than exchange rate comparisons, which can give a very erratic and misleading picture of China's geopolitical weight. I cite four illustrations of this:

i) Mr. Patten, the last British governor of Hong Kong, stated in an article in the *Economist* newspaper of 4 January 1997, that "Britain's GDP today is almost twice the size of China's — China's GDP is about the same as those of Belgium, the Netherlands and Luxembourg combined". If he had used my PPP converters, he might have said (of the 1994 situation) "Britain's GDP today is about one–third the size of China's — China's GDP is more than six and a half times as big as the combined GDP of Belgium, the Netherlands and Luxembourg";

ii) Similarly, one might argue that Hong Kong GDP in 1994 was 24.3 per cent of China's in 1994, using the official exchange rates to convert the official GDP estimates, whereas the PPP conversion suggests that Hong Kong's 1994 GDP was only 4.2 per cent of China's (see Table C.5);

iii) an exchange rate conversion suggests that China has become a very open economy with 1996 exports equal to 18 per cent of its GDP. Use of the PPP converter provide a very different picture — a Chinese export ratio of 4.3 per cent of GDP in 1995 (see Table 3.26 above).

iv) the World Bank, *China 2020*, Washington, D.C., 1997*a*, p. 75, states that China's energy intensity (consumption per unit of GDP) is "between three and ten times that of major industrial economies". This is presumably an estimate based on exchange rate converters. My own estimates do not support such an extreme statement. They suggest that China consumes more energy per unit of GDP than Germany and Japan, but less than Australia, New Zealand and the United States and about a quarter of the Russian level (see Table 3.5 above).

SSB Estimates of Investment

SSB estimates GDP by type of expenditure as well as by industry of origin, but the former are less developed. There is a discrepancy of up to 4 per cent in the level of current price estimates for the product and expenditure side (see SSB/Hitotsubashi, 1997, p. 59).

For our purpose the most interesting part of the expenditure estimates are those for investment. Table C.11 shows the original and adjusted estimates of gross fixed investment, inventories, and GDP. I adjusted the official figures to eliminate military investment which is treated as current government spending in Western national accounts, and have reduced the Chinese coverage of repair costs, most of which would be treated in Western national accounts as intermediate input (see notes to Table C.11). The size of this correction is judgemental but fairly modest (see Maddison, 1998, where

the comparable adjustment for Soviet accounts was much bigger — 6.4 per cent of GDP). The estimates of fixed investment are further adjusted to exclude residential investment.

Table C.12 shows official and adjusted estimates of fixed investment at constant 1987 prices. The adjusted estimates of non–residential fixed investment in column 4 were used to calculate the capital stock by the perpetual inventory technique from 1976 onwards (as described in Chapter 3).