China's Reform Period Economic Growth: Why Angus Maddison Got It Wrong and What That Means

China's economic growth statistics of the late 1990s have repeatedly been questioned. Angus Maddison in a 1998 OECD study goes further in that he revised China's official average annual real growth rate for the first seventeen years of economic reform, 1978 through 1995, downward by 2.39 percentage points per year. His study is the most thorough criticism of Chinese official statistics to date, and the one with the largest impact on the data. By 1995, the revisions imply 150% less output, in 1978 terms, than the official data do. Angus Maddison's revisions were subsequently incorporated into the Penn World Tables; the findings of countless cross-country studies are therefore affected by Angus Maddison's growth estimates for China. This paper examines Angus Maddison's revisions to official data and finds them invalid. Angus Maddison's growth estimates for China in the reform period constitute no alternative to the official data.

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Introduction

Over the past 25 years, China's economy grew at an average annual real growth rate of 9.37%. By 2003, according to the official data, China's gross domestic product (GDP) was 9.38 times larger in real terms than at the beginning of the reform period in 1978.[1] But in recent years, China's official real GDP growth rates have been repeatedly questioned.

Much of the criticism focuses on the GDP growth rates of the late 1990s. The real growth rates are supposedly in conflict with the growth in related physical quantities such as energy consumption, product quantities produced, or freight transportation. Yet, upon closer inspection, much of the perceived discrepancy can be reduced to an imperfect understanding of what the official data mean, in particular, which statistical units are covered by particular statistics, and how this coverage changes over time. Similarly, consistency checks of official GDP—which is based on the production approach supplemented by the income approach—via the two alternative approaches to the calculation of GDP yield either minor or unsystematic differences. There appears to exist no compelling evidence to show that official Chinese GDP growth rates became subject to data falsification in the late 1990s.[2]

A range of statistical breaks in 1998 introduced data inconsistencies for individual variables between 1997 and 1998. But even if these statistical breaks were to have affected official nominal GDP and real growth rates in the short run, critics of recent GDP data have not moved on to question China's long-run economic growth rates. Thus, they do not question the nominal GDP data for earlier and later years, such as for 1995 and 2002, or the official implicit GDP deflators, although a lower real growth rate in the most recent years should lower long-run average real growth rates in China.

Angus Maddison challenges official Chinese GDP data over the long run in a 1998 OECD study entitled *Chinese Economic Performance in the Long Run*, in which he offers an alternative real GDP time series for the years 1952 through 1995. He adopts alternative real growth rates for industry and "other services" and adjusts their base year value; he also re-calculates agricultural value added (and thereby its growth). The resulting average annual real GDP growth rate

between 1978 and 1995 is 7.49%. This contrasts with the official average annual real GDP growth rate in this period of 9.88%, a difference of 2.39 percentage points. Between 1978 and 1995, China's economy grew 3.42-fold according to Angus Maddison, but 4.96-fold according to the official data. In 1978 terms, official data show China to be 150% better off in 1995 (in terms of real GDP) than Angus Maddison thinks is the case.

Angus Maddison's alternative GDP estimates were widely noticed both within and outside China.[3] Xu Xianchun (1999a), head of the National Income Accounts Division of China's National Bureau of Statistics (NBS), in an early reply, summarized and questioned some aspects of Angus Maddison's alternative time series. On the other hand, the Penn World Tables (PWT) Version 6 for the case of China rely heavily on Angus Maddison's estimates to adjust China's official data (Alan Heston, 2001). Any researcher using PWT data for cross-country studies, thus, relies on Angus Maddison's alternative GDP data and real GDP growth rates; if these alternative data were not reliable, findings in a wide range of cross-country studies may be affected.

This paper examines the reliability of Angus Maddison's alternative real GDP growth rates and nominal GDP data. While Angus Maddison's alternative GDP estimates cover the period 1952 through 1995, the focus here is on the period which is of most interest to current economic research on China, namely the economic reform period (the years since 1978). The key question is if China's average annual real GDP growth rate indeed needs to be adjusted downward by 2.39 percentage points from 9.88% to 7.49% in the period 1978-1995.

The next section reports Angus Maddison's adjustments to the official data and examines the individual impact of the various types of adjustments. The following sections question his key adjustments. These are, first, to the real growth rate of "other services," second, to the real growth rate of industry, and, third, to base year nominal values. The sixth section links the PWT data for China back to Angus Maddison's alternative times series.[4]

Angus Maddison's alternative sector-by-sector GDP and real growth rate estimates

Angus Maddison presents an alternative set of annual GDP data, in constant 1987 prices, for the years 1952 through 1995. Compared to the official real growth rates compiled by the National Bureau of Statistics (NBS), Angus Maddison in his calculation of real GDP growth rates uses

(i) different techniques for measuring volume ("real") changes in some sectors of the economy,

(ii) a different base year, namely 1987 instead of the official linked, approximately decennial base years (1952, 1957, 1970, 1980, 1990), and

(iii) for this 1987 base year sectoral nominal values which are different from the official ones.

For the years 1978 through 1995, Angus Maddison arrives at an average annual real GDP growth rate of 7.49%, in contrast to the official 9.88% real GDP growth rate during this period.

Comparing Angus Maddison's growth rates to the official ones, the only significant differences occur in "other services" and in industry. (See Table 1.) Thus, between 1978 and 1995, according to Angus Maddison, industry grew at an average annual rate of 8.56% instead of the official 12.02%, and "other services" grew at an average annual rate of 6.71% instead of the official 11.76%. The differences in construction, in transportation and communication, and in commerce are zero; in agriculture the difference is negligibly small at 5.15 vs. 5.12%.

Angus Maddison's adjustments to nominal data are the following. In his benchmark year, 1987, he increases agricultural gross value added by 60.6b yuan RMB, industrial (gross) value added by 2.0b yuan RMB, and the (gross) value added of "other services" by 60.1b yuan RMB. (Since all value added in the following is gross value added, the label "gross" will be omitted.) This implies that, compared to the NBS values for sectoral (nominal) value added in 1987, Angus Maddison increases the weight of agriculture's from the official 26.79% to 28.88%, and the weight of "other services'" from 15.07% to 18.22%. With an increased (total) GDP, the shares of all other sectors fall.

Angus Maddison's different base year practice and different sectoral weights in his base year do not have much impact; what matters most are Angus Maddison's different real growth rates. Varying the combination of choice of sectoral real growth rates, choice of base year, and choice of base year sectoral weights yields average annual real GDP growth rates for the period 1978-95 which differ from the official 9.88% or Angus Maddison's 7.49% as follows:[5]

(i) official real growth rates of sectoral value added, *1987 base year*, sectoral weights obtained from official nominal 1987 sectoral value added: 9.85%;

(ii) official real growth rates of sectoral value added, *1987 base year*, *Angus Maddison's 1987 sectoral weights* based on his revised nominal 1987 sectoral value added: 10.23%;

(iii) *Angus Maddison's real growth rates* of sectoral value added, official procedure of linked decennial base years, official base year (1970, 1980, 1990) sectoral weights: 7.60%;

(iv) *Angus Maddison's real growth rates* of sectoral value added, *1987 base year*, official base year (1987) sectoral weights: 7.96%.

The switch to a 1987 base year while retaining the official data has only a minute downward impact on the official growth rate (from 9.88% to 9.85%), while the use of Angus Maddison's 1987 base year and weights even increases the average annual real GDP growth rate by 0.35 percentage points to 10.23%. It is the switch to Angus Maddison's real growth rates which has the biggest, now downward, impact (to 7.60% or 7.96% depending on base year), only slightly reinforced by his adjustments to nominal sectoral value added in 1987 (to obtain his 7.49%).

Real growth rate of "other services"

Angus Maddison's adjustments to real growth rates is largest in the tertiary sector subsector "other services." He accepts the official growth rates in the other two subcategories of services, namely in transport & communication, and in commerce & catering (which, together, he labels "productive services"), but does not do so in the case of "other services" (which he labels "non-productive services"). For "other services," Angus Maddison uses employment as an indicator of output. In other words, for "other services," but not for transport (& communication) and not for

commerce (& catering), he assumes zero labor productivity growth, justifying his assumption with "the practice of many OECD countries" (p. 151).

Angus Maddison's choice of employment data is problematic, potentially severely underestimating employment growth in "other services" and thus in output. The assumption of zero labor productivity growth in "other services" is also not credible to begin with. First, the assumption is not plausible in the context of an underdeveloped transition economy undergoing rapid economic growth and transition. Second, the OECD data provide a mixed picture, and data from other transition countries do not bear out Angus Maddison's assumption.

Employment data

The assumption of zero labor productivity growth in "other services" implies that Angus Maddison's real growth rate of value added in "other services" equals the employment growth rate in "other services." Angus Maddison's employment data are problematic in two respects: (i) he adds 3m military personnel to employment in "other services" under the assumption that these were previously omitted, and (ii) later revisions to official employment data suggest a massive underestimation of employment growth in "other services" by Angus Maddison.[6]

Table 2 reports Angus Maddison's employment data and contrasts these with employment data reconstructed from the *Statistical Yearbook*. The official source provides employment data since 1978, but without hierarchical structure in form of a list of different categories, from total employment to employment in agriculture, industry, construction, transport, commerce, etc., all the way to a category "others" following the various tertiary sector subsectors at the end of the table (see Table 3 for the categories). Angus Maddison includes the "others" in "other services," but omits employment in geological prospecting and water conservancy from "other services," arguing that in the Soviet material product concept previously used in Chinese national accounts this category forms part of "productive services" (p. 168).[7] Angus Maddison's employment data are mid-year data, obtained as the average of previous-year end-year values and current-year end-year values.

The addition of 3m military personnel to employment in "other services" every year is likely to be incorrect. Xu Xianchun (1999a, p. 12) reports that the value added of military personnel is included in the category government in the GDP statistics. The same is likely to hold for the employment statistics, which also have a category "government." If the 3m military personnel are excluded from Angus Maddison's 1978 and 1995 values, the average annual employment growth rate in "other services" rises from his 6.72% to 7.18% (Table 2).

A second and potentially much larger inaccuracy stems from upward revisions to total employment of the years since 1990 in the *Statistical Yearbook 1997* and in all later editions. The NBS retrospectively revised total employment data of 1990 upward by 14.12%, without, however, attributing this increase in employment to individual sectors. In other words, starting with the year 1990, the employment tables, besides the category "others," contain an *implicit* residual employment category. The size of the implicit residual category fell through 1995, when it was 9.10% of explicit employment across the various employment categories, before it rose again to 15.62% in 2002.[8]

The 14.12% jump in retrospectively revised 1990 employment suggests that employment data of earlier years should also be revised upward. For the year 1978, however, the impact could be small. In a much more tightly controlled society in 1978, employment data are likely to have been more accurate.

If all the sectorally unidentifiable laborers of 58.30m in 1995 were to be added to the category "other services," Angus Maddison's mid-1978 employment (less the presumably double-counted 3m military personnel) of 25.965m would have grown to 141.36m in mid-1995 (all employment except that in the primary sector, secondary sector, transport, commerce, and geological prospecting and water conservancy), an average annual growth rate of 10.48%, four percentage points higher than the growth rate adopted by Angus Maddison, little more than one percentage point below the official real growth rate of value added in "other services."[9] If the implicit residual were attributed to each employment category proportional to that employment

category's mid-year 1995 employment value, the average annual growth rate of "other services" would be 7.75%.[10]

Underemployment

The assumption of zero labor productivity growth in a transition economy is not plausible. In a transition economy, with a previously suppressed and therefore underdeveloped, under-motivated, and under-capitalized service sector, labor productivity growth, once the economy opens up, is unlikely to remain constant. Anybody who has exchanged currency in a Chinese bank in the early 1980s and then again in the mid-1990s can testify to a momentous reduction in the amount of time (and labor effort on the part of the bank) required to conduct the transaction. Similarly, anybody who has experienced a university administration or government organization in China in the early 1980s and then again in the mid-1990s is unlikely to accept the assumption of zero labor productivity growth.

The argument can also be phrased in terms of underemployment. The phenomenon of severe underemployment in (unreformed) socialist economies is an accepted fact in comparative economics.[11] But in the transition to a market economy, underemployment turns into unemployment. Angus Maddison assumes that underemployed laborers in the early reform years produce as much output as fully employed laborers in the later years. He provides no argument why a widely accepted tenet in economics—underemployment in (unreformed) socialist economies—does not hold for China.

The numerical evidence for zero labor productivity growth

Angus Maddison justifies his assumption of zero labor productivity growth with "the practice of many OECD countries" (p. 151). At first sight, aggregate OECD data appear to indeed justify Angus Maddison's assumption. But detailed inspection of OECD data yields more differentiated results. Furthermore, a set of highly developed countries need not be a good comparison case for China. Data from transition economies tell a different story.

Table 3 reports average annual labor productivity growth in China's various tertiary sector subsectors. (All labor productivity growth rates, here and below, are in "real" terms, i.e., output is measured at constant prices.) This requires matching value added with employment data. Not all output and employment categories can be matched: while there is data on value added created in public utilities, this category does not exist in the employment statistics. Conversely, the employment categories "geological prospecting and water prospecting" and "others" have no equivalent in the value added classification; the implicit residual employment category also has no equivalent in the value added classification.[12]

Across the various tertiary sector subsectors, average annual labor productivity growth between 1978 and 1995 varies from a low of 1.81% in commerce to a high of 8.34% in "science etc." (research, education/ media, health/ welfare).[13] But the individual time series inspire little confidence. Figure 1 shows the annual labor productivity values for the tertiary sector subsectors for each of the years 1978 through 1995 (in 1987 prices, standardized to 1978 levels, with mid-year employment data); presumably, re-classification of labor and post-population or post-tertiary sector census adjustments to labor data account for much of the year-on-year variation.

A solution is to switch to average annual growth rates and to aggregate subsectors of "other services" into two groups, following the OECD: (i) banking/ insurance and real estate, and (ii) everything else. The result, based on mid-year employment data, is average annual labor productivity growth in banking/ insurance and real estate of 6.58%, and of everything else within "other services" of either 2.79% or -0.44%, depending on whether implicit residual employment is excluded or included; in transport and commerce the figures are 4.01% and 1.81%. (See Table 3.) Aggregating even further, to the level of all "other services," including employment in "others" but excluding employment in geological prospecting and water conservancy, to replicate Angus Maddison's approach, yields 4.34%; once the implicit residual employment is included it falls to 1.16%.

The question then is whether these labor productivity growth rates are plausible in comparison to other countries? Since some of the data on other countries are rather limited, with

occasionally data for one year and then another year a decade later, comparisons below are based on year-end employment data. In the case of China, the resulting labor productivity growth rates, also reported in Table 3, are slightly higher, because the end-year employment values for 1978 tend to be lower and those of 1995 higher than the mid-year values: banking/ insurance and real estate: 6.72%; everything else within "other services:" 3.12% or 0.02% (including residual employment); other services in total: 4.67% or 1.62% (including residual employment).

Calculating average annual labor productivity growth rates for the 10 OECD countries for which this is possible based on the OECD's National Accounts database suggests that Angus Maddison is right; on average labor productivity growth rates in the two subsectors of "other services" are around zero, except that this is not uniformly the case across all countries and across all time periods.[14]

A more differentiated picture, however, emerges if the OECD Services database with more specialized data for 26 countries is consulted (Table 4); output and employment categories follow the International Standard Industrial Classification of all Economic Activities (ISIC) Rev. 3 classification. The table reports two sets of average annual (real) labor productivity growth rates over the longest time span for which data are available for each country.

In the first set (second-level classification) the service sector consists of "trade" (labeled "trade I" for its inclusion of transport and communication, and to distinguish it from the "pure" trade coverage below), finance ("finance I," including real estate and business services), and "other" services. The data show that non-trade non-transportation labor productivity growth rates can be well above zero, and even higher than those in trade and transportation. Labor productivity growth rates in finance and in "other" services exceed those in trade in Belgium; labor productivity growth rates in finance also exceed those in trade in the Netherlands and in Portugal, and in Slovakia labor productivity growth rates in "other" services of 7.83% exceed those in trade.

In the second set (third-level classification), services are broken down into the six subsectors trade, transport, finance, real estate, public administration, and social services. The results are

rather mixed. Labor productivity growth rates in the (now purely) finance sector across most countries are on a par with or higher than those in trade and transportation. At the extremes, the Czech Republic between 1990 and 1999 had average annual labor productivity growth in finance of -6.87% and the Slovak Republic between 1995 and 1999 of -9.71%, while the average annual labor productivity growth rates in finance in Poland (1992-99) and Portugal (1995-97) were 17.30% and 10.37%—this compares to 6.72% in China.

Labor productivity growth rates in real estate and business services are abysmal in most countries, except for the Slovak Republic, where the average annual growth rate in 1995-99 was 10.26%—this compares to 7.92% in China. It is difficult to imagine, in the case of China, that state-owned real estate companies in 1978 had equal or higher labor productivity, in real terms, than collective- and privately owned real estate companies in 1995. It is also difficult to imagine that the value of owner-occupied housing services in 1995 is no higher in real terms than in 1978, i.e., that the per laborer area and quality of housing in China has remained unchanged in 17 years of reform.[15]

Public administration tends to experience low but positive labor productivity growth rates, with a record average annual 3.00% in the Netherlands over a twelve-year period—this compares to 4.02% in China. Social services tend to have about zero percent labor productivity growth, compared to 2.95% or a combination of 2.95% in social services and 8.79% in science etc. in China. Overall, across OECD countries, there is no clear pattern for non-trade non-transportation services, especially not one of zero labor productivity. The pattern is particularly mixed for the least developed and/or transition countries.[16]

OECD countries are unlikely to be good comparison countries for China. From a development point of view, data from the OECD countries appear most relevant if they cover a period at least half a century ago, yet such data are not available.[17] An alternative is to expand the choice of countries under examination. This is achieved by combining value added from the United Nations National Accounts database (in domestic currency at 1990 constant prices) with labor data from the International Labour Organization's employment database. Table 5 reports

labor productivity growth rates from all countries worldwide for which these rates could be calculated, in the case of each country covering the maximum period for which the data are available, within the starting and end-year parameters set by the databases, of 1970 and 2003. With employment data following the ISIC Rev. 3, labor productivity growth rates for 66 countries can be calculated.[18] The relevant service categories are trade, transport, and "others."[19] An alternative category "others"—"Others II"—further includes those laborers which in the labor database are labeled "activities not adequately defined."

The last block of rows in Table 5 reports summary measures across all countries, treating each country equally, independent of its size or of the time period which its data cover. Average annual labor productivity growth in "other services" is 0.63% or 0.69% per year, depending on the definition of "others," lower than that in transport (2.90%), however, almost half a percentage point higher than that in trade, at 0.29%. Consequently, since Angus Maddison accepts China's official average annual labor productivity growth rate in commerce of 1.65% (based on end-year employment), he should be willing to accept labor productivity growth in "other services" of around two percent—where China reports 4.67% or 1.62% (including residual employment). Furthermore, the data suggest that much higher (as well as lower) labor productivity growth rates in "other services" are possible. Average annual labor productivity growth rates in "other services" range from a low of -13.59% to a high of 9.62%.

Of most interest are the transition countries (marked in italics in Table 5). Data are available on seventeen transition countries, of which four report two sets of employment data (leading to two observations for these countries). These observations exhibit a wide range of labor productivity growth rates in "other services." Some countries, such as Hungary or Latvia, were able to maintain 2-4 percent average annual labor productivity growth rates over a sustained period of time (a decade). Over shorter periods, much higher growth rates can occur. Non-transition countries, such as Ecuador, Ireland, Malta, Oman, Portugal or Quatar also managed average annual labor productivity growth rates above two percent for sustained periods of time, and higher growth rates in the short run.

If the transition effect is viewed as affecting labor productivity across all sectors, then labor productivity growth in industry, for example, and in "other services," should be correlated. Figure 2 shows the relationship between average annual labor productivity growth rates in industry and in "other services" for the case of the transition countries. It is a consistent positive relationship. Countries which experience relatively high labor productivity growth in industry also do so in "other services."[20]

China has experienced average annual labor productivity growth in industry between 1978 and 1995 of 8.19% (using end-year employment data, see Table 3). Based on the experience of all transition countries worldwide, one would expect average annual labor productivity in "other services" in China to be around five to six percent (Figure 2), compared to the 4.67% or 1.62% (including the residual employment category) based on the official data. In other words, based on the average transition country, one would expect labor productivity growth in "other services" in China to be at a level comparable to if not exceeding that implicit in the official data.

In sum, not double-counting military personnel means that Angus Maddison's employment growth rate is 7.18% instead of 6.72%. Including the implicit residual employment, or a share thereof, means that Angus Maddison's employment growth rate needs to be revised upward by up to four percentage points, coming within close reach of China official average annual real growth rate of value added of 11.76%. Separately, the assumption of zero labor productivity growth in "other services" is not credible for a transition country to begin with. Official labor productivity growth rates across China's *subsectors* of "other services" appear perfectly plausible in cross-country comparisons. China's official labor productivity growth rate in *aggregate* "other services" is perfectly plausible in a comparison with other transition countries, if not too low. There is no scope left for Angus Maddison's adjustments to real growth in "other services."

Industry

Angus Maddison revises the average annual real growth rate of value added in industry in the period 1978-95 down from the official 12.02% to 8.56%. The procedure used to arrive at his adjustments is highly questionable and the results of this procedure are not tenable in cross-country comparisons. The justification for undertaking revisions, to begin with, is invalid.

Real growth of industry

Angus Maddison's average annual real growth rate in industry, of 8.56% between 1978 and 1995, is based on constant price output estimates calculated by Harry Wu in 1997. These estimates are derived from the weighted quantity change in the output of 114 individual industrial products. Product-specific weights are provided by 1987 prices, and output values of industrial sectors (quantities times 1987 price, summed across products specific to a particular sector) are then translated into value added based on sector-specific ratios of gross output value to value added, obtained from the 1987 input-output table; sector-specific adjustment are made to take into consideration the fact that the 114 products are only a subset of all products produced in China.

The later published paper by Harry Wu (2002) covers 161 products.[21] The increase in products covered by 47 from 114 to 161 changes the average annual growth rate of real industrial value added from 8.56%, the figure used by Angus Maddison, to 9.85%. Since Angus Maddison explicitly subscribes to Harry Wu's methodology (pp. 140, 151) and adopts Harry Wu's findings for the years 1978-95 from Harry Wu's earlier study, the updated figure of 9.85% should lead to an update of Angus Maddison's overall GDP estimates. In other words, Angus Maddison's original industry growth rate of 8.56% is no longer relevant. The relevant figure is 9.85%.[22] What remains is a 2.17 percentage point gap between the official 12.02% and the updated Harry Wu/ Angus Maddison estimate of 9.85%.

Harry Wu's product method, and, therefore, Angus Maddison's average annual industrial real growth rate, has severe shortcomings. First, the product method ignores quality improvements

even though these are likely to be large in a transition economy. A typical TV set produced in 1978 is likely to be very different in quality from a typical TV set produced in 1995, but the simple counting of quantities cannot take into account quality differences. In some cases, such as for the typical "metal cutting machine tool," car, or personal computer, these quality differences could be very large. Surely a 1978 personal computer is not identical in quality to a 1995 personal computer. Yet this is what Harry Wu's product method assumes.[23] If a personnel computer produced in 1995 were three times "better" than one produced in 1978, and if this were true for all products covered by Harry Wu, then Harry Wu's 9.85% average annual growth rate would have to be revised upward to 17.19% (a 300% augmentation over the seventeen years).

Second, in many industrial sectors, it is not obvious how to obtain meaningful quantity data. For example, is it appropriate to measure the real growth in the production of light manufacturing machinery by the weight of this machinery? More recent versions of this machinery, holding constant quality, could well be made of lighter materials.

Third, Harry Wu's approach ignores the development of new products. But it is likely that growth rates are highest in new products. This is true for niche market variations of old products as well as for new mass market products. For example, his dataset does not include such recent consumer products as cell phones, DVD players, or video cameras.[24]

Fourth, the quantity data on 161 products are incomplete in that they are likely to cover only the output of a subset of enterprises. Product-specific output quantity data are reliably collected only from the "directly reporting industrial enterprises," i.e., those enterprises that report directly and regularly to the statistical authority.[25] In some provinces, guesstimates are made as to how much output of a given product occurs outside the directly reporting industrial enterprises, but in probably the majority of all provinces the reported product-specific quantity data cover only a subset of all enterprises. These provincial data appear to be added up by the NBS and then reported as the nationwide figure.[26] In as far as the most vibrant part of the economy are the small, often private enterprises which do not regularly report to the statistical authority, the product quantity data miss out on the fastest growing part of the economy.

Long-term comparisons, as are done by Harry Wu, are particularly dangerous since the directly reporting industrial enterprises accounted for virtually all industrial output in the pre-reform period, but for an ever decreasing share since 1978. In other words, while the quantities of products in the dataset used by Harry Wu are likely to in the pre-reform and in the early reform years cover all output of the particular product, by the year 1995 the coverage may extend to little more than 60% of the total output of these products. It cannot be ruled out that in Harry Wu's end-period—but not beginning-period—product quantities fall approximately 40% short of actual output.[27] This obviously lowers the average annual growth rate in the quantities of products. The fact that the choice of products on which official data on product quantities are available is likely to be biased towards those products predominantly produced in directly reporting industrial enterprises reduces the size of the potential end-period shortfall.[28]

All four arguments suggest that Harry Wu's product method severely underestimates industrial growth in China. Quality differences over time, ambiguous measurement units, the development of new products, and changing product coverage all bias the growth estimates downward, without any possibility for an objective evaluation of the size of the bias. Subjectively, the average annual downward bias in his growth rate could well be in the upper-level single-digit percentage point range.

A simplified version of Harry Wu's method allows a double-check with other countries. Figure 3 and Table 6 report the average annual growth rates of product quantities and of real industrial value added across thirty countries between 1978 and 1997. The countries selected represent a sample of highly developed countries and a sample of developing countries in Latin America, Europe, and Asia. All transition countries for which product quantity data are available in the two years (1978 and 1995) are included. The selection was made prior to any calculations.[29]

The period 1978 through 1997 (rather than through 1995) is chosen because Harry Wu used 1997 as final data point and in his summary table of results (Table 2, p. 191) provides a growth rate for 1978-97, rather than for 1978-95. (It is Angus Maddison's study which is limited to

1978-95.) Harry Wu's average annual growth rate of "total industry" between 1978 and 1997 is 8.69%.[30]

To calculate the average annual growth rate of product quantities for each country, the method advocated by Harry Wu (pp. 183f.) in case no price data are available is used, namely the geometric mean of individual products' growth rates. For each country, all products on which data are available are used.[31] The number of products included varies from 17 in the case of Taiwan to 380 in the case of Japan. For China, quantity data on 129 products are available, with an average annual aggregate growth rate of product quantities between 1978 and 1997 of 8.99%. This contrast with Harry Wu's 161 products and his average annual aggregate growth rate of 8.69%. The difference of only 0.3 percentage points validates the simplified method employed here.[32]

The findings reported in Figure 3 and Table 6 show that the growth rate of product quantities cannot serve as a substitute for the growth rate of industrial value added. In Figure 3, the great majority of observations is above the 45-degree line, indicating that real growth in industrial value added invariably is *above* that of product quantities. In some countries, such as Japan, Taiwan, Ireland or Thailand, the growth rate of industrial value added vastly exceeds that of product quantities. Only in one country out of the thirty, in Indonesia, does the growth rate of industrial value added fall significantly short of the growth rate of product quantities.

The average difference between the growth rate of industrial value added and the growth rate of product quantities across the different countries is two and a half percentage points, which puts China's average annual growth rate of industrial value added at eleven and a half percent, compared to the official 11.87% in this period. The relative difference between the growth rate of industrial value added and the growth rate of product quantities across the different countries is 45 percent of the growth rate of product quantities, which puts China's growth rate of industrial value added at thirteen percent.[33] There is no avoiding the fact that in cross-country comparisons China's growth rate of product quantities perfectly justifies China's official growth rate of industrial value added.

Angus Maddison's invalid justification for correcting industrial real growth

Before adopting Harry Wu's product growth estimates as a substitute for the official real growth rate of industrial value added, Angus Maddison presents a section labeled "official deflators understate inflation" (p. 140) as his (implicit) justification for ignoring the official data. He claims that "there are two official price indices which provide a more realistic measure of the pace of inflation" (p. 140) than official implicit deflators; these are the producer price index for industrial products (in official terms, the "ex-factory price index of industrial products"), and the retail price of industrial products in rural areas.

The cumulative value of the first, the ex-factory price index, was 344.2 in 1995 (up from 100 in 1978), compared to the industrial products rural retail price index at 274.6 and the official, implicit deflator of value added in industry of 223.5 (p. 144). It would, thus, indeed seem to be the case that the official implicit deflator of value added is too low, and official industrial real growth therefore exaggerated.

However, once, in a more elaborate calculation, the gross output value of industry is deflated by the ex-factory price index (the most inflationary index available) *and* the intermediate inputs are deflated by the purchasing price index of raw material, fuel and power, which is available for the years since 1985, the resulting deflator for value added is even *below* the official implicit deflator. Between 1984 and 1995, the official implicit value added deflator of industry rose 2.14-fold. In the same period, the ex-factory price index rose 3.34-fold and the input price deflator 5.13-fold; combining these two with gross output value and the value of intermediate inputs yields a 1.43-fold increase in the price of industrial value added.[34]

In other words, once a proper choice of alternative deflator is made, the official real growth rate appears to be an underestimate. The justification for switching to Harry Wu's data, in the first place, disappears altogether.

Overall, the severe shortcomings in the alternative product method used by Harry Wu render this procedure most questionable if not irrelevant. (The assumption of identical quality of a 1978

and a 1995 computer alone should make one stop and think.) The cross-country comparison reveals that the product method systematically underestimates real growth in industry, and that the difference between China's industrial growth rate following the product method vs. the official procedure perfectly matches international experiences. To begin with, Angus Maddison's (implicit) justification for switching to the product method is invalid.[35]

Adjustments to base year nominal values

Angus Maddison adjusts base year (1987) nominal value added. He increases the value added of "other services" by 60.1b yuan RMB, or 33.33%, and that of agriculture by 60.6b yuan RMB, or 18.91%. His industrial value added of industry is 2.4b yuan RMB, or 0.51%, larger than the official one due to his use of the official 1987 input output table data rather than the national accounts data. The total upward adjustment of 123.1b yuan RMB is equivalent to 9.33% of his adjusted aggregate 1987 GDP.[36] His large increases in the value added of "other services" and of agriculture are examined below.

Base year 1987 nominal value added of "other services"

Angus Maddison increases the 1987 weight (nominal value added) of the "non-productive," i.e., "other," services by one third because "the official coverage appears to be inadequate" (p. 151).[37] According to Angus Maddison, the official coverage "undervalues housing and military outlays and it probably does not cover welfare benefits in kind which are supplied free to employees of state enterprises" (p. 151).

Housing is a component of real estate services, besides real estate development and real estate administration. Housing comprises (i) rental services, (ii) housing services provided by work units to their employees, and (iii) owner-occupied housing services.[38] (i) The value of rental services is calculated from tertiary sector census data and household survey materials compiled by the urban and rural survey teams. There is no reason to assume that rental services are undervalued. (ii) Housing services provided by work units to their employees are currently

not valued separately because they are included in the depreciation values on all fixed assets of the work unit.[39] The scope for undervaluation appears minor. (iii) Urban owner-occupied housing services are valued at current value times a 4% depreciation rate; in the rural case, the depreciation rate is 2%. The depreciation rates appear on the low side.

In 1987, real estate services, according to the official GDP data, accounted for 11.03% of "other services" (19.88 b yuan RMB vs. 180.24b yuan RMB).[40] If half of all real estate services (of which housing is only one part) were undervalued by one-third, i.e., should be valued at a 50% higher level, this would imply that value added of the aggregate of "other services" should be adjusted upward by 2.76%.

As to military outlays, Xu Xianchun, currently head of the NBS National Accounts Division, in a 1999(a) article discussing Angus Maddison's growth estimates provides two examples of where Angus Maddison goes wrong. One example is that of military service outlays; he reports that these are included, together with police services, in the value added of government agencies, Party agencies, and social organizations. He does not comment on undervaluation, but concludes that the one-third increase in the value added of "other services" applied by Angus Maddison "therefore" over-estimates the value added of "other services."

The final argument of Angus Maddison as to why the value of "other services" needs to be increased by one-third is that its official value "probably does not cover welfare benefits in kind which are supplied free to employees of state enterprises." But such *services* are likely to be exceedingly small. They may even already be included in "other services." Xu Xianchun (2000, p. 54) states that in the case of residual services, i.e., those not covered by any of the other categories, value added is obtained following the income approach.[41] Labor remuneration in this approach explicitly includes in-kind income.

Data on in-kind income are compiled in the household surveys. The urban household survey, relevant for employees of state-owned enterprises, contains two questionnaires, one on living expenditures, and one on in-kind income. The one on in-kind income contains a long list of foods, and then the categories clothing, household appliances, medical goods, housing, various other

goods, transportation and communication, and entertainment/ education/ cultural services. Only the last two categories cover services, and only the very last one covers "other services."[42]

Assuming that these services are indeed, as Angus Maddison assumes, not covered in China's official GDP calculations, the service of any fixed assets in entertainment/ education/ cultural services enters GDP through depreciation. If one assumes that the remaining, unvalued entertainment, education, and cultural services provided by state-owned enterprises to their employees (and their children) free of charge in 1987 were equivalent to 20% of the "science, education, culture, health, sports, and welfare" value added officially included in GDP (36.78b yuan RMB), the value of "other services" in 1987 should be adjusted upward by 4.08%.

The two adjustments, of 2.76% for possibly undervalued real estate services, and 4.08% for possibly unvalued entertainment/education/cultural services in state-owned enterprises, add up to 6.84% of the official value of "other services."[43] Angus Maddison's upward adjustment by one-third, not further justified beyond the general statement quoted above, is five times higher. The small scope for adjustments implied by the data makes one wonder whether one should even bother. If one does, with the average annual real growth rates in "other services" above China's real GDP growth rate, the consequence is an upward adjustment to China's real GDP growth rate.

Base year 1987 nominal value added of agriculture

Angus Maddison adjusts the official 1987 agricultural value added of 320.43b yuan RMB to 381.013b yuan RMB, an increase of 60.583b yuan RMB, or 18.91%. All of the increase occurs in the subsector farming, from 265b yuan RMB to 325.470b yuan RMB, an increase of 22.82%. He accepts the official value added for the other three subsectors of agriculture, i.e., for fishing, forestry, and agricultural sidelines.[44]

Angus Maddison's alternative values for farming are derived following the same method as that of Harry Wu in the case of industry. Angus Maddison employs 1987 price data combined with quantity data for 125 farm output items in six benchmark years, of which three are in the reform period. Quantity data for 1975, 1987, and 1994 are obtained from the FAO, and 1952,

1957, and 1978 quantity data from the NBS (p. 102).[45] The average annual growth rate of Angus Maddison's agricultural value added series between 1978 and 1995 is near-identical to the official one (5.15% vs. 5.12%, see Table 1); the discussion here therefore focuses on the different base year 1987 weights.

The same shortcomings of the product-method apply to agriculture as do to industry, except that agricultural products could be more uniform in quality and with stable characteristics over time. The introduction of new cash crops is a problem in that it does not register in the long-run product method. Quantity data in the case of farming are based on output estimates from sample surveys combined with estimates of land in agricultural use; these estimates are notoriously unreliable. The switch from NSB data in 1978 to FAO data in 1987 and 1994 may also not be unproblematic.

Angus Maddison attributes his difference of 60.6b yuan RMB in the value added of farming to differences in valuation and possibly coverage. He reports that Albert Keidel in a World Bank study of 1994 suggested that in Chinese statistical practice farm self-consumption of grain is valued below market price, and that the quantity of grain and vegetable output is not fully recorded; the implications of Albert Keidel's adjustments are a 8 and a 6 percent increase in the value of (presumably official) farm output.

The imputed values of self-produced self-consumed farm products in China may indeed not equal market prices. In 1999, but not necessarily in 1998, imputed values were supposed to reflect a 10-15% discount on market prices.[46] But any such discount is well justified by the in this case absence of sales costs (such as transportation costs) and the absence of a mark-up by the trading sector. The discount even appears on the low side.

Angus Maddison (p. 102) reports that the FAO prices "seem to be somewhere between the quota and the above-quota prices." Traded farm products in 1987 were subject to three types of prices: quota prices, above-quota prices, and market prices. It is impossible to determine the extent to which output in each product was traded at each of the three different prices, and impossible to obtain nationwide average prices for each product in each pricing regime. If traded

farm products were mostly traded at quota prices, and only a small share at above-quota or market prices, as is likely, a price close to the quota price sounds most plausible.[47] In as far as the procurement price *actually paid* appears to be traditionally and systematically below the official quota price, the FAO price is likely to overestimate the actual price paid for traded products.[48]

Angus Maddison also ignores the discount needed for the, for example in the case of grain, three-quarters of all output that is not traded.[49] Instead, he simply applies the FAO price, which already is likely to be an exaggeration of the price actually paid, to all grain output, when it, at best, can apply only to traded grain. Overall, a price discount of approximately 15-20% for *all* grain produced appears utterly plausible where Angus Maddison has none.

As to the shortcomings of the quantity data, while some quantities may be underestimated in the official statistics, others are possibly overestimated. Thus, Xu Xianchun, in a rebuttal of Albert Keidel's adjustments, reports that the 1996 agricultural census revealed that (official) meat production is overestimated by more than 20%. With meat accounting for approximately 21% of the 1987 gross output value of farming in Angus Maddison's calculations (p. 123), this implies the need for Angus Maddison to revise his output value of farming downward by four percentage points.[50]

Finally, Xu Xianchun (1999a) in a second example of where Angus Maddison's goes wrong reports on the reclassification of some industrial activities out of "agricultural sidelines" into industry in 1984. This implies that Angus Maddison, by adopting the official value added for agricultural sidelines, works with inflated agricultural value added in 1978 but not in 1995.[51]

Given the wide range of uncertainty about the accurate average nationwide price of each product across pricing regimes, the likelihood that FAO prices exceed those actually paid, the absence of a price discount for non-traded agricultural goods in Angus Maddison's calculations, and Angus Maddison's over-estimated output of meat, there appears little scope for Angus Maddison's 22.82% upward adjustment to current price 1987 value added in farming. Furthermore, he underestimates growth in agricultural sidelines. There is a good chance that a downward adjustment is more appropriate than an upward adjustment.

Even if a minor upward adjustment to the official 1987 weight for agriculture were justified, the combined impact on GDP growth of adjustments to the nominal 1987 values of "other services" and agriculture cancels at least in part. Going one-fifth of the way towards Angus Maddison's corrections to the official value of "other services" in 1987 raises the official share of "other services" in GDP by about 0.6 percentage points; a sector which grows almost two percentage points per year faster than the GDP average thus gets roughly 0.6 percentage points more weight (also see Table 1). Going, as an example, one-quarter of the way towards Angus Maddison's corrections to the official value of agriculture in 1987 raises the official share of agriculture in GDP by about half a percentage point; a sector which grows four and a half percentage points per year slower than the GDP average thus gets roughly 0.5 percentage points more weight. The two corrections leave official average annual GDP growth to be revised downward by approximately 0.1%. If there were no grounds for adjusting the 1987 value added of agriculture, the minor upward adjustment to the share of "other service" means that official average annual GDP growth needs to be revised upward by approximately 0.1%.

Penn World Tables

The Penn World Tables (PWT) report comparable GDP data in "international dollars" for 168 countries. The quality of these data matters in that they are routinely used for cross-country economic studies; they are also incorporated into the World Bank World Development Indicator database, a second major source of data for cross-country studies. Yet, as Alan Heston (2001) explains for the case of the PWT Version 6, the data on China in the PWT rely heavily on Angus Maddison's adjustments to the official data.[52]

The PWT adopt Angus Maddison's three benchmark-year 1987 level adjustments to nominal valued-added in agriculture, industry, and "other services." Since the PWT rely on the expenditure approach to the calculation of GDP, they translate Angus Maddison's level revisions into revisions to official expenditure data in 1987 by allocating all revisions to household consumption. In addition, following Angus Maddison's advice, investment is reduced by 10%:

seven percentage points are assumed to reflect military investment and are therefore allocated to government consumption; the other three percentage points are assumed to reflect maintenance (which should not be included in GDP) and are deleted.

The only new adjustment in nominal values in the PWT, following Angus Maddison, is the deletion of 3% of investment in the expenditure approach to GDP. This deletion is inappropriate. Neither does Angus Maddison provide any evidence that Chinese investment includes maintenance, nor do the official NBS explanations on how expenditure approach GDP is derived list any maintenance in the otherwise exhaustive subcategories of investment.[53] The PWT end up with "about 12-13% a year" higher current price GDP values than the official data (Alan Heston, 2001, p. 4), where none of the difference is justified.

Adjusted nominal expenditure category data for other years are obtained by making proportional adjustments (of the same magnitude relative to the official data as in 1987). For the years 1996 through 1999 (not covered by Angus Maddison) an additional adjustment to consumption is made to reflect the perceived "wind of falsification." Key to the adjustment is the average propensity to consume. The adjustments are implemented based on the different time trends of the average propensity to consume based on official expenditure approach GDP data vs. one based on household survey data.[54] In 1999, the calculations result in a 10.93% reduction in private consumption (which, in turn, accounts for approximately half of expenditure approach GDP).[55]

As argued in Carsten Holz (2003), the evidence supposed to show data falsification in the late 1990s is deeply flawed. Furthermore, household survey data are not comparable to national accounts data (not only in China, but also in the U.S.).[56] Without good reason, the PWT make adjustment to official Chinese GDP data from 1996 through 1999; the adjustments are based on a convenient ratio from household survey data which is largely irrelevant in this context.

In order to obtain real growth rates for the years since 1978, the PWT deflates the investment component of expenditure approach GDP by applying the "implicit deflator of GDP from Maddison for producer durables and changes in inventories because this seemed where most of

the adjustment suggested by Wu would be. For construction we have accepted the construction deflators implicit in the official figures" (p. 5). Neither Alan Heston nor the PWT provide a breakdown of investment in the expenditure approach to GDP into "narrow" investment (however defined) plus construction. The data reported by Alan Heston (2001) allow no calculation of a deflator for expenditure approach investment, which makes a double-check difficult.[57]

The implicit deflator of investment in the PWT, if set at 100 in 1978, reached 320 in 1994, 368 in 1995, and 388 in 1998 (the last year in Alan Heston's article). The closest match with implicit deflators in Angus Maddison is not for GDP but for industry, with Angus Maddison's industrial deflator in 1994, the most recent year for which these data can be calculated, at 328 (compared to 320 in the PWT).[58] But Angus Maddison's average annual real growth rate in industry, which as has been argued above is incorrect, is three and a half percentage points below the official one. In other words, Alan Heston's deflator for investment is approximately three and a half percentage points too large every year.[59]

Alan Heston reports that household and government consumption in the PWT for 1978 through 1998 are both deflated using the official CPI (from 1978 through 1985 only urban CPI).[60] A double-check shows that discrepancies between the implicit deflator of private consumption in the PWT and the official CPI exist, albeit on a minor scale. For example, setting the two 1985 deflators equal to 100, the PWT consumption deflator in 1995 reached 310.7, while the official one stood at 302.8.[61] In contrast, the deflator implicit in the official expenditure approach household consumption data was 283.2 in 1995, and 272.9 for total consumption.[62] Data on the U.S. CPI and the U.S. deflator for consumption in the expenditure approach reveal a difference with identical sign as in the case of China. The PWT again over-deflate, and thus underestimate real growth in China (or the PWT need to adjust U.S. data, too).[63]

The numerous adjustments of the PWT to official data impact on real GDP growth rate estimates. The effect of level adjustments in the PTW is that the current price value of 1978 GDP is raised by 8.91%, of 1995 GDP by 8.25%, and of 1998 GDP by 3.08%. The use of wrong

deflators further reduces real growth rates. As a results, the official average annual real GDP growth rate of 9.88% between 1978 and 1995 is reduced to 7.95% in the PWT; while the official average annual real GDP growth rate of 9.71% between 1978 and 1998 is reduced to 7.80% in the PWT.[64] In other words, the PWT underestimate economic growth in China during the reform period by approximately two percentage points every year. The PWT then proceed to use purchasing power parity conversions to obtain a second set of internationally comparably priced GDP data; an examination of the conversion rates is beyond the scope of this paper.

Conclusions

Angus Maddison (1998) revised China's average annual real growth rate of GDP between 1978 and 1995 downward from the official 9.88% to 7.49%. The reduction by 2.39 percentage points every year is due to Angus Maddison's assumption of lower than official growth rates in "other services" and in industry, and a larger base year weight for "other services" and agriculture.

Angus Maddison's downward revisions to official real growth in "other services" is not justified due to (i) his incorrect adjustment for military to employment data and the likely omission of a significant number of employees in "other services" in later years, and (ii) the fact that his assumption of zero labor productivity growth in "other services", which justified the switch to his employment method to begin with, is incorrect. It is implausible from the point of view of comparative economics and from the point of view of any person who has been in China in the early and then again in the late reform years. It is rejected by the evidence from other transition countries.

Angus Maddison's downward revision to official real growth in industry, based on a study by Harry Wu, is not justified in that (i) it ignores quality improvements in individual products over time, problems of individual measurement units, the development of new products, and the changing (falling) enterprise coverage over time, and (ii) cross-country comparisons reveal that Angus Maddison's (Harry Wu's) product method consistently underestimates real growth in

value added by a proportion in other countries similar to that in the case of China. Angus Maddison's justification for the use of alternative data, namely improper official deflators, is invalid to begin with.

Angus Maddison's adjustment to base year nominal value added of "other services" is in large part invalid. His adjustment to base year nominal value added of agriculture is in part implausible, and should otherwise be offset against countervailing corrections to his data and method. If any adjustments, unambiguously smaller than those implemented by Angus Maddison, were still justified after the corrections to his adjustments, their impact on the growth rate of aggregate real GDP would be miniscule (on the order of perhaps 0.1 percentage points per year).

The PWT data on China, by adopting a number of Angus Maddison's unjustified revisions and by implementing additional, erroneous adjustments, underestimate economic growth by approximately two percentage points per year since 1978. Neither Angus Maddison's growth estimates for China in the reform period nor the PWT represent valid alternatives to the official data. In as far as the PWT are used for cross-country studies, findings in these studies are affected by the incorrect data for China.

The fact that Angus Maddison's alternative estimates are incorrect does not imply that the official data are correct. All it implies is that the use of Angus Maddison's estimates and of PWT data on China constitutes the use of incorrect data. Official data may still be incorrect and more efforts are needed to identify why they are incorrect, or what specific data are incorrect, and incorrect with what sign and to what extent.[65]

One may wonder why, if Angus Maddison's estimates are not justified, the NBS has not refuted them. I can only surmise that the NBS has better things to do than to delve into complicated data manipulations done in a foreign language by any academic abroad who feels inclined to pour scorn on Chinese data. Xu Xianchun (1999a), head of the NBS National Accounts Division, has written a brief response refuting Angus Maddison's findings, but did not comb through Angus Maddison's complex data manipulations.

NBS officials may not have the time required to get to the bottom of Angus Maddison's arguments, nor, perhaps, be favorably inclined towards academic skirmishes. But it could also be the case that a proper defense of China's official statistics requires revealing details of actual practices that the NBS may not be allowed to reveal by China's preoccupation with "state secrets," or may not be willing to reveal if numerous (possibly well-meaning) ad hoc procedures or estimates are used in the compilation of official statistics. Finally, few if any NBS officials, concentrating on a specific field or, at the other extreme, being political/ propaganda personnel, are likely to understand the full meaning and background of the official GDP data.

The ease with which Angus Maddison and the PWT revise Chinese official data, as it turns out, without justification, warns against ad hoc manipulations by researchers of data the precise meaning of which they do not understand. Doubts about the accuracy of official data do not give license to improvise adjustments. A 2.39 percentage point downward adjustment per year to China's GDP growth may not look like much, but over seventeen years, by 1995, the incorrect revisions imply 150% less output, in 1978 terms, than the official data do.

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Table 1. Angus Maddison's Estimates vs. NBS Data

	Agri-culture	Industry	Const-ruction	Transport (& comm.)	Commerce (& cater.)	Other services	GDP
Average annual real growth in value added (in %)							
Angus Maddison	5.15	8.56	11.09	9.97	9.90	6.71	7.49
NBS	5.12	12.02	11.09	9.97	9.90	11.76	9.88
Percentage point difference (NBS compared to Angus Maddison)							
Absolute	-0.03	3.46	0	0	0	5.05	2.39
Relative	-0.03	3.19	0	0	0	4.73	2.22
Value added 1987 (b yuan RMB)							
Angus Maddison	381.01	460.94	66.58	54.49	115.93	240.32	1319.28
NBS	320.43	458.58	66.58	54.49	115.93	180.24	1196.25
Sectoral shares in GDP, 1987 (in %)							
Angus Maddison	28.88	34.94	5.05	4.13	8.79	18.22	100.01
NBS	26.79	38.33	5.57	4.56	9.69	15.07	100.01

Maddison uses the term "non-productive services" for "other services."

The relative percentage point difference is calculated via ratios, such as, in the case of GDP, as 1.0988/1.0749; it shows the extra growth needed to make Angus Maddison's volume data match NBS volume data.

Sources:

Angus Maddison (1998), p. 157, Table C.3 reports volume measures ("real" measures) of output in each of the six sectors and GDP, for all years 1952 through 1995, in 1987 prices (and, thus, also reports nominal 1987 values). The same volume data, standardized to 1952 values, are repeated in his Table C.6 on p. 160 (except for what appears a typo in the case of commerce which would imply an average annual growth rate of 9.93%), for selected years, and contrasted to corresponding NBS data. This allows the calculation of the average annual real growth rates reported in the table here (with the original data used for commerce). Angus Maddison reports some, but not all, of the real growth rates in his Table C.7 on p. 160, rounded to one decimal.

Identical official real growth rates can be calculated from data presented for GDP and all individual sectors except "other services" in the *Statistical Yearbook 2003*, p. 58 (p. 55 of which is also the source for the nominal data) or in the *Statistical Yearbook 1996*, pp. 42, a source frequently used by Angus Maddison. For the tertiary sector in the years prior to 1991, the *Statistical Yearbook* only allows the calculation of the real growth rates of the whole sector and, separately, transport, and commerce, but not of "other services." (Since 1991, nominal value added and real growth rates in 12 exhaustive subsectors within the tertiary sector are available in the *Statistical Yearbook*.)

For "other services," *GDP 1952-95*, pp. 28, 37, contains real growth rates and current nominal data of all subsectors (of "other services"), which allows the calculation of a real growth rate for the total of all "other services," of 11.78% based on decennial subsector weights, slightly larger than the 11.76% implied by the official volume data for 1978 and 1995 reported by Angus Maddison in Table C.3 in constant 1987 prices and then in Table C.6 further standardized by 1952 values; based on 1987 official weights, the growth rate is 11.83%.

Angus Maddison (p. 151) reports that he "used 1987 value gross added weights throughout." Using his sectoral volume data (p. 157, Table C.3) with 1987 weights yields an annual real GDP growth rate of 7.54% compared to the 7.49% implied in his aggregate GDP data (same Table C.3). The NBS sectoral shares in GDP reported in the table are from the *Statistical Yearbook 2003*, p. 55.

Table 2. Employment in "Other Services," 1978 and 1995

	Mid-year employment (in thousand)		Growth rate (in %)
	1978	1995	mid-year
(1) Angus Maddison (labeled "non-productive services")			
including 3 million military (by ass.) — double-counted	28965	87440	6.72
Angus Maddison's values less 3 million	25965	84440	7.18
(2) *Statistical Yearbook* sources cited by Angus Maddison			
I	22920[a]	42610	3.71
II	27714[a]	85810	6.87
II, excl. geological prospecting and water conservancy	*25965*[a]	*84440*	7.18
(3) *Statistical Yearbook 2003*, pp. 128f.			
III	27714[a]	142730	10.12
III, excl. geological prospecting and water conservancy	*25965*[a]	141360	10.48

Data recalculated from the *Statistical Yearbook* which match Angus Maddison's data are in italics.

a: Angus Maddison combines employment data until 1977 following one classification (from one source) with employment data from another classification (and another source) for 1978 and later years. Data in corresponding categories in the two sources for 1978 and later years differ. The first source provides employment for the primary, secondary, and tertiary sector, as well as total employment with a split into material and non-material sectors (the latter is "other services," which allows to back out employment in the productive tertiary sector). Calculating the annual growth rates in employment in these sectors and subsectors between 1977 and 1978 from the earlier source, and then applying these growth rates to the relevant sectors and (all, more detailed) subsectors of the later source, yields approximate 1977 employment values following the later classification, thereby bridging the 1977-78 statistical break. The recalculated mid-year 1978 employment value for "other services" in Angus Maddison's coverage is unaffected by the statistical break.

Employment groups:

I: geological prospecting and water conservancy; financial intermediation and insurance; real estate activities; social services; health care, sports & social welfare; education, culture and art, radio, film and television; scientific research and polytechnical services; government agencies, Party agencies and social organizations.

II: I + "others."

III: Total employment less employment in primary sector, secondary sector, transport (transport, storage and communication) and commerce (wholesale and retail trade, restaurants).

Sources:

Angus Maddison's data: Table D.3, p. 171. The table carries the note: "*Source:* 1952-77 end-year estimates from SSB, *China Statistical Yearbook 1993*, pp. 78-9 [as it turns out, in the English edition; pp. 100f. in the Chinese edition]; 1978-84 from 1994 *Yearbook*, p. 68 [should be pp. 86f., in the now bilingual edition]; 1985-95 from 1996 *Yearbook*, pp. 92-3. I added 3 million each year for military personnel in "non-productive" services." Recalculated mid-year values in some years *between* 1978 and 1995 differ from Angus Maddison's, but only in the category "other services," and for no apparent reason (irrelevant for the average 1978-95 average annual growth rates). There is no statistical break between the second and third sources Angus Maddison uses.

Table 3. Labor Productivity Growth in China 1978-95

	VA in 1987 prices, b yuan			End-year employment, in m.			Prod. gr. (%)	
	1978	1987 in %	1995	1978	1995	ave. ann. growth	end-year	mid-year
GDP	510.7	100.00	2535.4	401.52	680.65	3.15	6.53	6.49
Primary sector	190.6	26.79	445.6	283.18	330.18	0.91	4.18	4.25
Secondary sector	211.7	43.90	1434.8	69.45	143.15	4.35	7.25	6.75
Industry	188.2	38.33	1295.3	60.91	109.93	3.53	8.19	7.67
Construction	22.3	5.57	133.2	8.54	33.22	8.32	2.56	2.12
Tertiary sector	117.9	29.31	687.7	48.9	150.56	6.84	3.83	3.69
Transport & commun.	23.6	4.56	118.9	7.5	19.42	5.76	3.99	4.01
Commerce	33.4	9.69	166.1	11.4	42.92	8.11	1.65	1.81
Social services	9.5	2.25	61.2	1.79	7.03	8.38	2.95	2.78
Public utilities	2.7	0.41	8.7					
Banking & insurance	10.9	4.49	119.7	0.76	2.76	7.88	6.72	6.34
Real estate	6.2	1.66	58.0	0.31	0.8	5.74	7.92	7.63
Science etc.	13.1	3.07	74.6	15.48	21.02	1.82	8.79	8.34
Government etc.	16.6	3.17	72.4	4.67	10.42	4.83	4.02	3.54
Geological prospecting				1.78	1.35	-1.61		
"Others"				5.21	44.84	13.50		
Residual				-0.01	56.76	infinite		
Non-transport, non-commerce in two aggregates:								
Banking/ ins. + real estate	17.1	6.15	177.7	1.07	3.56	7.33	6.94	6.58
Soc. + sci. + gov.+"others"	41.9	8.90	216.9	27.15	83.31	6.82	3.12	2.79
same + residual labor	41.9	8.90	216.9	27.14	140.07	10.14	0.02	-0.44
Reference:								
Other services I	59.0	15.05	394.6	24.79	43.38	3.35	8.21	7.82
less geological prosp.	59.0	15.05	394.6	23.01	42.03	3.61	7.94	7.53
Other services II	59.0	15.05	394.6	30.00	88.22	6.55	4.96	4.64
less geological prosp.	59.0	15.05	394.6	28.22	86.87	6.84	4.67	4.34
Other services III	59.0	15.05	394.6	29.99	144.98	9.71	1.93	1.49
less geological prosp.	59.0	15.05	394.6	28.21	143.63	10.05	1.62	1.16
Angus Maddison:								
Productive services	57.0	12.92	285.0					2.97
Non-productive services	13.1	18.22	396.8					0.00

VA: value added.

Prod. gr.: average annual (real) labor productivity growth between 1978 and 1995. Growth rates make use of more decimals of value added than listed in the table.

Employment data are year-end data. Labor productivity growth rates are calculated using both year-end employment data and (not listed in the table) mid-year employment data, where mid-year 1978 data for secondary and tertiary sector subsectors are estimates (see notes to Table 2).

The primary sector covers farming, forestry, animal husbandry, and fishery.

Employment data for industry are the sum of employment in mining and quarrying, manufacturing, and the production and supply of electricity, gas and water.

The following are the labels in the table; in the value added statistics; in the employment statistics:

* Transport & commun.; transportation, post and telecommunications; transport, storage, post & telecommunication services.
* Commerce; commerce; wholesale and retail trade, and catering services.

* Banking & insurance; banking and insurance; finance and insurance.
* Science etc.; science, education, culture, health, sports, and welfare; scientific research and polytechnic services + education, culture and arts, radio, film and television + health care, sports & social welfare (3 separate employment categories).
* Government etc.; government agencies, Party agencies, social organization and others; government agencies, Party agencies, and social organization.

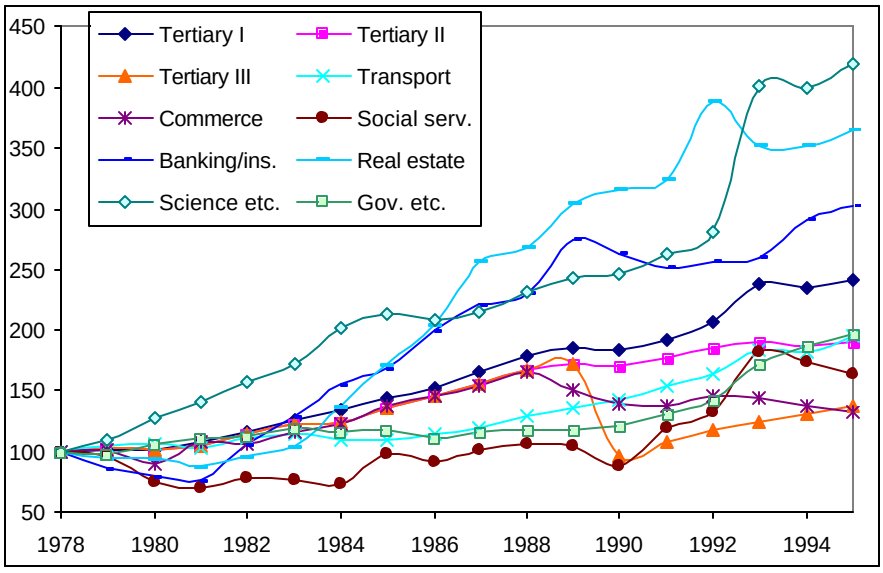
Geological prospecting refers to geological prospecting and water conservancy.

Other services I, II, and III: value added is the sum of value added across the non-transportation non-commerce tertiary sector subsectors, i.e., the sum of value added across social services, public utilities, banking & insurance, real estate, science etc., and government etc. Employment coverage is as follows:

* Other services I: social services, banking & insurance, real estate, science etc., government etc., geological prospecting.
* Other services II: "Other services I" plus "others."
* Other services III: "Other services II" plus "residual."

Sources:

GDP 1952-95, pp. 27f., 36f.; *Statistical Yearbook 2003*, pp. 128f. For mid-year employment data see Table 2 notes and sources. Angus Maddison's value added data are from his Table C.3 (p. 157), with transport and commerce here combined into productive services, and his employment data (with no breakdown of productive service employment into transport and commerce available) from his Table D.3 (p. 171); compared to the official employment data, his non-productive service employment data include 3m laborers extra (presumably double-counted military employment) throughout all years.



Labor productivity is value added in constant 1987 prices divided by mid-year employment (with mid-year 1978 data estimated as explained in notes to Table 2). For each sector (subsector), the 1978 value was set equal to 100.

Tertiary sector value added is provided in the GDP statistics. Tertiary sector employment:

Tertiary I: geological prospecting and water conservancy; transportation, storage, post and telecommunication services; wholesale and retail trade, and catering services; finance and insurance; real estate; social services; health care, sports and social welfare; education, culture and arts, radio, film and television; scientific research and polytechnic services; government agencies, Party agencies, social organizations.

Tertiary II = Tertiary I and "others."

Tertiary III = Tertiary II and implicit residual employment.

Sources:

Value added: *GDP 1952-95*, pp. 27f., 36f.; employment data: *Statistical Yearbook 1994*, pp. 86f. for 1978-93; *1996*, pp 92f. for 1994 and 1995; *2003*, pp. 128f. for revised total (to include the implicit residual); *1993*, pp. 100f. for relative change between 1977 and 1978 in primary, secondary, and tertiary sector (with, separately listed, "other services") employment data (also see notes to Table 2).

Figure 1. Labor Productivity Development in China 1978-1995, Tertiary Sector and Subsectors

Table 4. Average Annual Labor Productivity Growth in Services, OECD Services Database (in %)

	Austr.*	Austria^	Belgium	Canada	Czech R	Denmark	Finland	France^
	1974-98	1988-99	1983-99	1970-96	1990-99	1970-99	1975-99	1978-98
Trade I	1.45	1.84	0.36	1.22	1.77	1.55	2.68	2.39
Finance I	0.00	0.71	1.00	-0.88	1.27	0.39	1.17	0.30
Other	0.42	0.38	0.40	0.06	-1.04	0.15	0.42	0.82
Total	1.13	1.30	0.83	0.46	-0.02	0.94	1.62	1.31
	same period	same	1995-99	same	same	same	same	same
Trade	0.45	1.46	-1.98	0.81	-0.95	1.21	2.11	1.73
Transp.	3.81	2.83	1.08	2.31	7.09	2.23	3.33	3.66
Finance	3.24	2.74	6.58	0.06	-6.87	0.85	4.10	2.65
Real est.	-1.80	-0.43	0.07	-2.11	1.48	0.14	0.01	-0.56
Publ. ad.	-0.25	1.15	-0.07	1.43		0.29	0.62	1.41
Social	0.64	0.02	-1.05	-0.26		0.13	0.36	0.47
Total	1.13	1.30	0.29	0.46	-0.02	0.94	1.62	1.31
	Germany	Greece	Hungary	Italy#	Japan	Korea^	Korea*	Luxemb.
	1991-99	1995-99	1992-98	1982-99	1970-98	1989-99	(95-99)	1995-99
Trade I	1.32	3.44	2.48	1.75	3.07	2.64	(3.52)	1.43
Finance I	-0.37	1.40	-0.14	-1.54		-0.34	(-0.05)	-2.05
Other	0.24	-0.16	1.66	0.03		0.12	(-2.10)	-0.26
Total	0.91	1.38	2.24	0.71	1.99	1.42	(1.21)	0.71
	same	same	same	same	same	1992-99	1995-99	same
Trade	-0.56	4.10	0.09	1.30	3.89	1.44	1.34	-2.81
Transp.	6.21	1.28	6.25	2.92	1.90	6.60	6.47	5.59
Finance	3.42	3.69	-1.63	1.71	4.83	5.26	4.53	3.98
Real est.	-1.82	0.78	0.36	-2.89		-2.92	-3.03	-7.67
Publ. ad.	1.74	0.12	2.17	2.06	1.76	-5.15	-6.93	0.69
Social	-0.32	-0.37	1.33	-0.66		0.92	-0.46	-0.15
Total	0.91	1.38	2.24	0.71	1.99	1.43	1.21	0.71
	Netherl.^	Netherl.^	New Z.	Norway^	Poland	Portugal^	SlovakR*	Spain ^
	1987-99	(95-99)	1997-99	1970-97	1992-99	1995-97	1995-99	1995-99
Trade I	2.77	(3.01)	5.27	3.45	3.10	0.47	4.95	0.88
Finance I	1.40	(-1.74)	-0.56	-0.79	-1.78	4.04	3.55	-2.14
Other	1.77	(-0.60)	-0.35	-0.02	0.34	0.13	7.83	-0.05
Total	2.57	(0.56)	2.13	1.51	1.57	0.57	6.38	0.38
	same	1995-99	same	same	same	same	same	1995-98
Trade	2.09	2.17	3.89	2.94	2.59	0.05		-0.10
Transp.	4.45	4.79	5.11	4.22	4.06	3.84	9.01	2.85
Finance		-0.73		-1.94	17.30	10.37	-9.71	0.84
Real est.		-2.00		-0.84	-3.12	1.06	10.26	-3.02
Publ. ad.	3.00	1.36		0.77	0.00	1.37		0.83
Social	1.31	-1.19		-0.32	-0.49	-0.36		-0.52
Total	2.57	0.56	2.13	1.51	1.57	0.57	6.38	0.36
	Sweden	Switzerl.	Turkey	UK	USA ^			
	1993-99	1997-98	1988-98	1978-99	1987-99			
Trade I	4.34	0.81	2.26	2.08	2.93			
Finance I	-0.93	1.42	0.31	0.23	0.32			

Other	0.87	-0.48	0.18	0.73	-0.42
Total	2.06	0.82	1.82	1.23	1.16
	same	same	same	same	same
Trade	4.24	0.16	1.73	1.34	2.95
Transp.	4.80	2.53	3.54	3.62	2.79
Finance	1.18	4.03			2.18
Real est.	-1.45	-0.51			-0.59
Publ. ad.		-1.14		-1.33	1.23
Social		0.92			-0.67
Total	2.06	0.82	1.82	1.23	1.16

Labor productivity growth is calculated from value added (in constant prices) and employment data. The base year for value added in constant prices is not specified in the source. The maximum time period covered in the database is from 1970 through 1999.

The employment data are from the ISIC (International Standard Industrial Classification of all Economic Activities) Rev. 3.

* Per person.

^ Per full-time equivalent.

\# Per labor unit.

All other instances: exact definition of employment unknown.

Dates in parentheses: would have data for longer period, but chose the period to match the data in the more detailed classification.

The abbreviated labels stand for:

Trade I: motor, wholesale and retail trade; restaurants and hotels; transport and communication;
Finance I: finance, insurance, real estate and business services;
Other: all other services not included in Trade I and Finance I;
Total: total services;
Trade: motor, wholesale and retail trade; restaurants and hotels;
Transp.: transport, storage and communication;
Finance: financial and insurance services;
Real est.: real estate and business services;
Publ. ad.: public administration and defence;
Social: education, health, social work related, other community, social and personal services.

For Hungary and the Netherlands, two, in terms of time mutually exclusive except for one year, time series for value added are available, and two time series for total employment for the Netherlands; these time series were linked through the (one) overlapping year.

Sources:

http://www.sourceoecd.org (Services database, with "Value Added and Employment ISIC Rev. 3 – Total Employment –*Vol 2001 release 01"* and "Value Added and Employment ISIC Rev. 3 – Gross Value Added Volumes *Vol 2001 release 02"*). Accessed on 30 Sept. 04.

Table 5. Average Annual Labor Productivity Growth, Countries Worldwide (in %)

	Argentina	Australia	Austria	*Azerbaijan*	Bahamas	Belgium	Belgium	Belize
	96-02	88-02	94-03	99-03	91-94	01-02	94-99	93-99
GDP	-2.81	1.37	1.83	10.36	-3.68	0.24	1.58	-0.11
Agric.	-4.07	4.86	6.13	9.97	-4.90	7.08	4.24	0.16
Industry	1.64	2.49	4.29	23.90	-2.81	2.89	3.68	0.39
Construct.	-6.35	-0.09	1.45	19.72	1.52	-0.91	1.19	-0.46
Trade	-4.08	1.27	1.69	8.89	-0.24	-4.75	0.87	-0.78
Transport	0.25	4.31	2.40	9.07	-6.80	5.07	-0.08	-0.51
Others	-3.12	0.70	0.17	5.06	-5.30	-0.66	0.82	-0.07
Others II	-3.05	0.70	0.17	5.06	-5.56	-0.66	0.55	-0.07
	Bolivia	Botswana	*Bulgaria*	Canada	Costa Rica	*Croatia*	Cyprus	*Czech R.*
	96-00	95-01	98-01	87-02	01-02	96-02	99-03	93-02
GDP	-0.04	1.83	6.02	1.34	0.37	3.50	-0.74	2.39
Agric.	0.10	-1.42	0.71	1.79	-3.16	6.20	-5.96	6.41
Industry	3.39	4.28	6.94	1.49	2.56	4.76	0.33	4.70
Construct.	-8.08	-1.26	3.72	-0.38	-0.17	-0.21	-4.41	-7.75
Trade	-0.33	2.32	8.77	1.78	-0.38	3.81	-1.42	3.04
Transport	2.53	-5.17	12.62	2.62	3.24	1.87	9.84	5.58
Others	1.44	1.56	4.08	0.69	0.10	1.52	-3.58	-0.07
Others II	1.44	1.33	4.08	0.69	0.13	1.52	-1.32	-0.10
	Denmark	Ecuador	Egypt	El Salvador	*Estonia*	Finland	Germany	Greece
	94-02	99-02	97-01	98-02	90-02	89-02	95-02	93-02
GDP	1.69	1.51	1.87	0.32	2.68	2.12	1.24	2.55
Agric.	6.25	-4.33	3.24	4.60	8.23	5.16	5.01	2.09
Industry	3.25	-0.04	4.96	2.37	4.45	4.75	1.54	3.29
Construct.	0.45	8.25	-1.39	-0.79	7.39	0.02	-0.43	2.08
Trade	2.46	1.00	-1.04	-3.19	-1.38	0.94	0.18	1.45
Transport	3.77	3.05	-0.95	2.26	2.83	4.39	7.58	7.86
Others	0.35	2.66	0.47	-2.44	-1.29	0.71	0.75	0.01
Others II	0.37	2.66	0.74	-2.77	-1.17	0.68	0.75	0.01
	Hungary	Iceland	Ireland	Israel	Italy	*Kazakhst.*	R. of Korea	*Kyrgyzstan*
	92-02	91-02	86-02	95-02	93-03	01-02	92-02	90-02
GDP	3.67	1.69	3.75	0.66	1.05	9.69	4.03	-3.18
Agric.	6.61	2.30	1.17	8.36	3.29	3.16	4.58	-2.85
Industry	6.98	4.11	6.19	3.72	1.80	11.25	9.25	0.02
Construct.	1.37	0.47	2.00	-0.23	0.22	17.55	1.09	0.18
Trade	1.01	3.39	2.70	-1.04	0.65	8.96	2.36	-9.00
Transport	3.84	5.27	3.02	0.34	2.53	10.48	6.43	-6.04
Others	2.05	0.37	2.80	-0.42	0.14	9.62	-0.37	-1.77
Others II	2.08	0.35	2.80	-0.43	0.14	9.62	-0.37	-1.77
	Latvia	*Latvia*	*Lithuania*	Luxemb.	Macau	Malaysia	Malta	Mauritius
	96-02	90-00	98-02	95-02	98-03	01-03	00-02	00-03
GDP	5.50	-1.32	5.56	1.03	5.04	1.90	1.43	3.07
Agric.	6.17	-1.85	3.35	-2.86		4.54	1.37	4.42
Industry	6.69	-1.60	7.68	2.90	6.90	6.85	9.01	3.37
Construct.	-2.72	-10.00	-2.24	2.21	5.38	-4.15		4.57
Trade	7.47	0.61	5.15	2.63	7.68	-2.43	-1.89	-1.08
Transport	2.70	0.67	6.30	4.28	5.32	2.64	0.45	3.74

Others	3.59	3.51	4.87	-2.32	1.49	-0.63	4.53	2.65
Others II	3.59	3.51	4.87	-2.32	1.47	-0.63	4.53	2.65
	Mexico	*Mongolia*	Netherlands	NL Antilles	New Zeal.	Norway	Oman	Panama
	91-01	94-02	95-02	91-00	97-02	96-03	93-00	87-02
GDP	0.52	1.44	0.67	0.91	1.57	1.36	1.98	-0.02
Agric.	3.39	-4.77	1.44	-0.95	-0.24	3.60	8.34	1.22
Industry	-0.46	4.49	1.27	0.69	1.32	2.75	-3.61	-0.32
Construct.	-0.81	3.69	-0.71	0.84	0.86	-3.25	-7.78	-1.60
Trade	-2.82	2.39	1.52	-0.32	2.42	4.04	-2.13	-0.79
Transport	1.18	9.13	4.60	-1.27	5.25	4.99	-0.42	-1.44
Others	1.15	1.28	-0.49	0.47	0.98	0.82	2.81	-1.38
Others II	1.03	1.28	-0.10	0.47	1.06	0.81	3.05	-1.38
	Peru	*Poland*	Portugal	Qatar	*Romania*	*Romania*	*Russian F.*	*Russian F.*
	96-01	94-02	92-03	97-01	94-02	90-94	97-02	90-95
GDP	-2.34	5.17	1.33	3.60	4.70	-2.39	2.15	-6.78
Agric.	-7.43	6.13	-2.69	7.41	2.28	-6.31	4.47	-7.56
Industry	3.17	7.55	3.66	-3.23	6.45	7.78	2.53	-7.63
Construct.	-4.55	2.74	-3.08	-5.32	1.02	10.96	6.67	-10.77
Trade	-2.03	3.49	0.16	3.09	2.60	-13.08	-2.86	-5.74
Transport	-3.07	4.97	4.12	12.27	9.30	5.68	3.69	-10.67
Others	-3.82	0.97	2.16	4.18	1.71	3.28	-1.26	-0.14
Others II	-3.84	1.04	2.16	3.87	1.71	3.28	-1.26	-0.14
	San Mar.	Saudi Arab.	Singapore	*Slovakia*	*Slovenia*	S. Africa	Spain	Sweden
	95-03	99-02	85-02	94-02	93-02	00-03	92-03	87-03
GDP	0.96	-3.17	3.87	5.30	3.13	2.96	0.34	2.04
Agric.	16.79	9.62	-2.96	11.07	0.37	11.09	3.03	4.91
Industry	0.03	4.49	6.73	3.29	5.42	1.54	1.68	5.42
Construct.	1.23	5.57	2.73	-1.10	3.83	4.88	-0.94	1.37
Trade	0.48	-6.90	4.63	-0.02	1.14	2.69	-0.22	2.70
Transport	-0.99	3.23	4.47	4.09	4.48	6.08	1.13	4.07
Others	-0.03	-13.59	1.67	9.28	0.93	-0.75	-1.68	0.22
Others II	1.57	-13.56	1.67	9.36	0.73	-0.44	-1.68	0.22
	Switzerl.	Switzerl.	Turkey	*Ukraine*	*Ukraine*	UAE	UK	Uruguay
	91-02	91-02	00-02	99-02	01-02	95-00	88-02	00-03
GDP	0.51	0.73	0.38	5.60	1.85	-3.57	1.51	-2.98
Agric.	0.56	0.94	2.12	6.46	-6.97	-0.78	-0.08	1.41
Industry	2.35	2.36	-1.24	12.09	23.60	-4.72	1.90	-0.92
Construct.	0.65	2.43	13.11			-3.01	0.44	-6.58
Trade	0.91	1.51	-2.03	1.33	-16.26	-1.62	2.63	-7.96
Transport	0.76	0.14	3.18	6.70	-2.87	-2.92	0.64	-1.67
Others	-0.90	-1.06	-3.61	9.39	2.82	-2.89	1.26	-2.90
Others II	-0.81	-1.06	-3.61	9.39	2.82	-2.89	1.33	-2.90
	Min.	Max.	Mean	SD	CV			
GDP	-6.78	10.36	1.59	2.82	1.78			
Agric.	-7.56	16.79	2.34	4.83	2.07			
Industry	-7.63	23.90	3.68	4.86	1.32			
Construct.	-10.77	19.72	0.61	5.32	8.66			
Trade	-16.26	8.96	0.29	4.28	14.69			
Transport	-10.67	12.62	2.90	4.19	1.45			
Others	-13.59	9.62	0.63	3.24	5.13			
Others II	-13.56	9.62	0.69	3.22	4.68			

Labor productivity growth is calculated from value added (in constant 1990 prices) and employment data. The maximum time period covered in the database is from 1970 through 2003.

Transition countries are in italics.

The employment data are from ISIC Rev. 3 (1990):

Agric.: Agriculture, hunting and forestry ("Tabulation category" A); fishing (B);

Industry: Mining and quarrying (C); Manufacturing (D); electricity, gas and water supply (E);

Construct.: Construction (F);

Trade: Wholesale and retail trade, repair of motor vehicles and motorcycles and personal and household goods (G); hotels and restaurants (H);

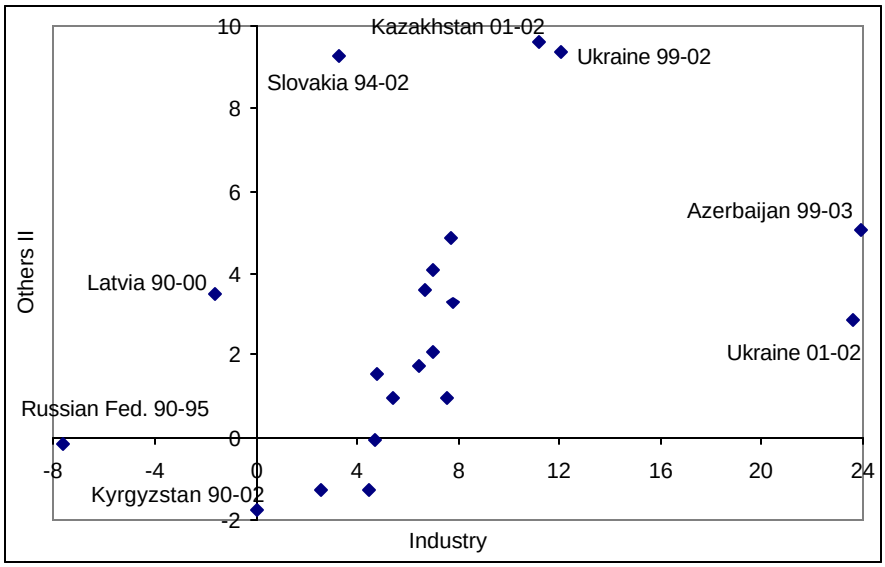
Transport: Transport, storage and communication (I);

Others: Financial intermediation (J); real estate, renting and business activities (K); public administration and defence, compulsory social security (L); education (M); health and social work (N); other community, social and personal service activities (O); private households with employed persons (P); extra-territorial organizations and bodies (Q);

Others II: Others, plus "not classifiable by economic activity" (X).

Sources:

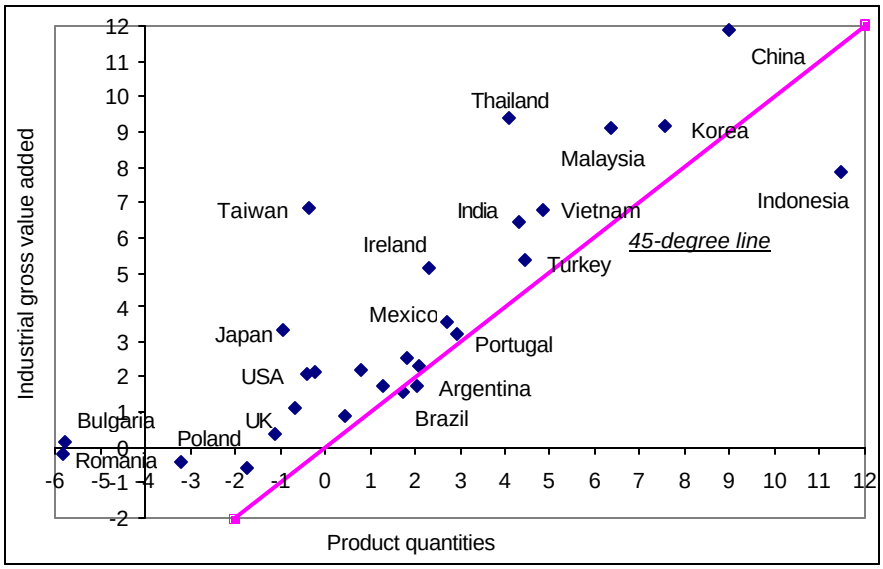
Labor data from the International Labour Organization (http://laborsta.ilo.org, accessed on 10 Oct. 04), and value added data from the United Nations (http://unstats.un.org/unsd/snaama, accessed on 10 Oct. 04). All countries on which data in the two sources are available are included; a few countries whose data exhibit irregularities were dropped (approximately half a dozen). Labor productivity data are calculated for the maximum possible time period. For some countries, two sets of labor data are available; in these cases, two sets of labor productivity growth rates are reported here.



Sources:

See Table 5. Mean labor productivity growth in industry is 6.84% (4.96% excluding the two far-right outliers), and 2.91% in "other services" (2.79%). The employment classification is Rev. 3.

Figure 2. Average Annual Labor Productivity Growth Rates in Industry and "Other Services" across Transition Countries



Sources:

United Nations Industry Commodity Production Statistics Database, United Nations National Accounts database at http://unstats.un.org/unsd/snaama (accessed on 10 Oct. 04), and for industrial value added of Taiwan in constant prices http://www.stat.gov.tw/bs4/nis/enisd.htm (accessed on 9 Feb. 2004).

Figure 3. Average Annual Growth Rates in Product Quantities and in Real Industrial Value added, 1978-1997

Table 6. Average Annual Growth Rates in Product Quantities and in Real Industrial Value added, 1978-1997

	Obs.	Prod. gr.	Ind. gr.		Obs.	Prod. gr.	Ind. gr.
Argentina	119	2.01	1.75	Malaysia	89	6.35	9.10
Australia	146	1.79	2.55	Mexico	186	2.67	3.54
Belarus	73	-4.23	N/A	Philippines	65	2.07	2.32
Brazil	254	1.72	1.55	Poland	301	-3.20	-0.44
Bulgaria	212	-5.78	0.18	Portugal	176	2.92	3.20
Canada	133	0.78	2.17	Romania	207	-5.83	-0.19
China	129	8.99	11.87	Spain	177	1.29	1.74
Cuba	51	-0.23	2.13	Taiwan	17	-0.35	6.84
France	224	-0.68	1.11	Thailand	81	4.09	9.37
Germany	24	0.45	0.90	Turkey	238	4.48	5.39
Hungary	203	-1.74	-0.56	Ukraine	220	-9.53	N/A
India	180	4.32	6.46	United Kingdom	244	-1.12	0.36
Indonesia	157	11.47	7.89	United States	250	-0.43	2.07
Ireland	48	2.27	5.15	Viet Nam	32	4.84	6.77
Japan	380	-0.94	3.31	*Mean*	*159*	*1.20*	*3.77*
Korea (Rep. of)	161	7.57	9.14				

Obs.: Number of observations.
Prod. gr.: Average annual growth rate in product quantities (geometric mean across products).
Ind. gr.: Average annual growth rate in industrial value added in constant prices.
Sources: see Figure 3.

Notes

[1] See *Statistical Yearbook 2004*, p. 50.

[2] On the double-checks via energy consumption, product quantities, and freight transportation see, for example, Meng Lian and Wang Xiaolu (2000), or Gerard Adams and Chen Yimin (1996). See Thomas Rawski (2001) for a less than one percentage point difference in the 1998 real GDP growth rate based on the income approach as compared to the official, revised data, and Albert Keidel (2001) for an alternative expenditure approach real GDP growth series. Carsten Holz (2003) critically examines the claims of problems in Chinese data.

[3] For example, a search for "Maddison" and "statistics" (both terms in Chinese) on Chinese Yahoo on 17 Sept. 04 yielded 552 hits.

[4] A large number of extensive appendices to this paper providing additional data and further explanations are available at my website, http://ihome.ust.hk/~socholz. The various appendices are mentioned below without repeating the address of my website.

[5] The relevant sector classification in this paragraph is the one used by Angus Maddison: primary sector, industry, construction, transportation and communication, commerce and restaurants, and "other services." For the data used in the calculations see Angus Maddison (1998), Table C.3 (p. 157), and *GDP 1952-95*, pp. 27f., 36f.

[6] His employment data are further problematic in that he ignores a statistical break in the employment data of most sectors between 1977 and 1978, and in that his employment data for "other services" in some years cannot be reconstructed. His employment data in "other services" in 1978 and 1995—of most interest here—are free of these problems, but the more extensive data he reports in his Table D.3 (p. 171) are not. See notes to Table 2 for details.

[7] But when it comes to value added (his Table C.3), where he lists transport and commerce separately rather than as one category "productive services," value added of geological prospecting and water conservancy is *not* included in these productive services. The GDP classification in use prior to 1998 (with data for 1978 through 1995) does not list the category geological prospecting and water conservancy separately. The GDP classification in use today, with publication starting in the *Statistical Yearbook 1998* and with data for the years since 1990, includes such a category. Details are provided in an appendix on the shares of tertiary sector subsectors in GDP. It is unclear how value added of geological prospecting and water conservancy was treated in the earlier GDP classification. (All appendices are available at the website given in note 4.)

[8] Angus Maddison was aware of the new data (note to Table D.4a, p. 171) but regarded them as false: "The 1997 *Yearbook* gives a total for the years 1990 onwards which is bigger than the sum of the sectors, and differs from the total in previous yearbooks. There seems to be some sort of error in the new official total."

[9] Three conjectures as to who the residual labor consists of are: (i) migrant laborers, especially those not employed by formally registered institutions, for example, maids employed by urban households; (ii) furloughed laborers in self-employment, for example, working as street hawkers; (iii) employees of government and administrative units who are not part of the official, authorized staff (*bianzhi*). A series of administrative reforms forced government and administrative units at all levels to reduce the number of their staff, which, however, all too often only meant the creation of unofficial positions or positions in subordinate or affiliated units; data on the number of these employees is typically not available. In as far as the employment categories "government" and "science" (research, education/ media, health/ welfare) reflect only official, authorized staff, the government and science categories may grossly underreport actual employment. In all three cases, "other services" would likely be the appropriate employment category.

[10] "Other services" would gain 13.63% of the mid-year 1995 58.30m implicit residual employment, raising employment in "other services" from 84.44m to 92.39m (using six decimals in the calculation). Compared to Angus Maddison's 1978 mid-year value of 25.965m, this implies an average annual growth rate of 7.75%. (The 13.63% gain reflects mid-year 1995 employment of 84.44m in "other services" relative to the sum of employment across all categories except the implicit residual category in mid-year 1995, of 619.29m.) Angus Maddison may wish to argue that the residual labor's output value is not included in the official GDP statistics and that, therefore, the residual labor should not be included in the calculation of his employment growth rate. Two answers are the following: first, official GDP statistics are not calculated based on employment data; second, if he wants to estimate China's "true" GDP growth rate and believes in his assumption of zero labor productivity growth in "other services," he needs to cover all labor in "other services."

[11] See, for example, Janos Kornai (2000), p. 29. To him, "unemployment on the job" is a key characteristic—a lasting, system-specific economic phenomenon—of a socialist economy.

[12] The value added classification in use since 1998 (with data for the years since 1990) contains the categories "geological prospecting and water conservancy" and "others," but then also "services for farming, forestry, animal husbandry, and fishery," with no such category in the earlier value added classification or in the employment classification. In terms of nominal value added, this service category accounted for 0.25% of GDP in 2001. For the data see *Statistical Yearbook 2003*, pp. 128f., or the appendix on the shares of tertiary sector subsectors in GDP.

[13] With value added in science based on the income approach, the high labor productivity growth rate in this sector reflects first of all income growth (as, indeed, salaries have risen repeatedly, and by large amounts, at least in research and education). One may wonder whether this income growth has been properly deflated. On the other hand, at least in tertiary level education, salaries in the early 1980s were provided in exchange solely for the existence of a person (no work obligations attached). Teaching and research requirements have since risen infinitely from this base of zero or near-zero labor productivity.

[14] The detailed data and interpretations are provided in an appendix on the average annual real growth of labor productivity based on the OECD National Accounts database.

[15] Even if this were true, incredible as it appears, China's real estate sector is small, accounting for 1.81% of GDP in 1995, compared to finance at 5.96%. See *Statistical Yearbook 2002*, pp. 49, 55.

[16] The OECD Services database also contains output and employment data following the earlier ISIC Rev. 2 classification. In this earlier period, data on only eight countries are available (Belgium, France, Iceland, Luxembourg, Norway, Portugal, Spain, and Sweden), and the table is therefore relegated to an appendix on the average annual real growth of labor productivity in services in the OECD services database ISIC Rev. 2. The key results are that the finance sector again fares exceedingly well, especially in the earliest years for which the data are available, with an average annual labor productivity growth rate in Belgium of 6.41% in 1975-80 (when data are calculated for five-year intervals) and in Luxembourg of 17.96% in 1970-75. Social services perform well in France (better than trade) while government services perform well in Portugal (again, better than trade). "Other services" fare well in Sweden (similar to trade).

[17] For the U.S., labor productivity growth rates in the 1950s (and later) can be approximated using deflated income data; an appendix on U.S. labor productivity growth in services reports and interprets the labor productivity data. A separate appendix reports on the case of Taiwan ROC, a country ethnically similar to China. Both cases confirm rather than question the Chinese labor productivity growth rates.

[18] The (similar) results in the case of employment data from the ISIC Rev. 2 (61 countries) are reported in an appendix on the average annual real growth in labor productivity across countries worldwide following ISIC Rev. 2. For some countries, two sets of employment data (within Rev. 2, or within Rev. 3) are available; these different data were all used, increasing the number of observations above the number of countries given in the text.

[19] The employment data offer further subsectors within "others," but the National Accounts data do not.

[20] Observations on all countries exhibit a similar pattern; see the appendix on average annual labor productivity in industry and "other services" across countries worldwide.

[21] Product quantity data combined with the largely imputed prices yields an aggregate gross output value in 1987 equal to 57% of official gross output value of industry (Harry Wu, 2002, p. 187, or Table 1, p. 188).

[22] The 9.85% growth rate follows from Harry Wu's estimated "total industry" value added in million 1987 RMB of 230,762 in 1978 and 1,140,485 in 1995 (Harry Wu's Appendix Table A2, p. 202). For a distinction between "Western style" and "Chinese style" calculations see the appendix on some details regarding Harry Wu's product method calculations.

[23] Lawrence Klein and Suleyman Ozmucur (2003) feel that quality improvements in China (and thereby economic growth) have been very much underestimated: "the Chinese 'market basket' is of such far greater quality in comparison with the start of reform that there is surely a need for a major adjustment in price indices—even larger than the quality improvements that have already been introduced in the US and other Western economies" (p. 23).

[24] Harry Wu (2002) acknowledges this shortcoming, as well as the problem of a change in product quality over time, which both lead to the underestimation of real growth (p. 193). On Harry Wu's aggregate product coverage see the appendix on some details regarding Harry Wu's product method calculations.

[25] Prior to 1998, the directly reporting industrial enterprises comprised all industrial enterprises with independent accounting system, located at township level and above (which implies that all industrial state-owned enterprises were included). Since 1998, the directly reporting industrial enterprises comprise all industrial state-owned

enterprises (SOEs) and all industrial non-SOEs with independent accounting system and annual sales revenue in excess of 5m yuan RMB. For details, see Carsten Holz and Yi-min Lin (2001b).

[26] For details, see Carsten Holz (2003).

[27] In 1995, the directly reporting industrial enterprises accounted for 63.42% or 62.49% of industrial value added. For the value added of the directly reporting industrial enterprises see *Statistical Yearbook 1996*, p. 411; for that of all industry see *Statistical Yearbook 1996*, p. 42. In 1980, the first year for which the data are available, state-owned industry and collective-owned industry (excluding "rural commune industry"), i.e., the enterprises under the regular reporting system, accounted for 93.80% of gross output value of industry (in 1970 prices, as only available). (*Statistical Yearbook 1981*, p. 208) Harry Wu's end-period is 1997, but he also reports aggregate data for 1995.

[28] A fifth, probably minor problem is that Harry Wu revises downward the most recent product quantities in the case of five products by resorting to alternative data sources when the data in his regular source appear too large; i.e., he interferes with the procedure used for other products to tilt the results in favor of his hypothesis. For details see the appendix on some details regarding Harry Wu's product method calculations.

[29] A selection was made due to the amount of effort required to calculate average annual growth rates in product quantities of one country and due to the perceived irrelevance of small countries like Trinidad and Tobago for the case of China (the selection is biased against economically small countries such as Luxembourg).

[30] No attempt was made here to estimate product quantity growth rates for the years 1978-1995.

[31] The types of products covered vary between countries. For each country, the raw product data had to be cleaned up. For details on half a dozen (minor) decisions that had to be made in the process of cleaning up the data see an appendix on the cross-country product method.

[32] The simplified method appears further justified by the fact that Harry Wu did not have product-specific prices for all products, but used 527 prices in "working out the average prices" for 118 items. See Harry Wu (2002) pp. 186f., also on how the prices for another 45 products were obtained. (118 plus 45 products yields a total of 163 products, and it is not clear why Harry Wu in the end uses only 161 products.)

[33] To calculate a meaningful ratio of the growth rate of industrial value added to that of product quantities, all observations with negative growth values of industrial value added and/or product quantities had to be excluded.

[34] The real value added time series was calculated by deflating gross output value by the ex-factory price index, intermediate inputs (current price gross output value less current price value added) by the input price deflator, and then taking the difference of the two. Contrasting the real value added time series with the current price value added time series results in the deflator for value added which in 1995 was 1.43 times its 1984 value.

[35] For a discussion of Harry Wu's (rather than Angus Maddison's) critique of the official data see an appendix.

[36] For Angus Maddison's adjustments see his pp. 151f., with adjusted aggregate 1987 GDP in Table C.3 (p. 157). The difference in the case of industry, of 0.51%, is small. For reasons of time consistency, I would have given national accounts data (used elsewhere, for other years, by Angus Maddison) priority over input output table data. But since Angus Maddison makes major revisions to agriculture and industry (and "other services"), with agriculture and industry in 1987 accounting for 63.82% of his alternative GDP estimate, switching to another official source of 1987 value added of industry is only a small extra step. It seems plausible as long as it is done in all sectors; it is unclear whether this is the case or not, i.e., if in all other sectors the values in the input-output table are identical to those in the national accounts which Angus Maddison uses. The industry data reported here are from Angus Maddison, Table C.3, p. 157, with his reasoning on p. 152, and from the *Statistical Yearbook 1995*, p. 32.

[37] Extensive revisions to tertiary sector value added were made following the tertiary sector census of 1993; Angus Maddison's data is post-census data and thus already incorporates the corrections. For details on the post-census revisions see an appendix.

[38] On the calculation of value added in the real estate sector see Xu Xianchun (2000), pp. 48ff., and NBS National Accounts Division (1997), pp. 99ff.

[39] In the production approach, gross output value less intermediate inputs—which do not include depreciation—equals value added.

[40] For the value added data on the tertiary sector and its subsectors see *GDP 1952-95*, pp. 27f. Table 3 has percentage shares *in GDP* in 1987.

[41] Also see NBS National Accounts Division (1997), p. 136.

[42] It would seem that medical services should also be included, but they are not explicitly listed. As long as state-owned enterprises contract out medical services, these are fully included in the GDP calculations.

[43] In the case of each individual adjustment, I first contemplated what would be an upper-level adjustment that I would still find acceptable, and only in a second step calculated the impact of such an adjustment on the total value of "other services."

[44] Angus Maddison's data are reported in his Tables C.2 and C.3 (pp. 156f.); the same values, with fewer decimals, are contrasted with official values on p. 102. The official values reported here are from the original source, for example the *Statistical Yearbook 1995*, p. 32, with more decimals, except for the value added of farming which Angus Maddison (p. 105) obtained from the 1987 input output table (not available to me).

[45] I assume "FAO" refers to the Food and Agriculture Organization of the United Nations—Angus Maddison does not provide the full term, nor is the source included in the references.

[46] Since 1998 (1997 *nian hou*), the average annual price at provincial or county level obtained by farmers when selling a particular good on the market is used to impute the value of the self-provided quantity of that good. Since 1999 (1998 *nian hou*) a multiplier of 0.9 is applied to a such obtained market price in the case of grain and meat, and a multiplier of 0.85 in the case of all other agricultural goods. For details on the changing imputation methods see Liu Chengxiang, Liu Ke, and Jin Zhaofeng (2000), pp. 129f.

[47] Angus Maddison in Table A.22c, p. 131, presents volume data on quota sales and above-quota sales for five products (four types of grains) which show above-quota sales to be approximately one-third to one-half of the sum of quota and above-quota sales. As source he gives the US Department of Agriculture (not included in the reference list), and one may wonder where the US Department of Agriculture obtained its data from when these are unlikely to exist even in China.

[48] For the example of red wheat, the *Price Yearbook 2001-2002*, p. 525, for the year 2000, reports a quota price (*dinggou jia*) of 55.77 yuan per 50 kg, a protection price of 54.73 yuan, and an *actual procurement price* (*shiji shougou jia*) of 52.57 yuan. These three prices are followed by the raw grain sales price (*yuanliang xiaoshoujia*), presumably the price at which the grain bureaus sell on the grain, of 52.95 yuan, and a market price of 47.35 yuan. Unless the actual procurement price includes the market price, the quota or the protection price overstate the price actually received by farmers. In the case of two types of rice, the numerical evidence is unambiguous: quota, protection, and market prices are *all* above the actual procurement price. This is not astonishing given the dispersed evidence on farmers not being paid by the government what they have been promised. Similar data for 1987 in the *Price Yearbook* series are not available.

[49] For details see an appendix on grain pricing.

[50] See Xu Xianchun (1999b) and Carsten Holz (2002), p. 63. Angus Maddison's calculations were probably completed before these census results became available (Angus Maddison makes no reference to them). Twenty percent of twenty-one percent of the output value of farming equals approximately four percent. Xu Xianchun also argues that Albert Keidel's upward adjustments to grain production are excessive, since the correction is based on adjustments to land in agricultural use, and the productivity of this additional land is low (consists of slopes, or roads); it is unclear whether this argument affects the FAO quantity estimates for 1975, 1987, and 1994.

[51] Xu Xianchun (1999a, p. 12) does not explicitly draw this conclusion, but elaborates further on a 1993 change in statistical classification in agriculture, and reaches the overall conclusion that "these circumstances obviously impact on Angus Maddison's estimates of China's economic growth and on his difference to China's official statistical data." The reclassification of some industrial activities from agriculture to industry are unlikely to affect the time series of industrial value added since those data were published only later; the earlier industrial gross output value data, on which value added data are based, were presumably revised following the reclassification (see Carsten Holz and Yi-min Lin, 2001a, p. 49).

[52] The current version of the PWT is 6.1, but the official website linking to these data (http://pwt.econ.upenn.edu/php_site/pwt_index.php, last accessed 17 Nov. 2004) presents this article by Alan Heston (2001) as the relevant documentation for China.

[53] See NBS National Accounts Division (1997), pp. 162-71. Angus Maddison, pp. 154 and 164 refers to "repair costs" and "part of repairs" in barely a half-sentence on each page, without giving any evidence.

[54] Alan Heston (2001), p. 4, lists the two sets of ratios for each of the years 1990 through 1999. The first is private consumption divided by the sum of private consumption, investment, and government expenditures, all based on official data. The second set is labeled "APC Zhang-Rawski," without further explanation or reference; Thomas Rawski kindly furnished the reference, Zhang Ping (2000), the data in which, when counter-checked against various data in the *Statistical Yearbook*, turn out to be household survey data. Alan Heston appears to use an unweighted mean between the in Zhang Ping separately listed urban and rural ratio of household survey consumption to

household survey disposable income, except in 1994 and 1996 when Alan Heston's data differ slightly from the unweighted mean. While Alan Heston includes 1999 data in his APC Zhang-Rawski column, Zhang Ping's data end in 1998. Alan Heston ignores that consumption and income data in the urban vs. rural case have different coverage.

[55] Alan Heston's procedure is to divide the first set of ratios by the second set, take the average of this new double-ratio of the years 1990 through 1995, and divide the double-ratios of the years 1996 through 1999 by this average double-ratio. This yields a correction factor which is then applied to official private consumption. My interpretation of this procedure is that Alan Heston takes the increasing discrepancy between the official average propensity to consume and the household survey average propensity to consume as a sign of official data falsification of consumption in the national income accounts. He then uses the in the latter half of the 1990s slightly increasing relative difference in the official and the household survey average propensity to consume (standardized by the household survey average propensity to consume), in as far as it exceeds the average 1990-95 relative difference, to adjust official private consumption downwards.

With four variables involved in the calculation, namely official consumption, official income, household survey consumption, and household survey income, some assumption such as "official consumption is wrong, all other data are correct," is required for Alan Heston's procedure to make sense. But, in this example, if official consumption is incorrect, then so is official income; maybe, then, the ratio again is correct? It seems that to justify his procedure, Alan Heston has to make very particular assumptions about each variable as well as their relative accuracy.

[56] For details see Carsten Holz (2004a).

[57] Alan Heston reports adjusted current price "investment" data (Table China-2) which match those in the PWT. He also reports adjusted constant price "capital formation" data (Table China-3) which in 1978 are 31.60% above the constant price investment data reported in the PWT, in 1996 equal, and in 1997 and 1998 smaller.

[58] The only current price GDP estimate in Angus Maddison for all years which I could find is the official one in Table C.11 on p. 164; I contrasted this to Angus Maddison's constant price GDP time series in Table C.3 on p. 157. (Angus Maddison's official GDP value for 1995 in Table C.11 on p. 164 is incorrect; all other GDP values in this table, checked since 1978, match the official values in the *Statistical Yearbook 2004*, p. 53; for 1995, the value in the *Statistical Yearbook* is 5847.81b yuan RMB and the one in Angus Maddison 6859.38b yuan RMB, 46.70% larger than in 1994, which is not credible.) Alan Heston does not provide page references to Angus Maddison. Perhaps he combined Angus Maddison's implicit industry deflator with the official construction deflator from, perhaps, the *Statistical Yearbook*?

[59] Alan Heston makes no further distinction for the years after 1994/ 1995, i.e., we do not know where the deflators for the years 1994 (or 1995) through 1998 (and beyond) in the PWT come from. (Angus Maddison provides data only until 1994/ 1995.)

[60] The household and government consumption deflators implicit in the PWT are near-identical through 1996, but from 1997 through 2000 differ by more than rounding discrepancies would allow for.

[61] For the official data see, for example, *Statistical Yearbook 2004*, p. 323.

[62] See *GDP 1952-95*, pp. 42 and 47.

[63] For an exploration of the discrepancy between official CPI and the deflator implicit in the official expenditure approach household consumption, and a presentation of the U.S. data see an appendix on the deflator for consumption.

[64] For the official data see the *Statistical Yearbook 2004*, p. 56.

[65] Carsten Holz (2004a, 2004b) argues for a significant margin of error but no systematic bias.