# Description of PWT 7.0 (June 3, 2011)

## Contents


I. Introduction, Organization and Documentation of PWT 7.0
II. Detailed Documentation
  A. Actual Consumption and Household Consumption
  B. Estimation of non-Benchmark Countries
  C. Treatment of China
  D. Growth Rates


# Introduction, Organization and Documentation

## I. Introduction and Acknowledgements


The Penn World Table grew out of the United Nations International Comparison Programme (ICP) that was jointly directed by Irving Kravis at Penn through the first three phases ending with 1975 comparison (Kravis, Heston and Summers, 1982). His collaborators at Penn, Robert Summers and Alan Heston, with the assistance of Sultan Ahmad sought to infer from the results of the 1970 ICP for ten countries the PPPs for 100 countries. Summers had the vision of expanding this exercise over time as well as space, a vision shared by Heston that resulted in PWT. Summers was active in the production of PWT through version 6.0. Alan Heston has been involved in the supervision of all the versions of PWT. Bettina Aten worked intermittently on parts of the PWT 5 series, and was fully involved in the production of PWT 6.0. Aten joined the Bureau of Economic Analysis in 2003 heading up a group working on regional PPP adjustments of personal income within the US; since joining BEA she is only able to provide periodic technical support to PWT. Programmer Analyst Ye Wang has been responsible for all of the computations of PWT and maintenance of the website since she joined the staff in 2004. Two student assistants, Yin Yin Yu and Hanzhe Zhang in particular, made contributions to PWT 7.0 joining a long list of past research assistants. Thanks are also due to those involved in annual international comparison workshops and in particular its organizers, Robert Feenstra of UC-Davis and Marcel Timmer and Bart van Ark of Groningen University and The Conference Board. As noted PWT would not have been

possible without the underlying benchmark information from the ICP nor without the continued support of the National Science Foundation. The statistical offices of the EU, OECD, and the World Bank have been very cooperative in making underlying data available for academic use and their assistance is much appreciated.

One part of our early vision was that the Table would become a data source not necessarily associated with its origins and it has come to pass that PWT has become generic. PWT 7.0 will be the final version of the Table produced at the University of Pennsylvania, with a likely terminal year of 2012. The website Table will become frozen and the baton passed. It has been a great ride that Bob and I have thoroughly enjoyed. Thanks to the many not named who have contributed to PWT and to our users who we are leaving in very good hands. Alan Heston

**II. Organization of PWT after PWT 7.0**

After 2012 PWT will be jointly maintained by Robert Feenstra at UC-Davis, and Marcel Timmer and Robert Inklaar at the University of Groningen. There will be two identical websites with the identifiers, PWT at Davis and PWT at Groningen. This timing will allow for what is anticipated as a seamless transition. PWT 7.0 at Penn will be current through 2012, with a likely terminal update to 2010. By 2013 it is anticipated that the 2011 ICP covering 180 countries will become available and will require another major revision of PWT. There are likely new methods to be adopted, additions and deletions of series and the like in versions of PWT beyond 7.0.

## III Differences of the 2005 ICP Benchmark and PWT 7.0

The 2005 ICP benchmark was a major improvement and expansion over the previous benchmark comparisons underlying PWT. (Deaton and Heston, 2010). For starters, it included 146 countries, a quantum leap from the ten countries in the first ICP in 1970. The 2005 ICP also devoted more resources to price collection and validation than in earlier rounds so it is very important to integrate ICP 2005 into PWT 7.0. This section has two major objectives: first to indicate the principal areas where we have departed from the basic inputs for

ICP 2005: namely to adjust the consumption PPPs for China; and second to indicate where PWT 7.0 departs from the 2005 benchmark and previous versions of PWT.[1] We begin with the adjustments of the 2005 ICP for China.

Because of China's population and a degree of uncertainty about the rate of growth of China's GDP as well as its actual economic size, PWT 7.0 provides two versions, an official and non-official. The former uses the ICP 2005 base estimate of China's GDP and the national growth rates; version 2 modifies both. The most important adjustment of China's PPP for consumption will be of interest to a small group of users and is treated in Part C of the Detailed Documentation. In the end, the PPPs of the basic headings of consumption for household consumption were adjusted downward by 20%. The adjustment of China's growth rates is discussed in section IV.

Finally, the modifications of China's growth rate are based upon earlier work of Angus Maddison and his collaborator Harry Wu; Wu has since updated their work to 2008. Their adjustments also called for an increase in GDP estimates for the sectors of non-material services and agriculture above the official estimates. In 1990, the reference year of Wu's update, the revision would call for a 5% increase in GDP. Because of the declining importance of agriculture the total adjustment would be about 2% in 2005. This adjustment has not been incorporated into PWT 7.0 in part because it is not clear how it should be distributed on the expenditure side of the accounts. Users are simply advised that Wu offers a rationale for some additional adjustment of China's national accounts.

The second modification of inputs arises from the use of different methods in the regions composing the ICP 2005 world for treating government and non-profit services primarily in education and health. The method recommended to

[1] The Global Office of the World Bank has made available to researchers the detailed basic expenditures and parities for 129 basic headings of expenditures on GDP. These are the data used to produce the inputs for the reference year of 2005 in PWT 7.0. Because several regions provided detail for more than 129 basic headings the published estimates (World Bank, 2008) cannot in any event be precisely replicated from the data provided to researchers. However, that source of difference is not large compared to the others discussed in this note.

the regions was to make salary comparisons for detailed occupations as the basis for PPPs for compensation expenditures on education and health following the practice of the EU and OECD at that time. This method posed a special problem in ICP 2005 because salary comparisons for the same occupation exhibited 100-fold differences between low and high-income countries within Asia-Pacific and Western Asia. As a consequence indirect volume estimates derived from such PPPs would produce unacceptably high volumes for countries like Cambodia or Yemen. In the end, a productivity adjustment was made in 3 of the 6 regions that in effect raised the salary based PPPs and lowered quantities of countries like Yemen, clearly a desirable adjustment. However this led to likely non-comparability for a non-trivial portion of actual consumption and GDP. While the method adopted in Africa, Asia and Western Asia certainly moves in the right direction the consequence of these adjustments is that for countries like Bolivia or Tajikistan, where no productivity adjustment was made, per capita incomes will be less comparable with countries at similar development levels in Africa, Asia or Western Asia. The method adopted in PWT 7.0 was to apply a common productivity adjustment to all of the regions on the basis of rough capital per worker data to estimate productivity per worker differences to apply to the education and health PPPs.

The other two differences between PWT 7.0 and the 2005 ICP relate to the unit of aggregation and the treatment of exports and imports. Countries were the unit of aggregation for each region and 5 regions were the units of aggregation for the global ICP 2005 (the 10 CIS countries were included with the OECD reducing the 6 regional comparisons to 5 for purposes of aggregation). This procedure was new and is being evaluated in terms whether it should again be used in the 2011 ICP. An alternative is the approach in the earlier ICP rounds and in PWT, namely using countries for the global aggregation. A related issue is that the ICP maintains fixity of regional results within the global comparison while PWT does not follow the current ICP practice, but rather the practices in the 1970-1980 ICP benchmarks.

With respect to exports and imports, ideally separate PPPs should be estimated based on price comparisons for imports and exports, something more easily said than done. (see Feenstra, et. al. 2008). The conversion factor used in the ICP, the exchange rate, and that used in PWT, the PPP for domestic absorption, are second best. The growth of world trade and the frequent fluctuations in oil prices and exchange rates have only made the need to estimate separate PPPs for exports and imports even more clear. One set of countries for which the use of a single conversion factor for exports and imports raises serious problems is the oil group. For a number of these oil exporting countries it has been necessary to truncate their historical series in the mid 1980s because their earlier GDP per capita estimates are so large as to be implausible.[2]

The above discussion dealt with some choices made in treating certain expenditure headings that require special treatment; the actual methods are discussed further in the section on changes in the main Table in PWT 7.0. Finally the vintage of national accounts used in ICP 2005 may have been revised by a number of countries as part of their routine national accounts updating methodology. The latest national accounts data available in 2010 are used in PWT 7.0 and so may differ for 2005 from those in the published ICP.

## Detailed Documentation

### Part A Actual Consumption and Household Consumption

In the ICP the distinction was made Phase I in 1970 between household consumption expenditure (HCE) and Actual Individual Consumption (AIC). (These are the official terms of international agencies, not of the early ICP.) HCE

[2] The underlying national accounts data for the years omitted from PWT 7.0 are available to users. Another contributing factor to the implausible per capita GDP estimates for small oil countries in earlier years is the treatment of long-term migrant workers in the gulf. The convention that persons living more than 6 months a year in a country are counted as residents is not always followed, often for lack of a proper sampling framework. Understatement of population means overstatement of per capita GDP.

refers to the expenditures of households and AIC to HCE plus provision of services by non-profits and the government, principally for education and health. In this note we will also refer to AIC as actual consumption and HEC as household consumption. The UN System of National Accounts (SNA1993) recommended that all countries provide AIC in their national accounts. This was immediately taken up by the OECD group but this change has only become more common in other countries since 1995. PWT has used HCE in all its versions until 7.0 for the reason that only a few countries outside the OECD had current, let alone historic series on actual consumption. This is rapidly changing and the 2005 ICP provides the most complete country coverage to date on household and actual consumption, and the parallel measures of collective and total government expenditures.

Many researchers are interested in these distinctions so PWT 7.0 introduces the different measures including approximations to move the series backwards and forwards in time. A supplementary file indicates years for which actual consumption is estimated as a national accounts entry. In practice most countries do not have very good data on non-profit organizations so for PWT 7.0, the underlying identity for the concepts is that actual individual consumption less household consumption expenditure equals total government expenditures less collective government expenditures, which are government expenditures on individual health and education. In symbols,

**(2.1*) AIC – HCE = TG – CG = THE***

Countries fall into 4 groups: a) 31 OECD countries whose national accounts distinguish AIC and HEC for some or all countries since 1970; b) a group of ICP countries that have AIC and HEC for 2005 and current price estimates for some or all the years from 1990 to 2009; c) the remaining ICP countries that only have AIC for 2005: and d) non-benchmark countries for which their national accounts only provide household consumption.

Starting with group d) estimating equations (described under the section on non-benchmark countries) based upon benchmark countries are used to obtain values for real Domestic Absorption (DA) and its price level as well as

their real shares of I, total TG and HEC. For present purposes only an initial value of PL DA is needed for the non-benchmark countries. For non-benchmark countries in 2005 the value of HEC and the estimated value of PL DA can use to derive an estimate of per capita DA that can be plugged into (2.2) below to obtain estimates of the national accounts value for AIC. The starting point is estimating equation (2.2) based on the 146 countries that do have AIC in 2005.

**(2.2) log (THE/TG) = -.2697* (y) + 0.2207**

The coefficients are all different from 0.0 at the 1% level. $R^2$ is .445 and the RMSE is .034, quite satisfactory for this type of estimate. Equation (2.2) can be used to move from observed national accounts values of household consumption and domestic absorption to estimated values of AIC for non-benchmark countries in 2005.

Would there be a trend in THE/TG over time? One basis for assessing this is the 1975 ICP for 34 countries where the distinction between AIC and HEC was made. Actually there were only 31 countries in 1975 that over-lapped because Jamaica did not take part in ICP 2005 and West Germany and Yugoslavia had changed boundaries. Unfortunately this check was not reassuring for either OECD countries or the remainder. Estimated values in 1975 for the 31 countries based upon time trend equations for the OECD countries did not correspond well with those used in the 1975 benchmark. One possible explanation is that the mix of private and public education and health expenditures and/or financing has changed over time.

In the end, the 2005 ratio of THE/TG is applied to TG for all years included in PWT 7.0 for country groups c) and d) to obtain THE. For OECD benchmark countries the national accounts expenditures on THE/TG are used where available and the ratio of the last 3 available years is applied for earlier years. THE is then subtracted from TG and added to HEC to obtain AIC. Group b) will be treated like the OECD countries in the next updating of PWT 7, but is handled like groups c) and d) in the present Table.

## Part B Treatment of non-Benchmark Countries

In previous PWTs estimating equations, based on regression relationships for benchmark countries, have been used to approximate the price levels of Domestic Absorption (DA) and real shares of C, I and G. The World Bank has carried out a similar exercise for purposes of their *World Development Indicators* (WDI) using a different estimating equation and only at the GDP level. Prior to 2008 these estimates would often differ significantly especially for some very poor countries. However, when the 2005 ICP benchmark data became available in 2008 the situation was greatly improved primarily because there were now many fewer non-benchmark countries. However another reason for improved comparability of WDI and PWT is that the Bank adopted a new estimating equation for non-benchmark countries (see "Estimation of PPPs for non-benchmark economies for the 2005 ICP round" on ICP website of the World Bank).

The method in PWT 7.0 is similar to previous versions in that it operates in 2 stages, first estimating the price level of DA for these countries. The basic estimating equation in versions of PWT has been of the form:

$$(1)\quad \ln PLDA_i = \alpha \ln PA_i + \beta \ln NOMDA_i + \lambda R_k + \gamma C_i,$$

where the dependent variable is the price level from an aggregation over the basic headings of DA and countries; not as for the World Bank, over GDP and regions as. In (1) the index *i* runs over the 146 countries, and for the variable $R_k$ the index *k* is over the 6 regions Africa Asia-Pacific, South America, EU-OECD, CIS, and W. Asia. The variable, PA is the average of 3 post adjustment indexes for the UN, the Canadian foreign ministry and the US state department and the variable $C_i$ is a country coefficient. The explanatory value of this equation is large and the RMSE is lower than in any previous PWT, 0.18 versus 0.25 or greater. This is in large part due to more benchmark countries.

The Table below illustrates the nature of the estimating equations for 2005:

| regressor\independent variable | ln(pl=cpd) | ln(pl=eks) |
|---|---|---|
| **intercept** | -0.63431 | -0.8852 |
| **ln(can)** | -0.55419 | -0.52594 |

| | | |
|---|---|---|
| **ln(icsc)** | 0.89386 | 0.86051 |
| **ln(dep)** | -0.36548 | -0.36722 |
| **ln(open)** | -0.2642 | -0.2932 |
| **ln(y*open)** | 0.191254 | 0.197241 |
| **class2=1** | 0.437945 | 0.473764 |
| **class2=2** | 0.153727 | 0.158664 |
| **class2=3** | 0 | 0 |
| **region=Africa** | -0.01527 | -0.03888 |
| **region=Asia/Pacific** | -0.23613 | -0.22725 |
| **region=CIS** | -0.44436 | -0.51712 |
| **region=OECD-Eurostat** | -0.02097 | -0.02097 |
| **region=South America** | -0.11886 | -0.13624 |
| **region=West Asia** | 0 | 0 |

The variables are the post adjustment indexes for Canada (*can*), the United Nations (*ICSC*), the United States State Department (*dep*); and *open*, a variable defined as exports and imports as a share of GDP and *y*open*, which interacts the per capita GDP of countries relative to the US with the open. The signs on the 3 post adjustment variables are of opposite sign because of their high correlation with each other; taken separately they would each have a positive sign. However, the equation is not structural but only used to estimate the price level of non-benchmark countries, so this is not a problem. In practice, not all indexes are available for all non-benchmark countries. For this reason one can estimate separate equations for all combinations of available indexes, or take an average taking into account available post adjustment indexes.

The variable labeled *class2* groups the countries into low, medium and high income from previous PWTs. These coefficients are plausible in that higher price levels are associated with higher income countries. The various regional coefficients put Africa, West Asia and the EU/OECD in one group, and South America, Asia-Pacific and the CIS countries with increasingly lower price levels given the other variables. The way that countries are linked in the ICP is the reason for these differences. In PWT 7.0 the an average of the equation coefficients was used to provide a price level for DA used to derive a preliminary estimate of real per capita DA that in turn becomes a variable in the second stage.

The second stage produces estimates of the real shares and price levels of the components of DA. These equations are the same as in previous PWTs. An equation is estimated with each of the real shares of C, I and G as the respective dependent variable in equations 1-3 for 2005 given below.

| Equation | 1 | 2 | 3 |
|---|---|---|---|
| Dependent | Real Share C | Real Share G | Real Share I |
| Nominal Share C | 0.8976 | 0.1125 | -0.0101 |
| Nominal Share G | -0.4658 | 1.5479 | -0.0821 |
| Nominal Share I | 0.0601 | 0.1642 | 0.7758 |
| $DAPC/DAPC_{US}$ | 0.0012 | -0.0021 | 0.0009 |

The right hand variables are the nominal shares of each country and their per capita DA relative to the US. The form of the equations assures that the real shares sum to 100% of DA. That is the sum of the coefficients is 1.0 across the 3 equations for each share, and the sum of the relative income coefficients is 0.0. The non-benchmark countries have the nominal shares and their relative DA from the estimates for 2005 discussed above. From these estimates it is possible to derive respective price levels that are the inputs to a new aggregation over all countries in PWT 7.0. The new aggregation in turn provides estimates of the per capita GDP and price level. These GDP estimates will be different than those of the WDI for the non-benchmark countries but the differences should smaller than before 2008.

## Part C: National Prices and Adjustments for China

From the inception of the project in 1968 through the most recent 2005 benchmark full participation in an ICP benchmark has required that countries provide a detailed distribution of expenditures on GDP for about 150 basic headings like rice, public transport and residential construction. This requirement can typically be met from existing national accounts data supplemented by commodity flow and consumer expenditure surveys. The more difficult task is that each country is also requested to provide national annual average prices of 3-10 product specifications per heading. It is the provision of national average

prices that is truly international characteristic of the work that permits estimation of PPPs at both detailed and aggregate levels.

In practice obtaining annual average prices has been the most straightforward aspect of the price collection for most countries, exceptions being very high inflation countries like Zimbabwe in the 2005 round. Pricing the same specification across countries is a task requiring price experts to meet and agree on what is to be priced and in what type of outlet. The 2005 ICP devoted many more resources compared to previous rounds in terms of regional consultations and price validations, especially for shop items. In previous ICP benchmarks for the non-OECD countries, there was typically one regional meeting and several country visits, with limited validation. So the 2005 round is a major improvement over earlier rounds in terms of insuring that countries compare like with like and price the same specification. This section is concerned with the third price descriptor, national average price.

## 1. National Average Prices in Practice

In principle one wants national average prices covering a whole country because these are the prices embedded in national accounts expenditures. Consider countries, A and B, and their expenditure, E, on a particular heading or item. We can write:

(1) $E_A = P_A * Q_A$ and (2) $E_B = P_B * Q_B$.

To make a quantity comparison between A and B, we can divide (1) by (2) and rearrange terms to obtain:

(3) $Q_A / Q_B = (E_A / E_B) / (P_A / P_B)$.

If we are to obtain an accurate quantity/volume comparison between A and B, we can divide the expenditure ratio by the price ratio, or in ICP terms, the basic heading parity. The problem for the ICP is that the underlying price collection framework in countries is oriented towards the consumer price index or other temporal measures of price changes. Within countries with no significant barriers to movement, prices change from year to year in tandem in all regions, urban and rural. Therefore, to obtain a good CPI, countries need not sample all urban areas or all regions.

This in turn raises a more general question for the ICP as between large, diverse countries and smaller countries and city-states. National average prices for countries like Hong Kong, Singapore and Luxembourg are quite fully covered in the outlets used for their CPIs. However, for large countries like Brazil, China or India this is less likely because prices within a country will move in unison over time so the CPI does not require nor typically conduct full country price surveys. This means the framework for collecting prices for non-tradable services does not adequately reflect internal price differences within large developing countries compared to very small countries or more affluent highly urban economies.

What is the recommended ICP practice to obtain national average prices? Recognizing that the CPI framework, with some exceptions like India, does not extend to rural areas, the EU countries have been expected to compute factors to go from urban centers to national prices by groups of basic headings based on a once-off survey. This procedure was established in the 1970s, when the then EU members had price surveys to adjust salaries for EU employees stationed away from Brussels.[3] The important exception in the EU is house rents that are collected on a national framework in a larger number of centers. In practice, these EU factors are quite dated, and are typically 1.0, meaning that the centers where ICP prices are collected are assumed to represent the national price. When the EU membership was about 10 countries, this was a reasonable assumption. Most large shop items are purchased in urban areas and the most important price differences will be for housing. Moving to an expanded EU and OECD membership, the assumption that city prices are national prices may be strained, but improvements in marketing and on-line shopping work in favor of the assumption.

What was actual practice in the 2005 ICP outside of OECD? For South America all price collections were done in urban areas. For Uruguay, no

[3] There is a regulation in the EU over a decade old mandating member countries to carry out regular surveys of regional price differences within their countries. No funding accompanied the mandate and in the recent past only a few once-off surveys have been carried out, including France, the UK and Italy.

problem, but for Brazil and other large countries, the regional differences are probably not fully captured. However, returning to equation (3)

(3) $Q_A / Q_B = (E_A / E_B) / (P_A / P_B)$,

note that $(P_A / P_B)$ are ideally national prices. Letting $P_{AU}$ denote urban prices in A, then if $(P_{AU} / P_{BU})$ approximates $(P_A / P_B)$ an urban comparison will get us close to the correct volume comparison. Thus within South America, urban price comparisons are 2nd best, but probably a fair approximation of the volume ratios across countries. If there is a direction of error it is probably to produce parities that are too large and volumes that are too small for the large countries.[4]

In Africa, a major effort was made to obtain national coverage of prices. Part of this effort was directed at improving the CPI framework in a number of countries, and in the larger countries to obtain a better understanding of regional differences in prices and levels of living. West Asia was mainly urban pricing, while Asia-Pacific was a mixture. Before turning to Asia-Pacific and China in particular, a general point is worth noting. While urban pricing may work within a region, comparing countries in a region doing rural and urban pricing, like Africa, with countries in South America, an element of non-comparability is introduced. In the 2005 ICP a comparison between a set of 18 Ring countries was used to link the regions. The pricing tended to be for shop items in capital cities of smaller countries, the exceptions being Brazil, Egypt, Japan, Malaysia, and the Philippines. It was anticipated that because the Ring countries would be compared on a common basis, their linkages would offset some of the differences in methodologies across regions. However, it is not clear this was accomplished because in practice the relative positions of Ring countries within their Region were not always mirrored in the relative positions of the same Ring countries within all Ring countries.

[4] House rents are handled separately from other goods and services. They are compared one way in South America, another way in Africa and Asia/Pacific, and still a 3rd way in West Asia. Direct quality adjusted quantity comparisons were used in South America and rental equivalence in OECD. Comparability of housing comparisons of countries in different regions remains difficult, and hopefully will be improved in the 2011 ICP.

Does this make a difference? Consider a large affluent country like the United States, where the CPI collects prices in only 38 urban centers ranging across city size and region. Aten (2006) reports that for the 38 urban centers used by the US for the CPI the differences between small southern urban areas and New York Suburbs and San Francisco are large, 81 versus 127 percent of the US average in 2003. From more than a million collected prices, Aten is able to obtain about 25,000 annual average price observations for 256 entry-level items collected by the BLS and uses these to estimate price level differences over all of consumption. This is a rich data set that has now been updated to include 2004 through 2009 with similar findings, so that we can be fairly certain that the range across US urban areas is around 55 percent and that differences of 25% between urban areas in the Northeast and the Midwest and South are common.

Aten also finds that arraying BLS centers by their personal income per capita, the gradient of prices from low to high is not large for goods, but it is much steeper for services, especially housing, a common finding across countries of previous rounds of the ICP. While the BLS does not collect prices in rural areas the American Community Survey does collect rents on housing in rural and urban areas for standardized dwellings. The differences between urban and rural rents within areas are less than the differences in urban areas across regions, an important point to keep in mind. So a large country with few barriers to movement of goods and people and many common national internet prices can still have significant differences in relative prices. The differences of prices within common currency unions, like the Euro countries, can be even larger. In the 2005 ICP the level of prices in the Euro countries ranged from the extreme of 45 in Montenegro to 137 in Ireland, with differences of 25% or more being frequent.

## 2. Implications of Differences in Country Price Coverage in the ICP

There was a common agreed expenditure framework across the ICP of 155 basic headings that regions could exceed or if necessary, fall short, so long as they fit into the target number of headings. However, the Global Office of the

ICP was developing standard product descriptions at the same time that Regions began their comparisons between their members. As a consequence not all methods of obtaining basic heading parities were common across regions and this is especially clear in Asia/Pacific where 57% of the global population reside (Japan and Korea were in the OECD comparisons and are 2.8% of world population).

With respect to national average prices, we have noted that urban states like Hong Kong, Macao, Singapore, or smaller countries like the Maldives or Bhutan, are likely to capture most prices in the collection framework of their consumer price index. Some countries like Indonesia and India regularly sample prices in their diverse regions and also in rural areas, while other large countries like Pakistan, only collect prices in urban areas. Hopefully, in the 2011 ICP, there can be a more consistent treatment of countries within regions and between regions so some of the sources of non-comparability in the 2005 ICP can be reduced. The only country adjustment that has been made in PWT 7.0 is for China, where pricing took place in 11 cities and their immediate ex-urban areas.

Before turning to this adjustment, one element of the 2005 ICP methodology should be noted. The regions of the world were linked by 5 Regional conglomerates, with the CIS countries linked to the OECD through Russia. An implication of this methodology is that relationships remain fixed within regions when the regions are combined in the Global comparison. In the Asia-Pacific Region, coverage of countries was systematically higher in the smaller countries because of their CPI sample frame, while in larger more diverse countries some regions or rural areas were not well sampled. So it is likely that the PPPs of the larger Asia-Pacific countries were higher compared to the smaller countries due to the sample frame for prices, and their respective volumes therefore lower. In the way the Global estimates were put together whatever systematic effects occurred within a region would be in turn show up in the ICP benchmark for 2005. As discussed below, this is one reason that in

PWT the aggregation of the basic headings has been across the 146 countries, not the 5 regions as in the published report.

## 3. Chinese Price Collection in ICP 2005

**Some Background**

China agreed to participate in the ICP in the 1993 and 2005 comparisons but on a limited level, namely providing mainly urban prices. In 1993 the plan was to compare Shanghai with Tokyo and Guangdong with Hong Kong; the Shanghai comparison was never made public but the Guangdong was completed

**Table 1: Population, Household Consumption and Wages 11 ICP Cities**

| Province | City | Population | Consumption | Wage | Urban/ |
|---|---|---|---|---|---|
| | | Thousands | Yuan | Yuan | Rural C |
| | | 1 | 2 | 3 | 4 |
| Shanghai | Shanghai-M | 17000 | 24260 | 49310 | 2.3 |
| Beijing | Beijing-M | 13200 | 18911 | 46507 | 2.3 |
| Guangdong | Guangzhou-PC | 12000 | 12663 | 29433 | 3.1 |
| Chongqin | Chongquin-M | 7500 | 6545 | 23098 | 3.8 |
| Hubei | Wuhan-PC | 6600 | 6583 | 19818 | 3.2 |
| Heilongjiang | Harbin-PC | 4750 | 5986 | 19386 | 2.8 |
| Shangdong | Qingdao-SPC | 3800 | 8075 | 22844 | 3.1 |
| Shaanxi | Xi'an-PC | 3800 | 5272 | 21525 | 3.7 |
| Liaonging | Dalian-SPC | 3500 | 7965 | 23202 | 3.0 |
| Zhejiang | Ningbo-SPC | 2182 | 12569 | 31086 | 2.5 |
| Fujian | Xiamen-SEZ | 1413 | 8772 | 22283 | 2.7 |
| Total or Mean | | 75745 | 13907 | 33673 | |

Note: M = Municipality, PC = Provincial Capital, SPC = Sub-Provincial Capital, SPZ = Special Economic Zone. Table entries refer to 2007. Source: China Statistical Yearbook, 2007.

and was described in the publication of ESCAP(1999).[5] Of course, that leaves the question of how you go from Guangdong to all of China, and in the ESCAP

[5] It is stated in Report of the Asian Development Bank that 2005 represents the first time that China has participated in the ICP. This is a bit misleading since China did participate in the 1993 ESCAP ICP comparison, hosting 2 meetings of participating countries, the last in 1997, when the final report was approved.

publication, this was not attempted. Interestingly there is a long tradition of such city-to-city comparisons going back to a Shanghai-Tokyo comparison for 1955.[6]

The price collection by China in 2005 took place in 11 cities and their surrounding areas. The expenditures refer to all of China and the prices were moved to an all-China basis to replicate the inputs of fully participating countries. Like the 1993 comparison, the relationship of selected urban to national prices is the critical step. To resolve this issue an Expert Group Meeting was convened in June, 2006 to decide on the best method to move the 11 city prices to a national level (Asian Development Bank, 2006). Table 1 presents some economic and demographic information about the cities for 2007 that will not be very different from 2005. The population of the 11 city administrative areas in which the prices were collected is 135 million people, and the provincial population 513 million, about 40% of China's total population.

**How the 11 City Prices Were Used in the 2005 ICP**

The problem faced by the Expert Group was how to translate the prices that China provided into national average prices. It should be mentioned at the outset that China did a very thorough and extensive job of collecting prices in the locations chosen, providing many more observations than is typical in ICP countries. It should also be mentioned that one section of the Bank, the poverty unit, also did a review of the price collection with Chinese officials, and their work will also be further referenced. (Chen and Ravillion, 2008).

The ADB expert group decision was to assign separate weights to the 'rural' and urban prices collected by China for each city based on the household expenditures of a reference group of provinces. The reference weights were of 4 clusters of provinces, namely Capitals, Inner Provinces, Coastal and North, and the assignment of weights was done separately for rural and urban prices.[7] The

[6] See Mizoguchi (1968). This study found that the urban price level in Japan was about 30% higher than in China. The study was also consistent with Colin Clark's estimates (Clark, 1965, 1976)

[7] The names of the groupings are clearly only suggestive in the sense that Harbin is the Capital of the northern most province, Heilongjiang; and Shanghai is both a Capital and a coastal city.

assignment was done by a cluster analysis on a set of census characteristics of the provinces, none of which related to prices. Thus the prices collected by China were assumed to represent all the variation of prices across rural and urban areas and regions of China, since all the ADB did was re-weight these prices. An interesting quote from the Report of the Expert Group (2006, p.3) is:

"At the request of the Expert Group, Mr. Dikhanov conducted a quick analysis of the preliminary 11-city price data from China supplied to the ICP Asia Pacific Regional Office. His preliminary suggestion is that while the price data showed many outliers there was only a limited variation in the PPPs for the 11 cities. The Group felt that given the limited variation in the price data for the 11 cities there was no need to explore the issue of robustness of the average prices to the choice of the clustering methodology."

Even when China broke down the 11 city prices into the 20% of the observations in the suburban areas and the 80% in the urban areas, there was little variation in the resulting PPPs from urban and ex-urban areas.[8] To many outside observers this lack of variation in PPPs appears more a reflection on the choices of items and outlets used in China than on the differences in rural, urban and regional prices. The ADB Expert Group was aware of a research study by two China scholars, Brandt and Holz (2006), who made a comprehensive set of comparisons of rural-urban and regional price levels in China for 1990 and 2000 with some updating of results to 2004.[9] For a common or joint basket of goods that holds quantities equal, the yuan cost in urban compared to rural areas was 31.1% higher for all provinces in 2000 and 29.5% in 2004.

The more striking point is that regional price differences are as great or greater than rural-urban differences. Even excluding Beijing, Shanghai, Tianjin and Guangdong, where prices are highest, the range across regions is substantial. For rural areas, Guizhou is 60.6% higher than Chongqing; for urban

[8] Information based on discussions with ICP staff at the World Bank. The average prices of the rural and urban areas of the 11 cities have not been made available.
[9] The Brandt-Holz estimates have been used by Sicular, et.al. (2007) to compare the rural-urban income gap in China. In their work Brandt and Holz only approximate rental differences by the cost of construction taking no account of the scarcity value of land. As more and more of the urban housing is market priced, the rural-urban differentials for rented and owner-occupied housing have increased in China. If there is a direction of error in their shelter estimates, it is to understate the difference between rural and urban prices in China.

areas, Hainan is 49.8% higher than Chongqing; and for all areas Hainan is 48.9% higher than Chongqing. The differences make clear why it is difficult to move from urban to national prices in a large country like China. In dismissing the Brandt-Holz study, the Expert Group noted that using a fixed basket imparts a serious "substitution-bias", and that unit values may not adequately deal with quality differences.[10] These are both reasonable criticisms, but they do not validate what the ADB has done. Correction for substitution-bias and possible quality effects due to use of unit values would reduce some of the differences in prices between poorer and richer provinces noted in the Brandt-Holz study. But as mentioned above, Brandt-Holz do not really compare rental housing or many other consumption items for which regional price differences are largest like medical, and personal services.[11] But inclusion of more services would work to increase the differences between rural and urban areas and provinces. It is hard to draw the conclusion of the ADB that the apparent small variation in prices across the 11 cities of China in the 2005 ICP is an adequate representation of the situation for all of China.

It is clear that Chen and Ravillion (2008) also see more price variation in China between rural and urban areas than shows up in the sample of prices for the 11 cities. They say.

"Our discussions with NBS staff responsible of implementing the ICP price survey revealed that the choice of these 11 cities was influenced by expectations about the likely availability of the types of goods referred to in the ICP survey, notably the more 'international' goods not readily available throughout China. One would not expect to find that all the commodities identified in the ICP price survey schedule are readily available in more rural areas of China, or even in many urban areas." (2008, p. 6)

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[10] A range of the substitution bias across a range of countries comes from the ICP Phase II, where one compare the Geary-Khamis method with the fisher ideal with the US for 6 lower income countries in that benchmark. The range the Fisher PPP exceeded the G-K was from 5.7 to 17.6%, the mean being 11.4%.

[11] For example, Aten (2007) shows that for the United States, prices of commodities increase only slightly as you move from low income small urban areas to higher income centers like New York or San Francisco, whereas service prices rise fairly sharply. Overall prices have ranged by abpit 55% across the 38 BLS centers that are surveyed over the period 2003-06.

In the discussion of the "rural areas" of the 11 cities we have used the terms ex-urban and suburban. Again quoting Chen and Ravillion,

"We discussed the survey design with the senior statistician of NBS managing the unit implementing the ICP for China and other staff of NBS in Beijing. We were assured that the 'rural' coverage was little more than the suburban areas at the urban fringe, and could not be considered representative of prices in rural areas." (2008, pp. 6-7)

Nor could the coverage be considered representative of prices in other regions. Certainly the NBS did not say the prices represented more than those 11 cities and their surrounding hinterland. Rather it is the extension of the sample prices to all of China that is at issue.

## Alternatives to the ADB Approach

### Brandt-Holz

The average prices in the 11 cities in 2000 in the Brandt-Holz study were 20.5% above national urban prices, both sets of prices weighted by urban populations. If we use as weights the administrative area populations of the 11 cities to apply to rural prices and compare it to the average for all rural areas the 11 city provinces are 15.0% higher than the national average. For all of China Brandt-Holz find that in 2000 urban prices were 31.1% above rural prices. Clearly their study would suggest that the 11 city prices were 20% above the national urban average and that taking account of rural-urban and regional differences the overall effect would be in the 30 to 50% range. Corrections for quality and the substitution effect would reduce this range, but even a quarter to a third would be a generous allowance, still leaving a substantial difference.

### Chen-Ravillion

Chen and Ravillion developed with the NBS regional food bundles that would provide 2100 calories a day and priced these at the median unit values of the items from household expenditure surveys in both urban and rural areas. Their estimates were that food costs were 42% and total budget costs 37% higher in urban than rural areas of China. In estimating the global poverty line Chen and Ravillion (2008) adjusted the ICP PPPs for household consumption downward by 37% for rural China. Though developed for different purposes, the

37% estimate of Chen and Ravillion is certainly consistent with the Brandt-Holz type of numbers.

## Gong and Meng

Another study by Gong and Meng for urban China provides estimates from 1986-2001. The authors use 3 different methods and sets of data in their research. The first is indirect and uses budget shares of food and other variables to correct for the substitution bias of the consumer price index over the period 1986-2001. As part of the output of a set of annual regressions are coefficients of the provinces that represent differences in urban prices that they term spatial price indexes. The 2nd method is similar to Brandt-Holz, based on the same household surveys but of more recent vintage. Finally they use a series from the NBS that was collected from 1991-97 for the purpose of testing alternative methods of constructing the consumer price index. The prices were collected from 260 urban centers for 120 goods and services and aggregated to average urban provincial prices.

The CPI special collection is especially informative with respect to the services-commodity differences in China because the unit values from household expenditure surveys typically have no services, with few exceptions. However, the CPI data set for 1991-97 has 23 service items including dwelling rents. For tradable goods Gong and Meng (Appendix A) find the range to average 4.02 and increase over the 1991 to 1997 period. The disparity for non-tradables across the provinces also increases over the period with an average of 7.87. This is a common feature within many economies where the dispersion is usually driven by dwelling rents. In the case of China the range of rents per square meter across provinces averaged 7.03, less than the average of non-tradables. These three approaches have terminal years prior to 2005, one is 1997 and two are 2001. The 11 city average for the three indexes ranges from 6.3 to 11.6% above the respective national urban averages of the three approaches.

## Indirect Evidence from Table 1

Table 1 also contains indirect evidence on price variation across all-China compared to the 11 cities. Consider the regional variation in consumption per

family of all households across the 11 cities in column 2 of Table 1. The weighted average by population is 13,907 and the simple average 10,691 yuan, with a low of 5,272 in Xi'an (Shaanxi Province) and high of 24,260 yuan in Shanghai.[12] All China consumption per household is 7081. Clearly the 11 cities are in provinces with relatively high consumption households. Nine of the remaining 20 provinces have average incomes below Shaanxi Province, the lowest in Table 1.

There is strong support for the proposition that price levels in poorer areas will be lower than in higher income areas from all ICP studies, including the 2005 benchmark for all countries, and the Euro countries; and from studies within countries like the US. Brandt-Holz (Table 7) report correlations of their basket costs and disposable income in the provinces and for 2000 these were .45 in rural areas, and .80 in urban areas, and for both urban and rural areas .77. One common explanation of this is the Balassa-Samuelson effect; low consumption is due to low incomes; low incomes are due to low productivity in traded goods, which in turn leads to low wages in traded and non-traded goods. Because productivity differences between countries tend to be less for non-traded goods, low wages in non-traded goods lead to lower prices in low-income areas.[13] This effect is reinforced by the fact that land values tend to be lower in poorer areas, if not offset by climate or other natural amenities.

Column 3 in Table 1 provides average wages in the provinces of the 11 cities. The average wages have a smaller variance across provinces in part because of the mobility of labor and partly because State Owned Enterprises up to the 1980s maintained a common national wage structure. Construction is a less organized industry and thus more likely to reflect the local market for casual labor. The range of construction wages for the 11 cities was 15,521 in Xi'an to

[12] The population weights in Table 1 are of the administrative area, usually a county of the city. The average consumption figures, however, are of the province containing the administrative area, and are likely to show much less variation than for the 11 cities.

[13] For further discussion see Heston, Summers and Nuxoll (1994) in Research Papers on the PWT website.

52,698 yuan in Shanghai, greater than for average wages. For all the provinces in 2007, the national average wage in construction was 18758 while for the 11 cities it was significantly higher, 23,190 yuan. Unless there are productivity offsets, lower wage levels will contribute to lower distribution costs and lower prices in retailing, and other services, like food away from home.[14]

Column 4 in Table 1 illustrates another common pattern, namely that urban-rural differences in household consumption tend to be associated with lower average household consumption across the 11 provinces. The national average ratio in 2007 was 3.7, and only 2 provinces in Table 1, Chongquin at 3.8, and Shaanxi at 3.7, are at the national average. Table 2 provides the distribution for all 31 provinces between average consumption and urban to rural consumption ratios. Two-thirds of the provinces lie on the principal diagonal suggesting a strong relationship. Another way to describe this relationship is low-income urban areas go together with even lower-income rural areas.

**Table 2: Cell Count of Average Wage and Urban to Rural Consumption Expenditures for 31 Provinces of China, 2007**

**Consumption Group Urban to Rural Consumption Expenditure Ratios**

| Average Consumption | Urban/Rural < 2.7 | Urban/Rural 2.7-3.3 | Urban/Rural > 3.3 |
|---|---|---|---|
| > 7,500 yuan | 5 | 3 | 1 |
| 5 - 7,500 yuan | | 9 | 5 |
| < 5,000 yuan | | 1 | 7 |

If provinces are grouped by average wages the pattern is similar but not as pronounced. Our argument is that the 11 cities used in ICP 2005 for China are higher consumption and wage cities. Suppose China is like other countries in having lower price levels in lower income areas, which is supported by the work of Chen and Ravillion, and Brandt and Holz. Then the parities for China used in ICP 2005 based on the 11 cities are higher than national average prices.

[14] In suggesting that lower rents and wages lead to lower retail prices we are holding constant purchase costs of the retailer and the market structure of retailing.

The question then becomes, should an adjustment be made, and if so, on what basis.

## Should the Chinese Prices be Adjusted?

One argument against any adjustment is that many other countries only provide urban prices, so why do something special for China. If one wants to compare China with similar countries in its region that only collect urban prices, say Pakistan, then it may make sense to do no adjustment. But even within Asia-Pacific, India does try to cover the whole country including rural areas and the major regional difference between the South and the North. So making no adjustment for China within Asia-Pacific does not provide the best comparison with India or for that matter, most of the very small countries or larger more affluent countries. Nor the best comparison with countries with higher per capita GDPs and more urbanization, like Brazil.

Further, if the interest is getting the best reading of China's economy against the G-20, then some adjustment seems appropriate. From the standpoint of PWT 7.0, where we are already offering 2 Chinas, with official and adjusted growth rates, it is simple to also offer users a choice of initial 2005 levels. So we are left with the question of how and by how much to adjust the ICP parity for China. The how question relates to using detailed adjustment of parities for consumption headings like clothing, food, personal services and purchased transport, or to make a more global adjustment for total consumption. We have chosen the overall consumption adjustment as being more transparent.

## Adjustment of China's Consumption Price Level in PWT 7.0

Thus far we have argued that the prices for the 11 Cities did not represent all of China, no matter how they were weighted. We have based our argument on ICP 2005 evidence across the Euro countries and the well-documented price level variation within the United States. For China, we have discussed the work of Brandt and Holz based upon unit values, with very few services, and the pricing of poverty bundles by Chen and Ravillion. We have also argued that the higher average consumption is associated with higher price levels within and between countries in the ICP and other studies. Since the 11 cities have higher

price consumption levels than the rest of China, we would also expect the all China price level to be lower than the 11 cities.

One official series by the Ministry of Civil Affairs in China for 2002 also supports the type of adjustment that will be used. The cost in each county of China for a given minimum bundle of goods for those in poverty submitting claims was estimated for 2002 and also updated more recently.[15] The system is tied to the *Hoku* or registration system in each county or district, so poverty standards are local and in principle, are not available to those registered elsewhere. The national average of 160 yuan per month is based upon the total claims made per person for the 1600 plus counties and districts. For the 11 cities the simple average was 227 and the population weighted average 254 yuan, 41 and 59% higher than the all China figure.[16]

## The Form of the China Adjustment

In PWT 7.0 reference year estimates require as inputs the price levels and expenditures of C, I and G. Our modification of ICP 2005 for China is to make a downward adjustment of 20% to the price level of C that enters into the PWT estimate for 2005. We arrive at 20% by considering a range of estimates that are set out in Table 4 and making what we judge to be a conservative adjustment. As indicated the Brandt-Holz and Ravillion-Chen studies both make direct price comparisons, while the consumption and wage estimates are arrived at by inferring price differences. To illustrate, suppose that the 11 city average consumption is 30% higher than the national average. How much lower are average prices likely to be at the national level than in the 11 cities. Based on the United States, a 10% lower average consumption across metropolitan regions will be associated with 6.17% lower prices. Using this estimated

[15] See http://cws.mca.gov.cn/accessory/200908/1250662163330.htm.

[16] I would like to thank Hanzhe Zhang for assisting me in understanding this program and the underlying data. Remaining errors are my own. In terms of understanding the 11 cities, it should be pointed out that each city includes several counties and districts, the unit of residential registration. For example, Beijing consists of 2 counties and 16 districts where the range of payments is 280 to 443 yuan per month.

coefficient, we would infer that the 11 city prices would be associated with prices that were 30*.617 = 18.5% higher prices than the national average. The range of estimates shown in the cell for the average consumption line in Table 4 corresponds to alternative weightings of the 11 city prices. The same is true for the range of the poverty bundle estimates.

**Table 3: Alternative Adjustments of 11 City Prices to National**

| Source | Data Source | Scope of Coverage | Basis for Adjustment | Range of Estimates |
|---|---|---|---|---|
| Brandt-Holz | Unit Values Rural-Urban and Provinces | Few Services | 11 Cities/ National- Rural- Urban- Regional | < 57.9% |
| Ravillion-Chen | Poverty Bundle Urban-Rural | Few Services | Rural-Urban | > .27 * 37% = 10% |
| Poverty Claims | Poverty Bundle across Counties | Few Services | 11 Cities/ National | 18.5, 25.9 and 36.2% |
| Gong-Meng | Prices, Unit Values and Engel Estimates | 11 Cities versus national Urban Indexes | Combining Urban and Rural Estimates | 20 to 25% |
| Household Consumption Differences | Consumption Across Provinces | 11 City Provinces versus National Consumption | Regression Relationship | 16.6 to 59.7% |
| Wage Differences | Construction and Average Wages | 11 City Provinces versus National Averages | Regression Relationship | 14.6 to 21.6% |

The entry for Brandt-Holz multiplies the rural-urban differences and the 11 city to national urban difference but does not subtract for the likelihood that some of the rural urban differences will have been captured in the ICP price surveys and is therefore an upper bound. Similary, Ravillion-Chen is a lower bound because it weights the 37% rural-urban difference by the share of consumption of rural China but takes no account of regional differences across urban areas. We

believe that an overall estimate of 20% from the range in Table 4 is a conservative allowance for adjusting from 11 cities to national average prices. Erring on the lower side seems appropriate because no attempt has been made to adjust prices for other 2005 ICP countries. However, the adjustment that has been made should make the estimates for China more in line with other countries in the G-20. In terms of the methods of PWT, this amounts to adjusting the input price level PPP/Exchange Rate) of consumption that from roughly .40 to .32. And as noted users are also provided in PWT 7.0 estimates based on unadjusted prices for China for comparison.[17]

**Part D. Growth Rates in PWT 7.0**

PWT 6.3 introduced a new preferred growth rate series, rgdpl2, a Laspeyres index based on the growth of the trade sector and domestic absorption with a reference year of 2005. In the initial version of PWT 7.0 this new rate and the rates of growth used in previous versions of PWT are all provided. At a later date there will also be another rate provided based on growth between previous versions of PWT to be fully described when it is available.

As in previous versions of PWT China gets special attention. An official version of China's growth based on official constant price series and the 2005 ICP benchmark is provided as China1. Section III of the Description and Part C above describe the adjustments made to the 2005 benchmark for all countries and especially for China. This modified ICP estimate for China in 2005 is the reference point for China's growth series.

In previous versions of PWT we have attempted to document the assumptions used in spreading an adjusted GDP implicit deflator among the main expenditure groupings of household consumption, government current expenditures and domestic investment. In PWT 7.0 a less detailed approach has been used to derive the growth rates and implicit deflators for the expenditure

[17] The direction of this adjustment is to raise the estimate of real consumption and GDP but the exact impact will depend on the aggregation of the PPPs of the other expenditure headings. A guesstimate would be somewhat under 10%.

groupings of Domestic Absorption (DA) in PWT 7.0. As in previous PWTs no adjustment has been made to the growth rates/deflators for exports and imports.

The source for the adjusted GDP growth rates is a recent paper by Harry X. Wu of the Hitotsubashi University (Wu, 2010) that builds upon and extends his work with Angus Maddison that was used in earlier PWTs. Wu adjusts the constant price totals and growth rates of the major productive sectors of the Chinese economy generating a new growth rate for GDP from 1949 to 2008 and implicitly a revised series of constant price DA from 1952. The official Net Foreign Balance in constant prices has been subtracted from Wu's constant price GDP series to derive an estimate of his adjusted constant price DA2, versus the official DA1. In PWT 7.0 the constant price expenditures of C, I, and G in year *t* have been derived from the series of constant priced DA2. The ratio of the growth of DA2/DA1 from in each year from *t-1* to *t* has been applied to the official growth rate of DA from *t-1* to *t* for each the expenditure components. This calculation is set out in (1) below.

(1) $DA2_{it} = DA1def_{it-1} * (DA2_{t} / DA2_{t-1})$,

where *i* is the index of the 3 expenditure components of DA. This is surely not correct, but the value added from attempting to estimate different growth rates for the components is small given the likely errors. Further new research is continually providing new information on past national accounts of China so this procedure may be improved in the future.

For the whole period 1952 to 2007 DA1 grows at 6.9% a year and DA2 by 5.8% representing a downward adjustment of about 15%, with more than a 20% adjustment since 1990 and a roughly 10% adjustment in years prior to 1990. For the present the only consequence of use of official rates versus the downward adjustments that are used in PWT 7.0 is the year in which the measured GDP of China exceeds that of the United States. It will be somewhere between 2012 and 2015 in whatever version of PWT 7.0 that is used. Using official growth rates and the measures underlying the late Angus Maddison's work on China (Maddison, 2007), or the estimates in PWT 6.3 or the World Bank's estimates for

2005 prior to the release of ICP 2005, China would have already surpassed the United States as this is written.[18]

It should be noted that Wu's growth rate adjustment is smaller than in the original Maddison-Wu paper (2008 publication date but circulated earlier and contained in lst edition of 1998 of Maddison, 2007). This was in part a response to the criticism of Carsten Holz (2006) who questioned their assumption that there was zero productivity growth in non-material services. Wu (2010) does allow for a productivity improvement in non-material services though much lower than that assumed in official statistics. It may also be noted that Holz (2008) in discussing prospects for future Chinese growth came up with projections lower than official rates.

**A New Growth Rate**

An objective of PWT 7.0 is to provide a growth rate that is fixed prior to the reference year, but may be changed for later years. The major idea is that as later reference years are adapted, the growth rates in the intervening years from the previous benchmark will be fixed, and so forth. There will be exceptions to this pattern when countries introduce major historical revisions to their national accounts. The advantage of fixing earlier growth rates is that newer versions of PWT will not report different growth rates for the same earlier periods as older versions. Work on the particular version to be presented in the first modification of PWT 7.0 is a variation on what has been suggested by discussions with various colleagues.[19]

# References

Aten, Bettina (2006), "Interarea price levels: an experimental methodology" Monthly Labor Review, September.

[18] It was noted in Part C above that Wu also adjusts the official level of national accounts of China based on estimated understatement of output in the agricultural and non-material goods sectors, which is not included in PWT 7.0. The Wu adjusted growth rate implicitly includes the trends in the shares of these sectors over time that would have complicated incorporating Wu's level adjustment in PWT. A recent posting by Subramanian (2011) that incorporates the changes discussed for China for 2005 in PWT 7 already has China surpassing the US in 2010.

[19] I would particularly like to thank Arvind Subramanian, Robert Feenstra and Angus Deaton, for their ideas but none are responsible for the particular version.

Brandt, Loren and Carsten Holz (2006), *Spatial Price Differences in China: Estimates and Implications*, Economic Development and Cultural Change.

Chen, Suchua and Martin Ravillion, *China is Poorer than we Thought, But No Less Successful in the Fight against Poverty*. Policy Research working paper 4621, World Bank, May.

Gong, Cathy Honge and Xin Meng (2008) *Regional Price Differences in Urban China 1986-2001: Estimation and Implication,* Discussion Paper No. 3621, July, Australian National University and IZA, iza@zia.org.

Heston, Alan, and Robert Summers and Daniel Nuxoll (1994), "The Differential Productivity Hypothesis and Purchasing Power Parities: Some New Evidence," Special Issue on the Balassa-Samuelson Effect, *Review of International Economics*, October

Holz Carsten A. (2006) "China's Reform Period Economic Growth: How Reliable Are Angus Maddison's Estimates." *Review of Income and Wealth 52*, no. 1 (March): 85-119. See also: "China's Reform Period Economic Growth: How Reliable Are Angus Maddison's Estimates? Response to Angus Maddison's Reply." *Review of Income and Wealth 52*, no. 3 (September): 471-5.

Holz, Carsten A., (2008) *China's Economic Growth 1978-2025: What we know about China's Economic Growth Tomorrow?* World Development, Vol.36 No. 10

I.B. Kravis, A. Heston and R. Summers (1982) , *World Product and Income: International Comparisons of Real GDP*, Johns Hopkins University Press, May .

Maddison, Angus (2007), Chinese Economic Performance in the Long Run, 960-2030, 2nd edition, OECD Paris. Update and expansion of 1998 lst edition.

Maddison, Angus and Harry Wu (2008) *Measuring China's Economic Performance,* World Economics June.

Subramanian, Arvind (2011) Is China Already No. 1? New GDP Estimates, Posting of Jan. 19th.

World Bank (2008), Global Purchasing Power Parities and Real Expenditures: 2005 International Comparison Proram, Washington, DC.

Wu, Harry X. (2010), "ACCOUNTING FOR CHINA'S GROWTH IN 1952-2008 - CHINA'S GROWTH PERFORMANCE DEBATE REVISITED WITH A NEWLY CONSTRUCTED DATA SET," Institute of Economic Research, Hitotsubashi University Discussion Series Draft (December) kindly provided by the author.