Angus Deaton, Princeton University TAG meeting, 18 September, 2012

CONSUMER PRICE INDEXES, PPP EXCHANGE RATES, AND UPDATING

Underlying problem

- Between ICP1993 and ICP2005, there were very large revisions in the PPPs
 - Actual PPPs for 2005 relative to PPPs for 2005 calculated by updating using CPIs or IPDs
- The poorer the country, the larger the upward revision relative to the US
- The world became much more unequal
 - Enough to reverse the trend of declining global inequality that we thought we knew
- Could be lots or errors, omissions, and improvements in ICP protocols
- OK, but same happened between ICP1985 and ICP 1993
 - Which could also be an accident





Give up CPI updating?

- Ravallion (2010) argues that CPI updating should be abandoned in favor of use (his version) of Balassa-Samuelson theorem
 - This gives better results from 1993 to 2005
- I will return to this at the end
 - Note no explanation is offered for why CPI updating fails
 - Indeed, R notes that, if his method works, so should CPI updating
 - Balassa-Samuelson says the same thing

No lack of explanations

Long known the PPPs are *not* generally consistent with CPIs

- Change in PPP from t to t+k is not generally the same as relative CPI changes over the same period
- On which more below

- Several papers suggesting reconciliation methods and formulas
- McCarthy lists a number of other problems
 - Treatment of trade balance is different
 - Hedonic adjustment in some countries, not others
 - Different lists for CPIs from ICPs
 - More unrepresentative goods and services to get match
 - Broader set of prices in CPIs
 - Multiple levels at which PPPs could be updated, e.g. IPDs for categories of GDP and they give different answers
 - Some countries use chain-linking for CPIs, and some do not
 - Countries often revise their GDP numbers, which ICP cannot do
- I don't have anything to say about any of these

Analyzing the bias

- Rather than propose reconciliation methods, I would like to understand better why and in what direction CPI (or IPD) updating gives the wrong answer
 - Not sure how to assess proposals without understanding what is going on
- This paper looks at one contribution to the difference
 - Theoretical analysis of weighting difference
 - Empirical assessment of its importance
- I look at bilateral comparisons only
 - US versus other countries in empirical evidence

Simplest case

c(u, p) = ua(p)

 $d\ln P_i = d\ln a(p_i)$

 $\ln PPP_2 = \ln a(p_2) - \ln a(p_1)$

 $d\ln PPP_2 = d\ln P_2 - d\ln P_1$

This is what we want: the rate of growth of the PPP is the differential rate of growth of the two CPIs.

Non homothetic case

$$d\ln P_i = \sum_n \frac{\partial \ln c(u, p_i)}{\partial \ln p_{in}} d\ln p_{in} = s_i' d\ln p_i$$

$$d \ln P_2 - d \ln P_1 = s_2' d \ln p_2 - s_1' d \ln p_2$$

$$\ln PPP_2 = 0.5(s_2 + s_1)'(\ln p_2 - \ln p_1)$$

This assumes Törnqvist, but *any* symmetric index must use both sets of shares Change in ln *PPP* is no longer equal to differential change in ln *CPI*

 $d\ln PPP_2 = (d\ln P_2 - d\ln P_1) - 0.5(s_2 - s_1)'(d\ln p_2 + d\ln p_1)$

National and international

 $\ln P_t^C$

Suppose that everyone uses Törnqvist type indexes

$$\ln P_t^C = \sum_n w_{tn}^C \ln p_{tn}^C$$

• Ignore changes in the weights (whose effects are second order) then differential CPI change is

$$d\ln P_{t}^{B} - d\ln P_{t}^{A} = \sum_{n} w_{tn}^{B} d\ln p_{tn}^{B} - \sum_{n} w_{tn}^{A} d\ln p_{tn}^{A}$$

• There is also a PPP index for B relative to A, and suppose that it , too, has the same form (isn't usually the case)

$$d\ln PPP_t^{BA} = \sum w_{tn}^{BA} (d\ln p_{tn}^B - d\ln p_{tn}^A)$$

• For a Törnqvist index, the weights are the average of the country weights

Aggregation bias

 The difference between the updating formula and the benchmark change is then

 $d\ln PPP_{t}^{BA} - (d\ln P_{t}^{B} - d\ln P_{t}^{A}) = -0.5\sum_{n} (w_{tn}^{B} - w_{tn}^{A})(d\ln p_{tn}^{B} - d\ln p_{tn}^{A})$

- This will be zero if the shares are the same in B and A, or if the changes in relative prices are the same in B and A, or if the changes in relative prices are orthogonal to the shares
- Suppose B is China, and A is the US, that the share of nontraded goods is larger in the US, and the relative price of nontraded goods is rising more rapidly in China (BS), then RHS is *positive*, and PPP will rise over time relative to the updating formula
- Or food, for example. Cannot sign in general.

CPI updating

- Will not give the right answer even under ideal circumstances
- There is another term
- The direction of this additional term can be expected to be positive for relatively poor countries
 - Poor countries have higher budget shares on food
 - Food is largely tradable and relatively expensive
 - Over time, parities of services will rise relative to parities for food
 - Makes last term positive
- PPPs should be revised upward at each ICP round relative to CPI updating
 - Even if everything is perfectly measured
- But other things can be going on too in any period
 - Unwise to rely on a general rule that is not understood

Balassa-Samuelson

- Also depends on changes in relative prices of tradable and non-tradable goods
- But it is a completely different thing
- Here, we are trying to explain difference between rate of growth of PPP and differential rate of growth of CPIs
- BS tries to explain difference between rate of growth of market exchange rate and differential rate of growth of CPIs
 - BS literature does not use *level* of PPP
 - So purchasing power parity puzzle literature is all about rates of change
 - Which is why there is so little contact with the ICP, which has been largely about *levels*
 - BS has nothing to say about exchange rate and PPP, or about the difference between CPI and PPP

Empirical evidence

- Correction proposed here is theoretically in the right direction
 - But does it explain what happened?
- I look only at bilateral Törnqvist indexes
- And only at consumption
- Need to check those look like actual PPPs from ICP 2005
- Compare price of consumption from ICP and Törnqvist bilateral indexes with US



Calculations

I actually calculate the following expression

$$\Delta_i = -0.5(s_i^{93} - s_{USA}^{93})'(\ln \pi_i^{05} - \ln \pi_{USA}^{93})$$

 But note that the 93 data are very aggregated and I may not have used them correctly And they are a mess
Need to redo for 2011 v 2005



Figure 2 comments

- The negative correlation with per capita GDP is as predicted (-0.39)
- Very small changes for similar countries at top right
- Poorer countries (In GDP per capita less than 8), discrepancy is about 9 percent on average
- What about the predicted changes versus the actual changes
 - For the countries that were in both 1985 and 1993



Figure 3 comments

- Insignificant positive correlation
- Actual adjustments are *much* larger
- Countries with log per capita GDP less than 8 had adjustment upwards of 45 percent on average
- Lots of possible reasons
 - My approximations
 - All of Paul McCarthy's list
 - Greater hedonic correction in US goes in wrong direction
 - Better quality matching doesn't seem to be a big deal
- Not very helpful in understanding what happened

How to update?

- After each round before the next one
 - As now up to 2011
- CPI or IPD adjustment is done now
 - With various frills
- Seems worth adding the extra term here
 - Theoretically justified
 - Can be calculated from NAS information in intervening years
- What about Ravallion's suggestion of using Dynamic Penn Effect?

Dynamic Penn Effect

- Price of consumption (or GDP) is lower in poorer countries
- Change in consumption price might be similarly related to growth of GDP
- Ravallion finds this "dynamic Penn effect" does better than CPI updating from 1993 to 2005
 - Not so clear that the 1993 cross section regression of Inpc on InGDP will hold over time
 - But certainly possible

But, but . . .

- The theory here is that the XR should move with the prices of *traded* goods
- So if prices of non-traded goods rise more rapidly in poor countries
- Ratio of CPI to XR will rise in poor countries
- This is an *alternative* way of predicting differential increase in CPIs versus XRs
 - The theory *assumes* that CPI moves with PPP: not true
- But perhaps dynamic Penn effect will do better?
 - Perhaps, but no reason to expect it to be stable over time
 - Depends on differential productivity increase in non-traded
 - Offers no explanation for why CPI updating fails
 - Major part of the evidence it cannot explain, so to use it is as dangerous as using CPI updating, which didn't work