

## Estimation of PPPs for non-benchmark economies for the 2005 ICP round

This note provides a brief explanation on the imputation method used to estimate PPP rates at the GDP and private consumption level for economies that did not participate in the 2005 ICP round. Although these “non-benchmark” economies account for only a small share of the global output and population, it is important to include them in any comprehensive measurements of economic size and international poverty.

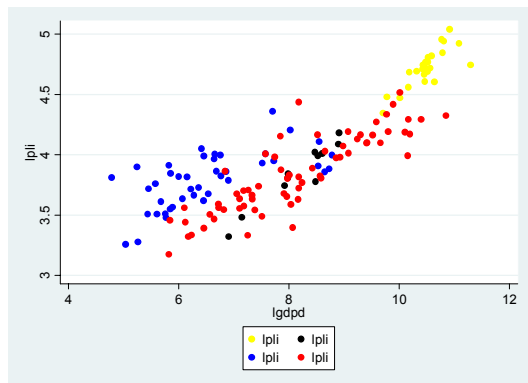
The ICP 2005 Final Report<sup>1</sup> includes a discussion of the regression models used in the previous (1993) ICP round to impute PPP rates at GDP level. The specifications were used to impute PPPs for the 2005 round. Estimated values for non-benchmark countries can be found at page 164 of the Final Report.

Afterwards, a search for better regression model was undertaken and an alternative model was found to yield better estimates. The new model uses the price level index (PLI) as the dependent variable. The PLI is the ratio of a PPP to a corresponding market exchange rate. The PLI with the United States = 100 is modeled as:

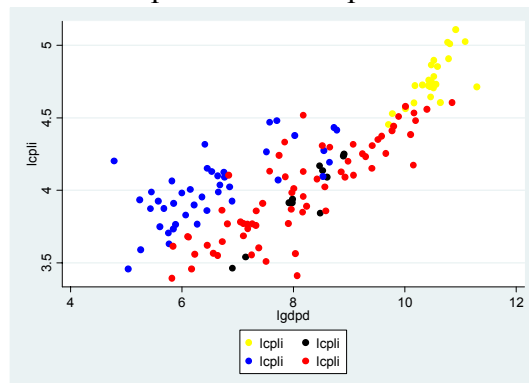
$$PLI_i = a + b \cdot X_i + e_i \quad (1)$$

The explanatory variables,  $X_i$ , included GDP per capita in US\$ at market prices, imports as share of GDP, exports as share of GDP, the age dependency ratio, dummy variables for Sub-Saharan African economies, OECD economies, island economies, and landlocked developing economies, as well as the interaction terms of GDP per capita and dummy variables. Data came from the ICP 2005 and WDI databases, supplemented by other official data sources in a small number of cases.

Figure 1: Price level index increases with GDP per capita in US\$  
PLI at GDP level



PLI at private consumption level



Color representation: yellow - OECD; blue - Sub-Sahara Africa; black-Latin America and Caribbean; red - all others

<sup>1</sup> International Comparison Program, *Global Purchasing Power Parities and Real Expenditures*, (Washington, DC: The World Bank, 2008).

Because the USA is the base country in the multilateral comparison, by definition its PPPs are always 1 and its PLIs are always 100. So it is necessary to add an explicit constraint on the equation (1) to force those values. If the constraint can be written as

$$PLI_{usa} = a + b * X_{usa} \quad (2)$$

Substitute (2) into (1), the equation becomes:

$$PLI_i - PLI_{usa} = b * (X_i - X_{usa}) + e_c \quad (3)$$

Both dependent variable and explanatory variables are “normalized” by the corresponding values of the United States. Note in regression, all continuous variables are in natural log. There are two regressions – one for PLI at GDP level and one for PLI at private consumption level. Two regressions are run together using Zellner's Seemingly Unrelated Regression method. The regression results are presented in the following table.

Table 1: Regression results

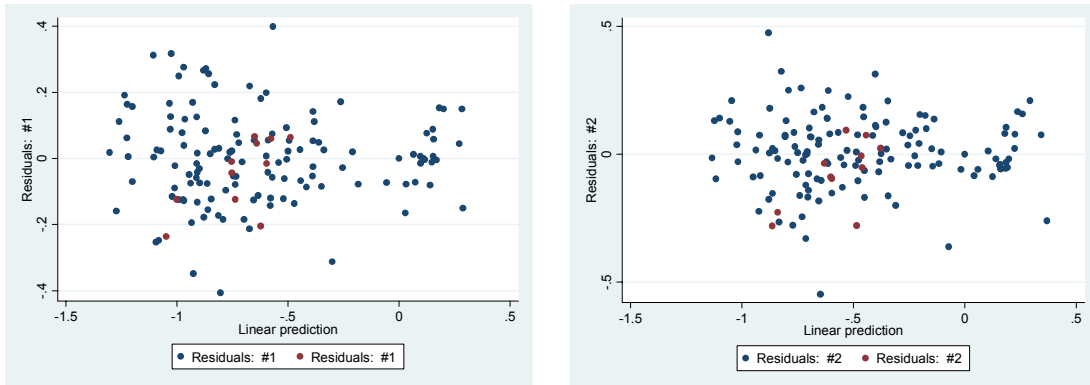
Dependent variable	Eq #1: PLI at GDP level (N=143)		Eq #2: PLI at private consumption level (N=143)	
	coefficient	standard error	coefficient	standard error
GDP pc (US\$)	0.279	0.008	0.253	0.007
Export as % of GDP	-0.102	0.017		
Imports as % of GDP	0.071	0.022		
Age dependency ratio	0.348	0.076	0.384	0.079
GDP pc (US\$)*SSA dummy	-0.083	0.022	-0.056	0.022
GDP pc (US\$)*island economy dummy	-0.063	0.026	-0.049	0.027
GDP pc (US\$)*landlocked developing economy dummy			-0.011	0.005
OECD dummy	0.238	0.030	0.210	0.030
SSA dummy	0.733	0.158	0.603	0.163
Island economy dummy	0.633	0.223	0.556	
Landlocked developing economy dummy	-0.071	0.032		0.232
<b>Regression summary<sup>2</sup></b>	<b>R<sup>2</sup></b>	<b>RMSE</b>	<b>R<sup>2</sup></b>	<b>RMSE</b>
	0.969	0.135	0.948	0.143

Figure 2 below plots residuals against fitted values in each regression and Figure 3 plots imputed PPPs for non-benchmark countries and actual PPPs for benchmark countries against GDP per capita in US\$. Figure 4 compares the predicted PPPs with the actual

<sup>2</sup> Both regressions exclude constant term as the equation (3) indicates. The same regressions are run with constant term and a joint test of both constant term being zero gives  $\chi^2(2) = 6.16$ .

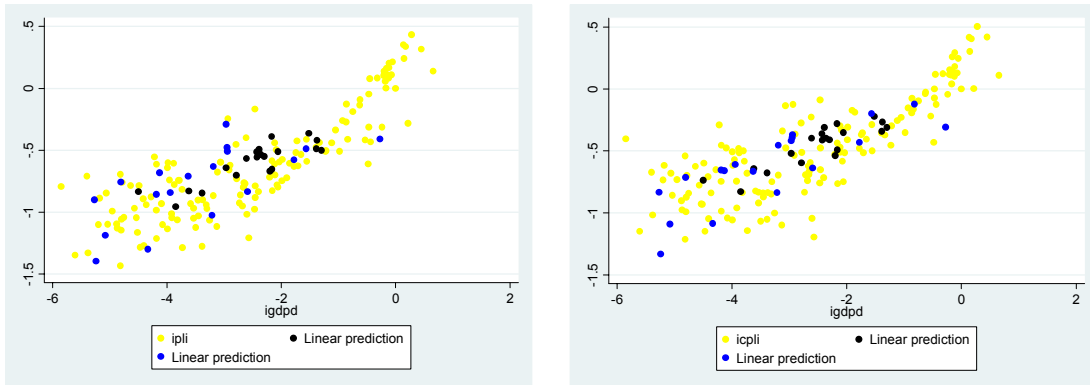
PPPs for benchmark countries using the previous method reported in the ICP final report and using the method presented here. Clearly the average deviation for both PPPs are smaller using the new method.

Figure 2: Residuals against predicted values  
Eq #1 Eq #2



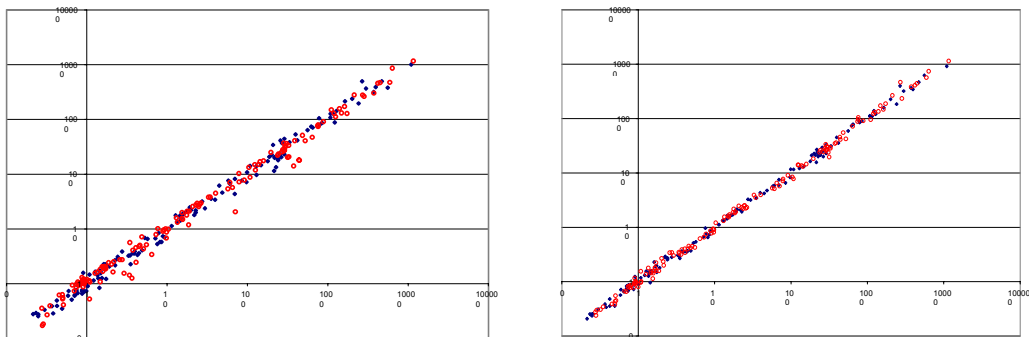
Color representation: brown –Latin America and Caribbean; blue – all other countries

Figure 3: Imputed and actual PPPs against GDP per capita in US\$  
PPP at GDP level PPP at private consumption level



Color representation: yellow - ICP benchmark countries; blue - non-benchmark countries in Latin America and Caribbean; black – other non-benchmark countries

Figure 4: Imputed PPP against actual PPPs  
old method                      new method



Color representation: blue – PPP at GDP level; red- PPP at private consumption Level

Table 2: Imputed PPP estimates for non-benchmark economies

<b>Country</b>	<b>Region</b>	<b>Exchange Rate (LCU/US\$)</b>	<b>PPP for GDP (LCU/PPP\$)</b>	<b>PPP for private consumption (LCU/PPP\$)</b>
United Arab Emirates		3.672	2.438	2.696
Bahamas, The		1.000		0.886
Micronesia, Fed. Sts.	EAP	1.000	0.748	0.658
Kiribati	EAP	1.310	0.662	0.678
Myanmar	EAP	5.761	1.426	1.521
Papua New Guinea	EAP	3.102	1.336	1.687
Solomon Islands	EAP	7.530	3.201	3.920
Timor-Leste	EAP	1.000	0.469	0.490
Tonga	EAP	1.943	1.205	1.312
Vanuatu	EAP	109.25	58.13	69.37
Samoa	EAP	2.710	1.628	1.874
Turkmenistan	ECA	11022.1	3950.3	4768.8
Uzbekistan	ECA	1112.9	304.1	376.1
Antigua and Barbuda	LAC	2.700	1.774	2.068
Belize	LAC	2.000	1.222	1.465
Barbados	LAC	2.011	1.237	1.431
Costa Rica	LAC	477.8	244.8	279.0
Dominica	LAC	2.700	1.558	1.791
Dominican Republic	LAC	30.409	17.256	20.396
Grenada	LAC	2.700	1.827	2.043
Guatemala	LAC	7.634	4.022	4.540
Guyana	LAC	199.88	87.11	105.17
Honduras	LAC	19.000	8.151	9.662
Haiti	LAC	40.450	17.569	19.365
Jamaica	LAC	62.281	37.290	43.362
St. Kitts and Nevis	LAC	2.700	1.876	2.161
St. Lucia	LAC	2.700	1.619	1.898
Nicaragua	LAC	16.733	6.435	7.297
Panama	LAC	1.000	0.521	0.611
El Salvador	LAC	8.750	4.335	4.812
Suriname	LAC	2.732	1.601	1.834
Trinidad and Tobago	LAC	6.300	3.816	4.614
St. Vincent and the Grenadines	LAC	2.700	1.547	1.783
Algeria	MNA	73.276	31.807	38.739
Libya	MNA	1.308	0.735	0.850
West Bank and Gaza	MNA	4.490	2.207	2.310
Afghanistan	SAS	49.680	15.132	16.710
Eritrea	SSA	15.500	6.312	6.734
Seychelles	SSA	5.500	3.379	4.499