Producing PPPs for Imports and Exports and the Covid-19 Disruptions to Global Trade

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Robert Feenstra, Robert Inklaar and Marcel Timmer, “The Next Generation of the Penn World Table,” ***American Economic Review***, 2015, 105(10), 3150-3182.

Robert Feenstra and John Romalis, “International Prices and Endogenous Quality,” ***Quarterly Journal of Economics**,* May 2014, 129(2), 477-528.

Introduction

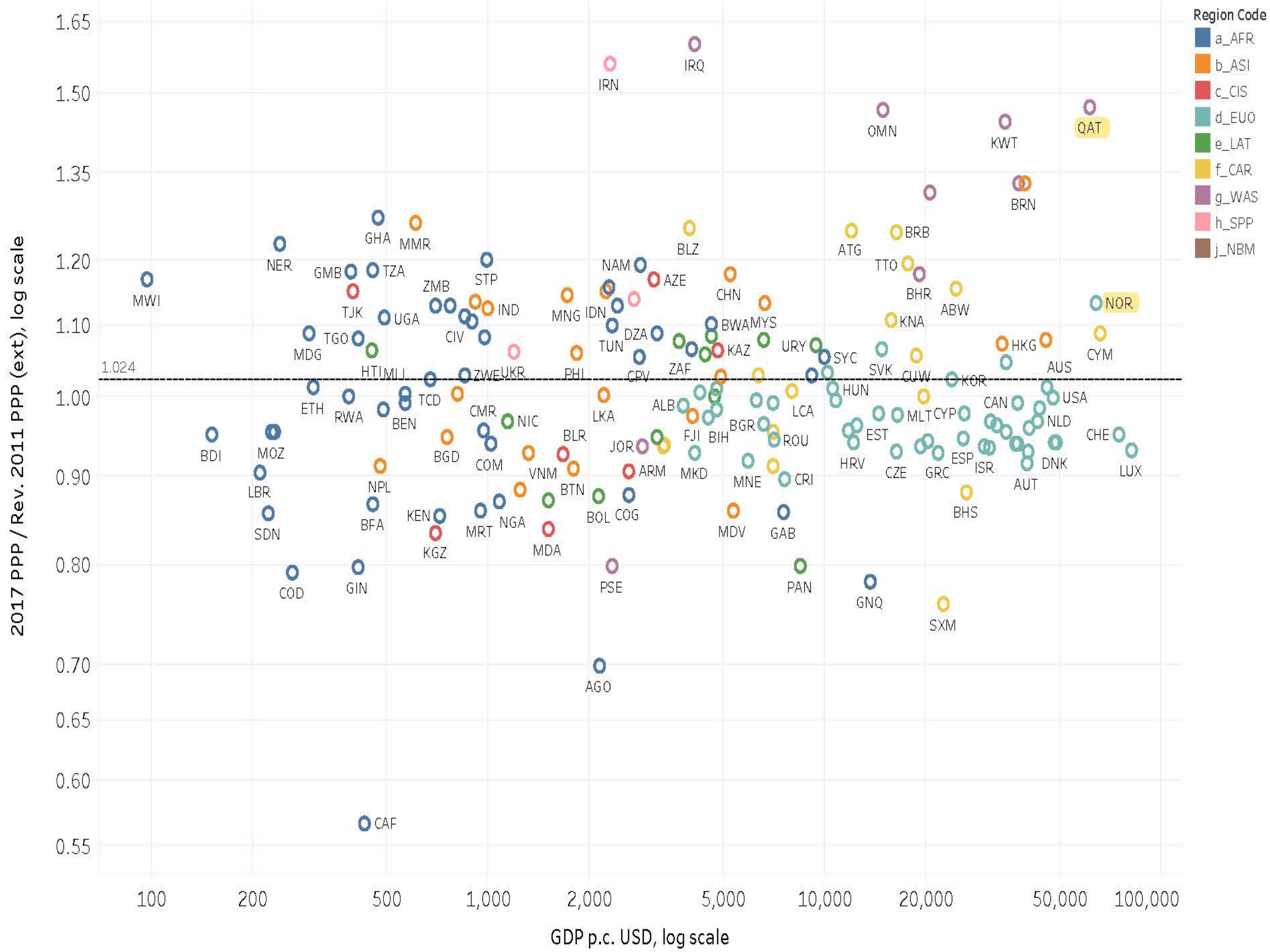
ICP uses the nominal exchange rate for the PPP on imports and exports

Instead, we could construct PPPs for imports and exports. This would correct for some anomalies in the results, e.g. Norway *was a standout in 2017 as compared to using extrapolated PPPs from 2011*

Explanation: *a)* Norway is an oil exporter, so for oil the Kroner/US$ price of exports is equal to the nominal Kroner/US$ exchange rate

b) But Norway imports many differentiated products, and from 2011 to April 2020 there was a depreciation of the Kroner relative to the US$. That should raise import prices, but not by the full amount of the exchange rate depreciation (due to partial pass-through of exchange rate). So Kroner/US$ price of imports rises by *less than* the Kroner/US$ price of exports (i.e. oil)

GDP: 2017 PPPs / 2011 (revised) Extrapolated PPPs



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General Solution:

Construct PPP indexes for exports and imports, and apply those to measure "real GDP". This is what the "next generation" of PWT (since v8) does to obtain **"GDP in the output side":**

$$CGDP_j^o = \frac{C_j + I_j + G_j}{PPP_j^q} + \frac{X_j}{PPP_j^x} - \frac{M_j}{PPP_j^m} \equiv \frac{GDP_j}{PPP_j^o},$$

An alternative solution is to use the PPP for domestic absorption (i.e. C+I+G) to also apply that to net exports (X – M). Since PWTv8, this is included in the "next generation" of PWT and is called **"GDP on the expenditure side"** (also called **"GDP on the income side"** in the SNA):

$$CGDP_j^e = \frac{C_j + I_j + G_j}{PPP_j^q} + \frac{(X_j - M_j)}{PPP_j^q} = \frac{GDP_j}{PPP_j^q},$$

Challenges with constructing PPP's for exports and imports:

1) Since M enters GDP with a negative sign, the GK method might fail. *This is not much of a problem in practice provided that the right prices are used for exports & imports.*

2) The only prices available for trade goods are *unit values.* So these suffer from "product mix" and "quality" issues, which are especially severe for internationally traded goods.

The Washington Applies Effect (*Microeconomics,* Allen and Alchian):

Suppose that a high quality apple sells locally in Washington state for 25¢ and a low quality apple for 15¢. Shipping them to the East coast costs 10¢. Then the *relative price of the high-quality apple on the East coast is*:

$$\text{Export market} = \frac{35¢}{25¢} = 1.4 < \frac{25¢}{15¢} = 1.67 = \text{local market}$$

So the *relative price of the high-quality apple is **lower** in the export market, and **more will be sold there***. Therefore, the unit-value of exports will exceed the unit-value of local goods.

How to correct for this?

Example 1: Country-product-dummy + distance (CPDD) regression:

Use *unit-values for goods k exported from country i to j:*

$$\ln UV_k^{ij} = \alpha^i + \beta_k + \gamma \ln dist^{ij} + error$$

Measure UV_k^{ij} as the free-on-board (f.o.b.) price in the exporter *i* for good *k,* i.e. *without* any transport costs. What is the sign of γ?

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Results: Find that γ>0, which is due to the quality of the exports!

Could we measure the *quality-adjusted export price* by α^i:

$$\ln UV_k^{ij} = \alpha^i + \beta_k + \gamma \ln dist^{ij} + error$$

That is, we treat $\ln dist^{ij} = 0$ to get the *quality-adjusted price?*

***But:** must correct for the differing basket of exports from each country!*

Example 2: Run country-product-dummy + distance (CPDD) regression

$$\ln UV_k^{ij} = \alpha^i + \beta_k + \gamma \ln dist^{ij} + error$$

Strip out distance: $\ln \widehat{UV}_k^{ij} = \ln UV_k^{ij} - \hat{\gamma} \ln dist^{ij}$

Use a GEKS procedure to form: $\widehat{UV}_k^{i,World} / \widehat{UV}_k^{US,World}$

The above is the *starting point* for Feenstra and Romalis (*QJE*, 2014):

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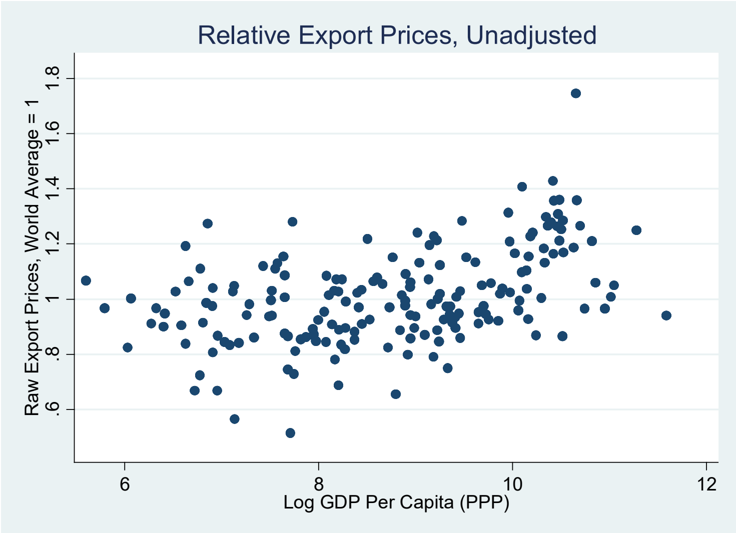
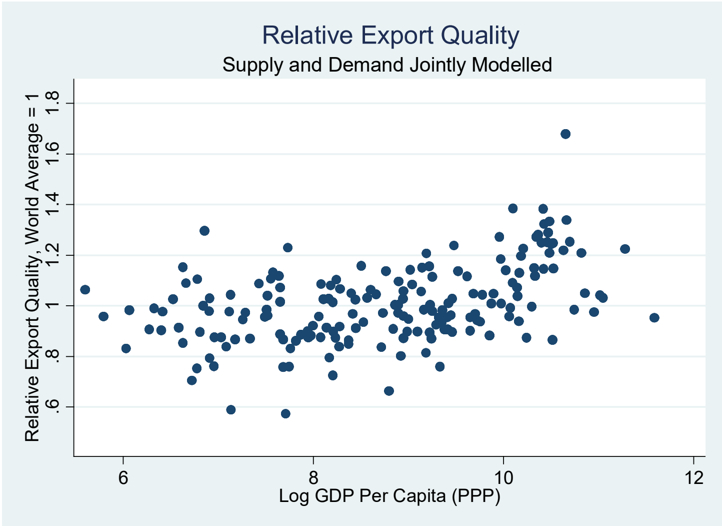
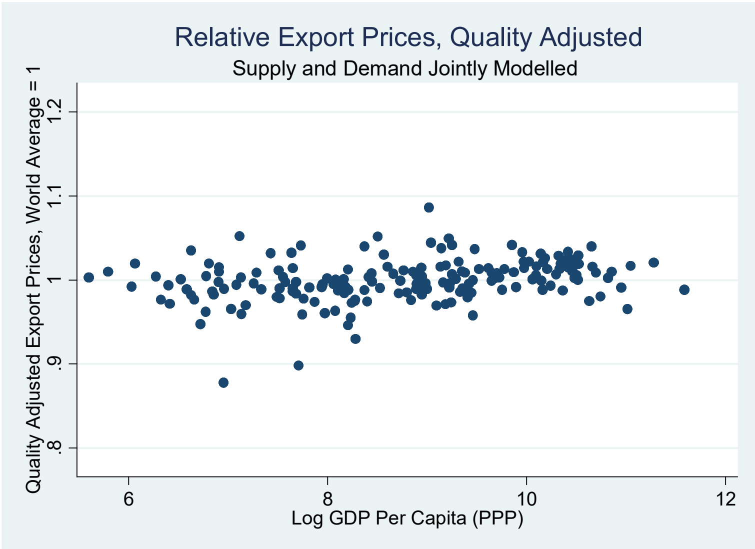
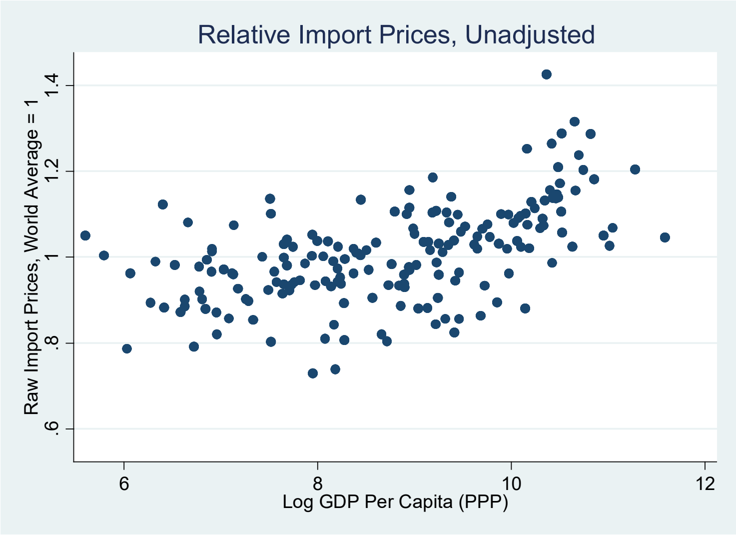
Results for country export prices in 2007:

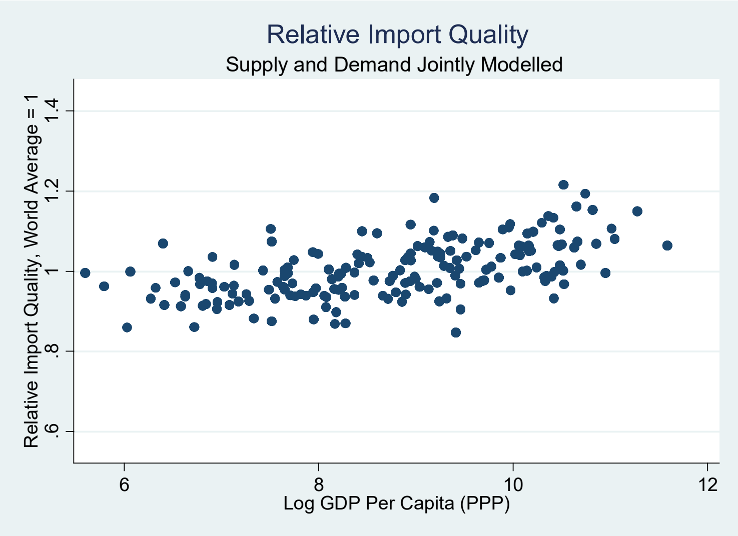


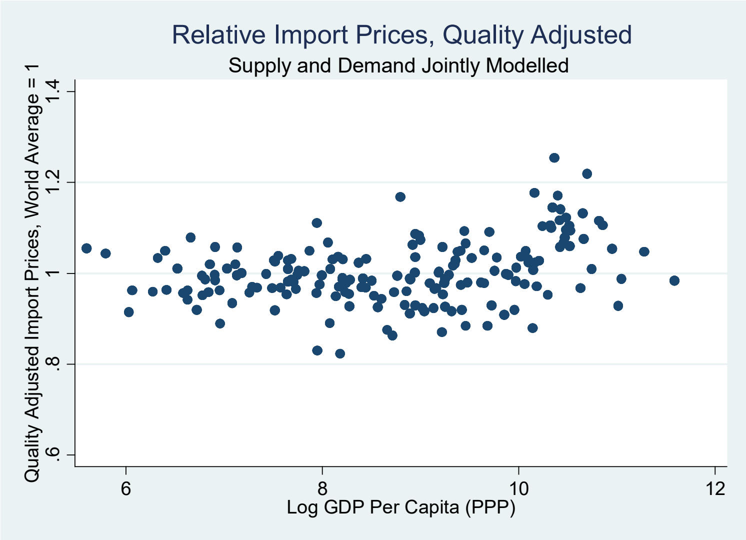




Must do another procedure on the **import side:**







Diff. between **CGDP-e** (using PPP-da) and **CGDP-o** (using PPP-x, PPP-m):

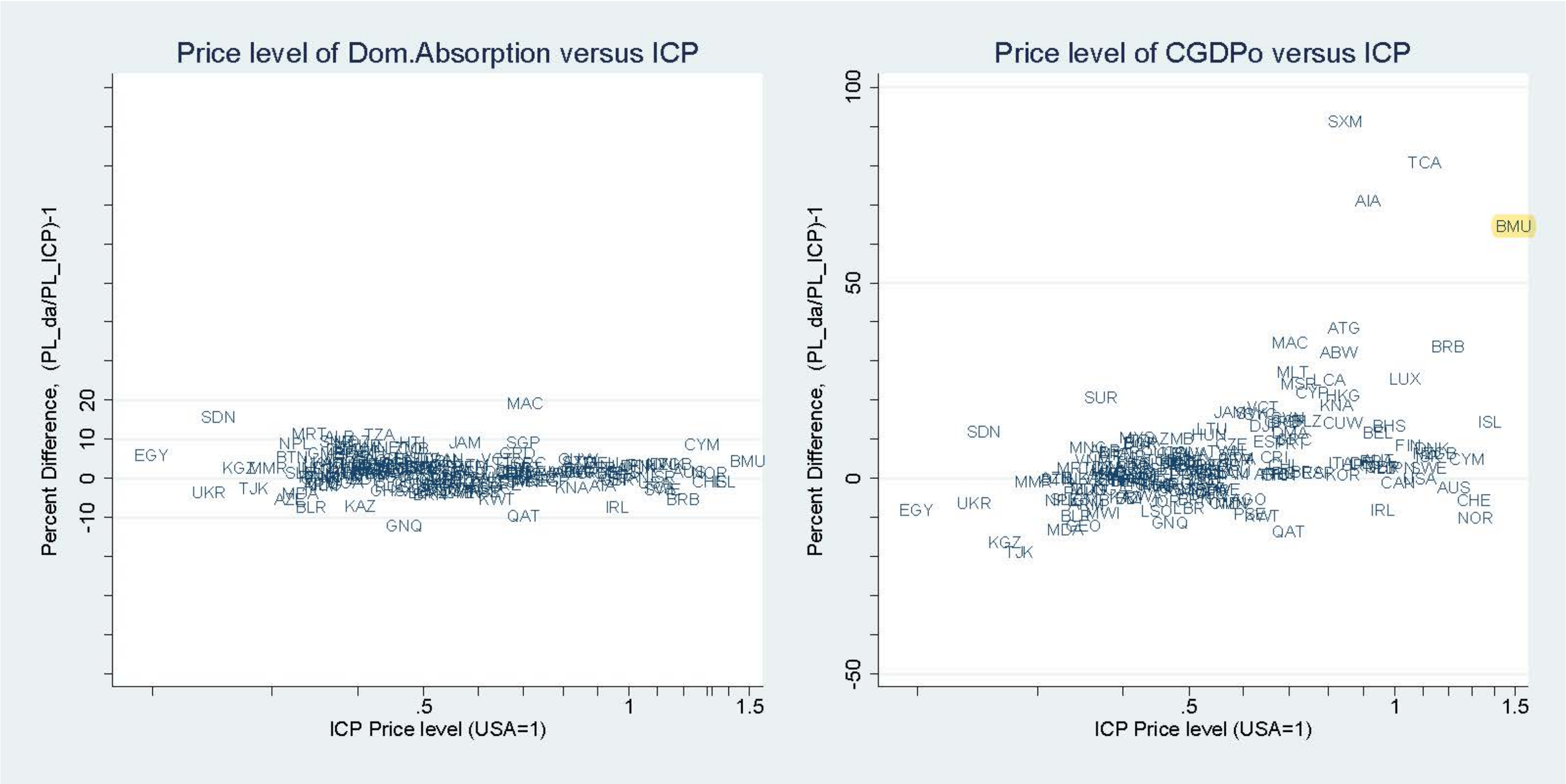
$$\underbrace{\frac{CGDP_j^e - CGDP_j^o}{CGDP_j^o}}_{\text{Gap}} = \underbrace{\left(\frac{PPP_j^x}{PPP_j^q} - \frac{PPP_j^m}{PPP_j^q}\right)}_{\text{Terms of trade}} \underbrace{\frac{1}{2}\left(\frac{X_j / PPP_j^x}{CGDP_j^o} + \frac{M_j / PPP_j^m}{CGDP_j^o}\right)}_{\text{Real Openess}}$$

$$+ \underbrace{\left[\frac{1}{2}\left(\frac{PPP_j^x + PPP_j^m}{PPP_j^q}\right) - 1\right]}_{\text{Traded/Nontraded Price}} \underbrace{\left(\frac{X_j / PPP_j^x}{CGDP_j^o} - \frac{M_j / PPP_j^m}{CGDP_j^o}\right)}_{\text{Real Balance of Trade share}}$$

Conclude:

- Difference in PPP-x and PPP-m is multiplied by *average* of exports and imports (potentially a large number)
- Difference in *average of PPP-x and PPP-m as compared with PPP-da* is multiplied by the net real trade balance (a smaller number)

Difference of ***PWT*** **PL-da or PL-CGDPo** with ***ICP*** **Price level:**



PL-da (used in CGDPe) differs from PL-ICP depending on trade balance.

But PL-CGDPo also differs from PL-ICP because *PL-x* $\neq$ *PL-m*. E.g., *high-priced sailboat exports* from Bermuda and other island economies.

Conclude:

1) Using *PPP's for exports and imports* results in a output-based measure of CGDPo; quite different from the *expenditure-side* measure used by ICP

2) Furthermore, CGDPo is quite sensitive to *PL-x* $\neq$ *PL-m*, because these PPP/price levels are multiplied by *gross* X and M

3) In contrast, CGDPe is an expenditure-side measure analogous to "command-basis GDP" or "real national income", and it uses PPP-da to deflate the *net trade balance* X – M

4) We observe differences of **about ±10%** between PL-da and PL-ICP depending on the sign of the net trade balance

5) There are ***larger*** differences between PL-CGDPo and PL-ICP because *PL-x* $\neq$ *PL-m,* which can have a *magnified impact*

6) Any impact of COVID on PL-da or *PL-x* $\neq$ *PL-m would equally well impact the difference between ICP-GDP and CGDPe or CGDPo.*