

# Compilation of PPPs on an annual basis

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# Background

- ICP surprises:  $\Delta \log PPP_{ij} \neq \Delta \log P_i - \Delta \log P_j$ 
  - ICP 1993 to ICP 2005, ICP 2005 to ICP 2011
- Harmonizing methodology (Deaton & Aten, 2016; Inklaar and Rao, 2016) removes systematic bias between 2005 & 2011,
- But root mean squared difference (RMSD) of 15 percent is worrisome

# Options for annual series

1. Global extrapolation
  - Leads to the problems we want to avoid
2. Annual full ICP benchmark
  - Is too expensive
3. Rolling price survey
  - Shows potential

# Rolling survey mix

- Every year: mix of survey results and extrapolation
  - If not global extrapolation, how detailed should extrapolation be?
- Asymmetries:
  - Survey coverage may not be (simultaneously) global, or even regional
  - Especially in interim period (2012–2016)



# Extrapolation bias (1)

- Two countries,  $i$  products, Törnqvist PPP and CPI, abstracting from practical problems

$$\ln PPP_2^s = \frac{1}{2} \sum_{i=1}^N (s_{i1} + s_{i2}) (\ln p_{i2}^s - \ln p_{i1}^s)$$

$$\ln P_2 = \sum_{i=1}^N s_{i2} (\ln p_{i2}^{t+1} - \ln p_{i2}^t)$$

$$\ln P_1 = \sum_{i=1}^N s_{i1} (\ln p_{i1}^{t+1} - \ln p_{i1}^t)$$



# Extrapolation bias (2)

$$\begin{aligned} & \ln PPP_2^{t+1} - \ln PPP_2^t \\ &= \ln P_2 - \ln P_1 - \frac{1}{2} \sum_{i=1}^N (s_{i2} - s_{i1}) \left[ \ln \left( \frac{p_{i2}^{t+1}}{p_{i2}^t} \right) + \ln \left( \frac{p_{i1}^{t+1}}{p_{i1}^t} \right) \right] \end{aligned}$$

- No bias if:
  - Expenditure shares are identical
  - Relative price movements are absent  $\Rightarrow$

# Extrapolation bias (3)

- Prices of all products (e.g. within a commodity group) change by rate  $\alpha$  in country 1 and rate  $\beta$  in country 2:

$$\begin{aligned}\ln PPP_2^{t+1} - \ln PPP_2^t - (\ln P_2 - \ln P_1) \\ &= -\frac{1}{2} \sum_{i=1}^N (s_{i2} - s_{i1}) [\alpha + \beta] \\ &= -\frac{1}{2} (\alpha + \beta) \sum_{i=1}^N (s_{i2} - s_{i1}) = 0\end{aligned}$$

- Special case, but can be a helpful guide
- Result applies to any other homogenous index (e.g. Fisher)

# Updating exercise

**Aim:** estimate global PPPs for 2012 and 2013

- Interim updating, including basic data quality assessment
- Framework for integrating asymmetric data

**Approach:** use available data & detail

- Global linked PPPs for 2011
- BH expenditure levels, 2011–2013 (GO compilation/estimation)
- COICOP-level CPI and NA deflators 2011–2013  
(GO compilation/estimation)
- Eurostat and ESCWA PPPs for 2012–2013



# Scope of the data

- Country coverage: 172 countries
  - All GDP-level countries from ICP 2011, except 5 Caribbean countries\*
- Expenditure detail: 151 basic headings
  - All basic headings,\*\* except balancing items
- Extrapolation:
  - 135 countries with CPIs for multiple COICOP categories
  - 139 countries with NA deflators by expenditure category
  - 172 countries with either total CPI or GDP deflator

\* Curaçao, Montserrat, Sint Maarten, Turks and Caicos Islands and the British Virgin Islands

\*\* Including some further estimations based on ICP 2011 data

# Data quality: CPI

1. CPI weighting, compare
  - Overall CPI
  - Törnqvist aggregate based on BH expenditure weights

# Data quality: CPI

- Average annual inflation, 2011–2103: 4.4%
- Median absolute difference: 0.3%
- 90% of countries, absolute difference  $< 1.0\%$
- Three countries with absolute difference  $> 2\%$
- Could be outdated or inconsistent weighting

# Data quality: GDP deflators

2. GDP deflator weighting, compare
  - Overall GDP deflator
  - Chained-Laspeyres aggregate of expenditure categories based on BH expenditure weights
  - Adjustments to ICP GO extrapolation database:
    - Construct export/import balance deflator based on exports and imports NA deflator (even better: exports and imports with corresponding NA deflators)
    - Compare with exchange rate approach and change back in few cases
    - Use GFCF deflator for inventory changes (instead of exchange rate)

# Data quality: GDP deflators

- Average annual inflation, 2011–2103: 4.6%
- Median absolute difference: 0.6%
- 90% of countries, absolute difference  $< 3.3\%$
- Four countries with absolute difference  $> 10\%$
- Could be outdated or inconsistent weighting
- Adjusting trade balance deflators reduces differences in most countries

# Updating approach

- *Step 1:* Extrapolate linked BH PPPs using most detailed inflation rate relative to US
  - COICOP-level if available, otherwise overall CPI, otherwise GDP deflator
  - No inflation data below BH-level  $\Rightarrow$  no need to re-link regions
- *Step 2:* Insert regional PPPs for Western Asia and Eurostat using extrapolated linking factors
- *Step 3:* Aggregate and link regions at aggregate level
  - CAR method & “special situations”

# Analysis: set-up

- Comparison:
  - *Full updated ICP*: BH-level extrapolation, new regional data, linking across regions
  - *Global extrapolation*: use aggregate relative inflation to extrapolate aggregate PPPs (e.g. CPI for household consumption PPPs)
  - *Partial updated ICP*: omit new regional data

# Analysis: question

How well does the updating approach perform?

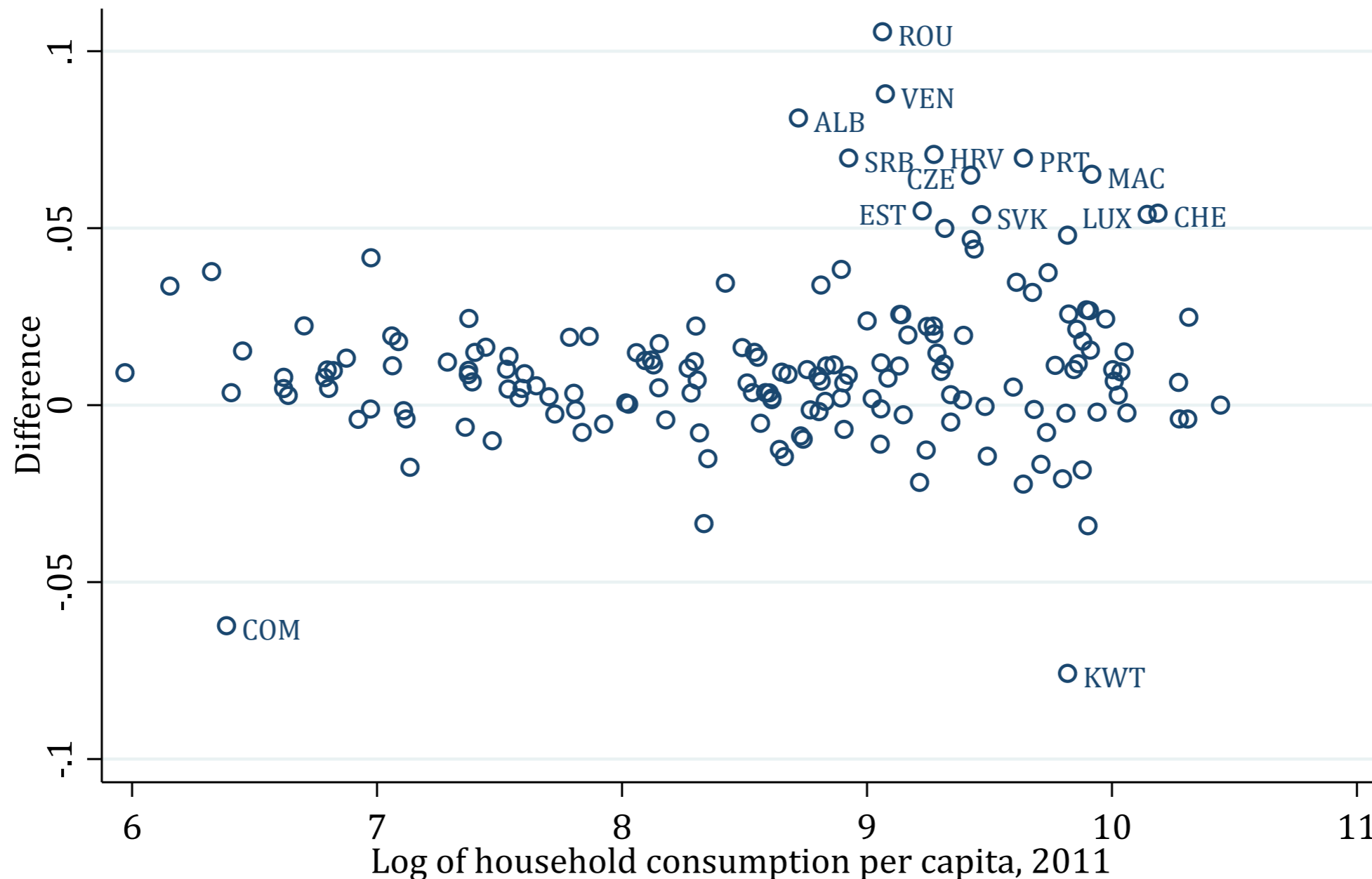
- Global extrapolation should be a reasonable approximation to partial update, ...
- ... while new (survey-based) data can easily differ by more

Compare for 2013 PPPs  $\Rightarrow$  biggest deviation from 2011



# Household consumption

(Global extrapolation PPP / Updated PPP – 1)

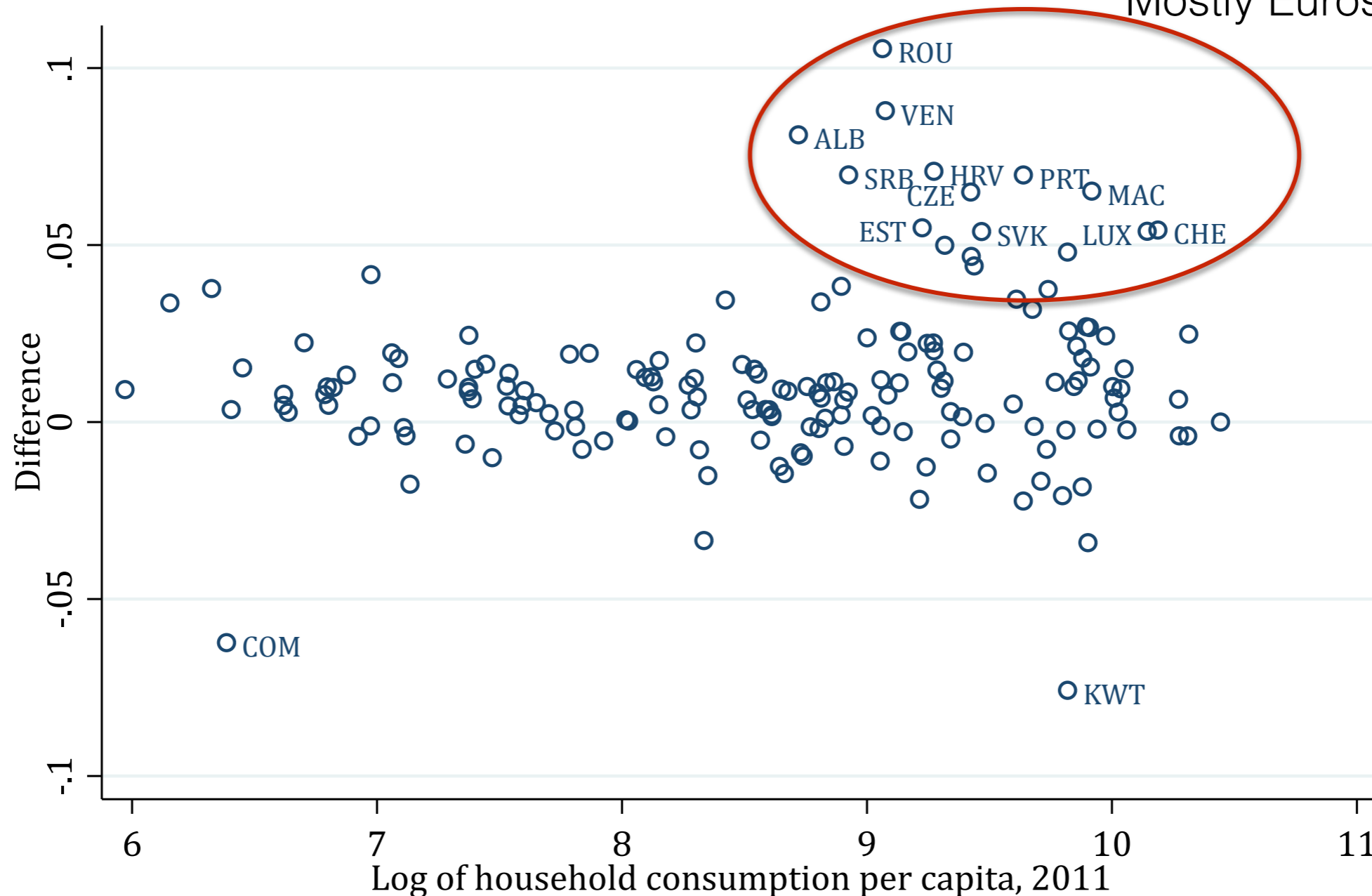


*Notes:* Global extrapolation uses the change in CPI (or household consumption deflator) relative to the US to estimate PPPs for subsequent years. Detailed extrapolation uses the CPIs at the most detailed level to extrapolate basic-heading level PPPs, reflects changing basic heading expenditure levels, and links regions above basic heading level according to the ICP 2011 methodology. This also includes benchmark PPPs from Eurostat and the more detailed extrapolation for Western Asia.

# Household consumption

(Global extrapolation PPP / Updated PPP – 1)

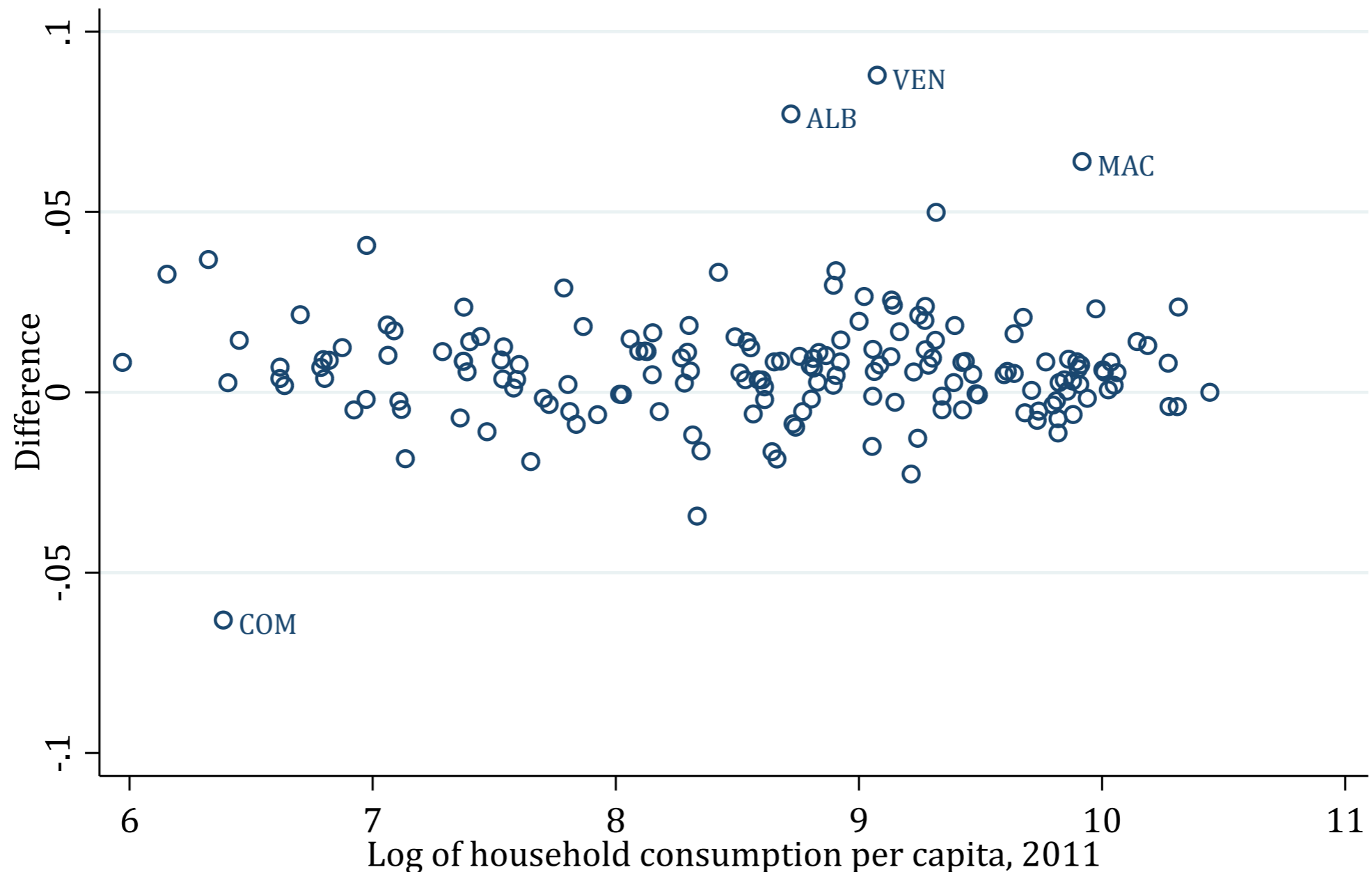
Mostly Eurostat countries



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# HHC: excluding new regional data



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# HHC: Summary

	Full update	Partial update
Average difference	0.011	0.007
Root mean squared difference	0.026	0.017
Coefficient on log(expenditure/capita)	0.003	0.000
	0.002	0.001

\* Partial update omits new regional data for Eurostat & Western Asia

- No systematic difference
- RMSD is small (compared to ICP 2005 vs. ICP 2011)

# GDP



*Notes:* Global extrapolation uses the change in GDP deflator (or CPI) relative to the US to estimate PPPs for subsequent years. Detailed extrapolation uses the CPIs at the most detailed level to extrapolate basic-heading level PPPs, reflects changing basic heading expenditure levels, and links regions above basic heading level according to the ICP 2011 methodology. This also includes the benchmark PPPs from Eurostat and the more detailed extrapolation for Western Asia.

# GDP: Summary

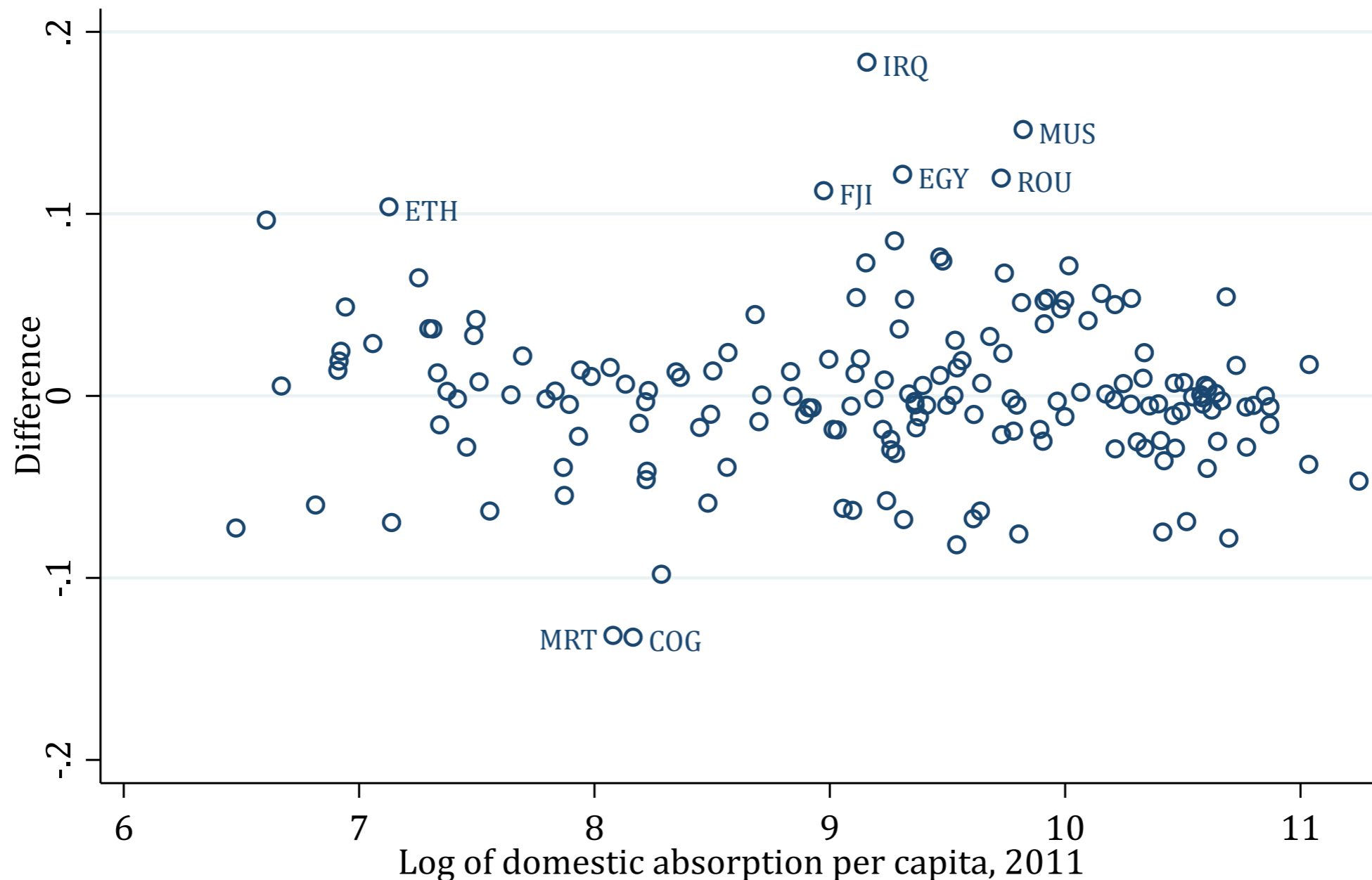
	Full update	Partial update
Average difference	0.002	-0.002
Root mean squared difference	0.047	0.043
Coefficient on log(expenditure/capita)	-0.001 0.003	-0.003 0.003

\* Partial update omits new regional data for Eurostat & Western Asia

- No systematic difference
- Larger differences than for HH consumption



# Similar pattern for domestic absorption



*Notes:* Global extrapolation uses the change in GDP deflator (or CPI) relative to the US to estimate PPPs for subsequent years. Detailed extrapolation uses the CPIs at the most detailed level to extrapolate basic-heading level PPPs, reflects changing basic heading expenditure levels, and links regions above basic heading level according to the ICP 2011 methodology. This also includes the benchmark PPI from Eurostat and the more detailed extrapolation for Western Asia.

# Taking stock

- Importance of internal consistency checks
  - Exchange rate for net exports second-best approach
  - More straightforward to have exports and imports separately for extrapolation
  - Consequences for including price detail?
- Feasibility of proposed approach
  - Limited, asymmetric information fully utilized
  - Results different, but not *too* different (modest RMSD)
  - No systematic differences



# Counterfactual 2005 vs. 2011

Differences in household consumption PPPs

ICP 2011 vs. extrapolated **counterfactual** ICP 2005

