Product Introductions, Currency Unions, and the Real Exchange Rate

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Motivation

- Classic theories of the real exchange rate (RER) assume traded goods adhere to the "Law of One Price" (LOP)

- Big literature shows LOP fails among traded goods (Engel 1999; Crucini et al. 2005; Gopinath et al. AER 2011)

- Understanding international relative prices matters for behavior of RER shocks

What We Do

1. Introduce large dataset of identical tradeable goods, sold by global retailers in three industries and dozens of countries.

2. LOP generally holds within Currency Unions, fails otherwise (including pegged regimes).

3. New decomposition shows RER at time of introduction is most important component of RER and moves closely with NER.

Price Data from Four Global Retailers

- Apple, IKEA, Zara, and H&M

- Among the largest global retailers (by sales) in technology, furniture, and apparel industries

- Headquartered in different countries, not jointly owned

- Prices "scraped" off the retailer websites
  (eg. `http://store.apple.com/us/shop_ipad/accessories/cases`)

How Does "Scraping" Work?


```
<html>
<!-- START product -->
<ahref="productId=MD963LL"></a>
<p class="productname">Ipad Mini Smart Cover – Dark Grey</p>
<td class="Price">$39.00</td>
<!-- END product -->
.....
```
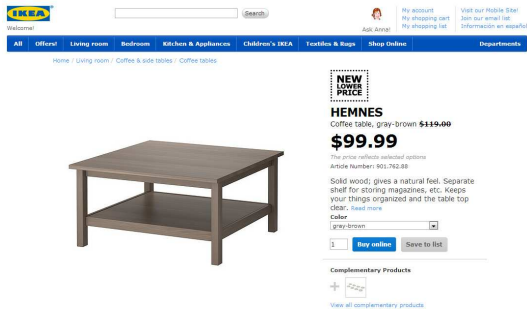
Online Prices

- Daily prices for $\sim$ 120K goods, aggregated to weeks. 85 countries from 2008-2013. Coverages varies by retailer. ▸ Details

- Match identical products using retailer-specific id codes (larger overlap and coverage than region-specific UPCs)

- Prices include VAT taxes (US/Can are exceptions). Not within-country shipping costs. No info on quantities.

- Online and offline prices generally identical. Confirmed with customer service as well as our own physical checks.

- One price per country (true for most non-grocery items of largest U.S. retailers, like Walmart, Walgreens, Costco, etc.)

Online Prices Equal Offline Prices
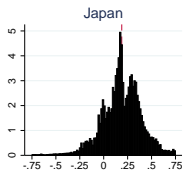

(a) IKEA Online

(b) IKEA in Store

Good-level RER Definition

- $p_i(z, t)$ is log price of z in country i in week t

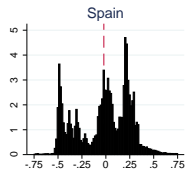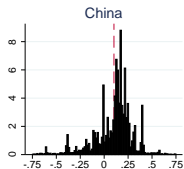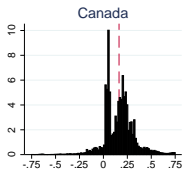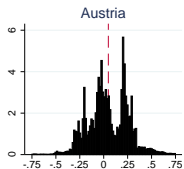- $e_{ij}(t)$ is log exchange rate (units of currency i per unit of j's)

- $q_{ij}(z, t)$ is the log of the good-level RER:

$$q_{ij}(z, t) = p_i(z, t) - e_{ij}(t) - p_j(z, t)$$
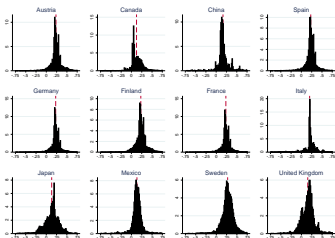
- $q_{ij}(z, t) = 0$ when the LOP holds
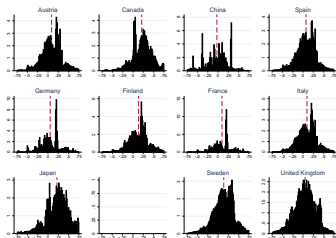
Good-level RERs q_{ij} for $j =$ United States
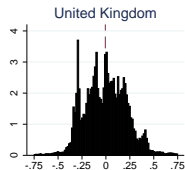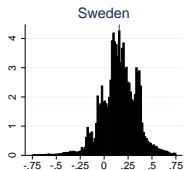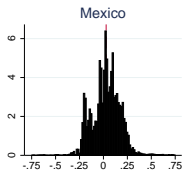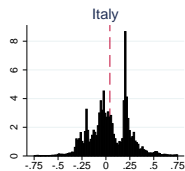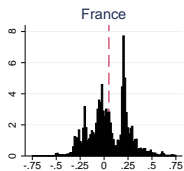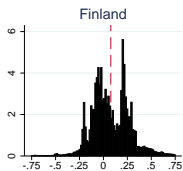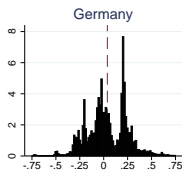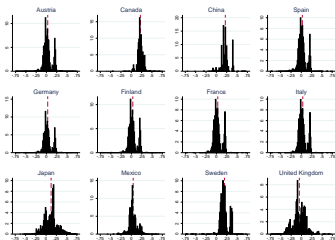
Good-level RERs q_{ij} for $j =$ United States, by Store

(a) Apple
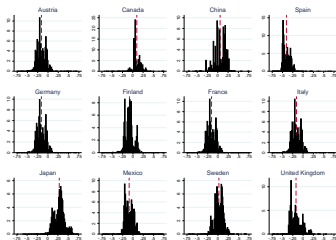
(b) IKEA

(c) H&M

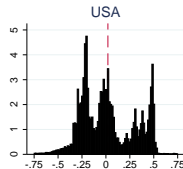(d) Zara

Good-level RERs q_{ij} for $j = $ Spain
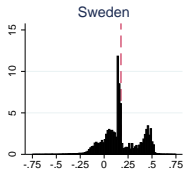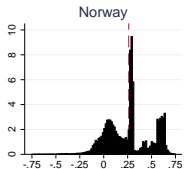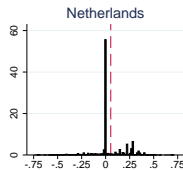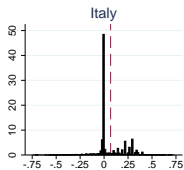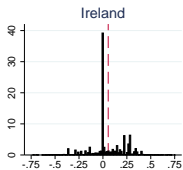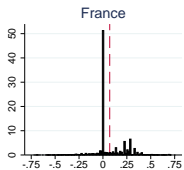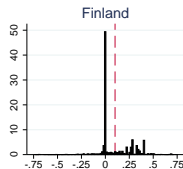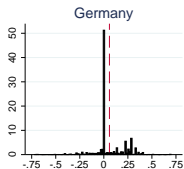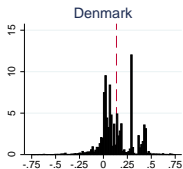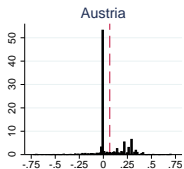
Good-level RERs q_{ij} for $j =$ Spain, by Store
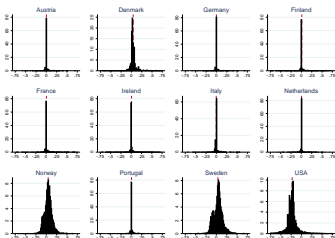
(a) Apple
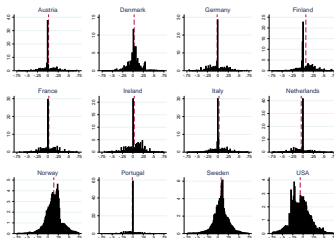
(b) IKEA
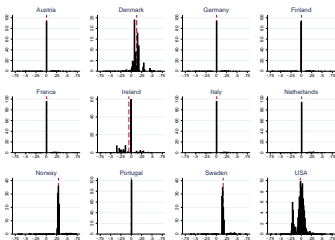
(c) H&M
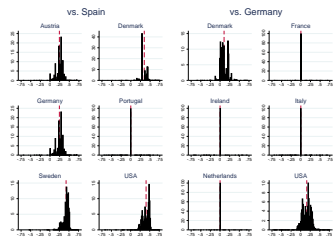
(d) Zara

Currency Unions or the Euro Zone?
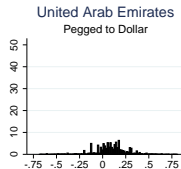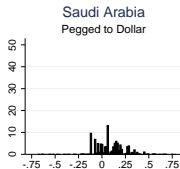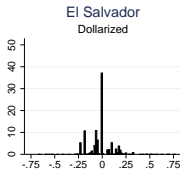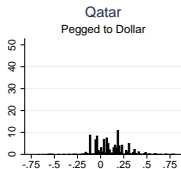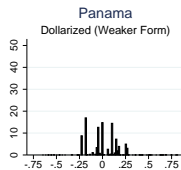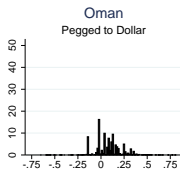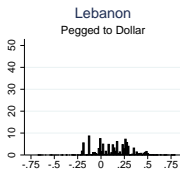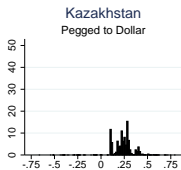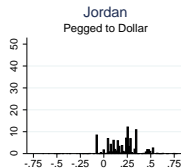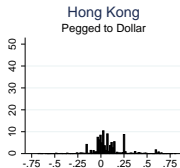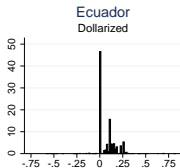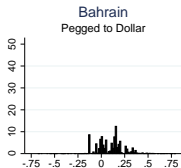
Unconditional Averages

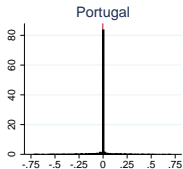|	All Stores	Apple	IKEA	H&M	Zara
Panel A: Average Absolute Values of Log Good-level RERs					
Currency Unions	0.076	0.023	0.129	0.020	0.102
NER Pegs	0.116	0.085	0.145	0.119	0.115
Floats	0.187	0.143	0.216	0.145	0.207
Panel B: Share of Abs. Val. of Log Good-level RERs < 0.01					
Currency Unions	0.610	0.681	0.307	0.911	0.548
NER Pegs	0.069	0.140	0.081	0.069	0.064
Floats	0.045	0.049	0.033	0.062	0.040

Conditional Results

	All Stores	Apple	IKEA	H&M	Zara
Outside of CUs.	0.123	0.054	0.034	0.091	0.162
Pegged NER	-0.037	-0.040	-0.018	0.003	-0.053
Log NER Vol.	-0.034	-0.017	-0.029	0.001	-0.027
Log Bilateral Dist.	0.013	0.012	0.015	0.007	0.016
Abs. Relative Inc.	0.002	-0.001	0.023	0.003	0.000
Abs. Relative Taxes	0.074	0.477	0.072	0.049	0.015
Cty. Dumies:	Y	Y	Y	Y	Y

Are Results Representative? Just Small-Ticket Items?

		All Stores	Apple	IKEA	H&M	Zara
Panel A: Average Absolute Values of Log Good-level RERs						
Full Sample	Currency Unions	0.076	0.023	0.129	0.020	0.102
Full Sample	NER Pegs	0.116	0.085	0.145	0.119	0.115
Full Sample	Floats	0.187	0.143	0.216	0.145	0.207
$(p_i + p_j) > \$100$	Currency Unions	0.065	0.023	0.096	0.005	0.086
$(p_i + p_j) > \$100$	NER Pegs	0.109	0.081	0.107	0.113	0.111
$(p_i + p_j) > \$100$	Floats	0.189	0.144	0.178	0.152	0.205
$(p_i + p_j) > \$400$	Currency Unions	0.043	0.022	0.086	0.013	0.097
$(p_i + p_j) > \$400$	NER Pegs	0.096	0.078	0.094	0.125	0.118
$(p_i + p_j) > \$400$	Floats	0.171	0.151	0.170	0.141	0.270

Are Results Representative? Additional Stores...

		All Additional Stores	Adidas	Dell	Mango	Nike
Panel A: Average Absolute Values of Log Good-Level RERs						
(i)	Currency Unions	0.086	0.087	0.054	0.112	0.053
(ii)	NER Pegs	0.154	0.172	0.130	0.158	0.103
(iii)	Floats	0.201	0.207	0.139	0.203	0.210
Panel B: Share of Abs. Val. of Log Good-level RERs < 0.01						
(iv)	Currency Unions	0.377	0.353	0.380	0.332	0.442
(v)	NER Pegs	0.054	0.027	0.041	0.053	0.092
(vi)	Floats	0.049	0.045	0.052	0.041	0.138

Are Results Representative? Distributer Role Only...

- Is it important that manufacturer and retailer are the same?

- IKEA, for example, makes nearly all the goods it sells, and sells nearly all the goods it makes

- Apple, however, makes less than half of the goods that it distributes. It sells, for example:
    - Cables and adaptors by Apogee, Belkin, and Kanex
    - Canon digital cameras
    - Epson printers
    - Michael Kors travel totes

- Of the goods sold by Apple, our patterns hold equally well among Apple and non-Apple products

Does This Show Up in "Aggregated" Data? Eurostat...

	Audio Equip	Clothes	Elect Equip	Metal Prods	Shoes	Furniture	Software	Transp Equip
Euro	0.067	0.091	0.069	0.067	0.114	0.095	0.112	0.079
Pegs	0.103	0.167	0.082	0.115	0.174	0.375	0.109	0.120
Floats	0.123	0.198	0.091	0.101	0.200	0.296	0.133	0.121

Results

- Result 1 : LOP holds well within currency unions ($q \approx 0$)
  - Does not hold for hard pegs, so not just lack of NER volatility
  - Evidence for both euro zone and dollarized countries
  - Currency union swamps geography, tariffs, culture, etc.
  - Conveniently eliminates worry about matching errors

- Result 2: We now introduce an RER decomposition

RER Decomposition

- Let $i_i(z)$ be the t at which good z is first available in i

- Let $l_i(z, t)$ be the most recent t when z changed price in i

- Let $\bar{p}_i(z) = p_i(z, i_i(z))$ be the log price at introduction

- We can then write the price of z in i at t as:

$$p_i(z, t) = \bar{p}_i(z) + \Delta_{i_i(z)}^{l_i(z,t)} p_i(z)$$

RER Decomposition

- Re-write this when translated into country k currency units:

$$p_i(z,t) - e_{ik}(t) = \underbrace{\bar{p}_i(z) - e_{ik}(i_i(z))}_{\text{Price at Introduction}} + \underbrace{\Delta_{i_i(z)}^{l_i(z,t)}(p_i(z) - e_{ik})}_{\text{Price Changes}} - \underbrace{\Delta_{l_i(z,t)}^{t} e_{ik}}_{\text{Stickiness}}$$

- Combining with equivalent expression for $p_j(z,t) - e_{jk}(t)$:

$$q_{ij}(z,t) = \underbrace{\bar{p}_i(z) - e_{ik}(i_i(z)) - \bar{p}_j(z) + e_{jk}(i_j(z))}_{\text{Good-Level RER at Introduction}}$$

$$+ \quad \underbrace{\Delta_{i_i(z)}^{l_i(z,t)}(p_i(z) - e_{ik}) - \Delta_{i_j(z)}^{l_j(z,t)}(p_j(z) - e_{jk})}_{\text{Changes in Demand}} - \underbrace{\left[\Delta_{l_i(z,t)}^{t} e_{ik} - \Delta_{l_j(z,t)}^{t} e_{jk}\right]}_{\text{Stickiness}}$$

RER Decomposition

- To eliminate dependence on 3rd countries we take the average of the decomposition when $k = i$ and when $k = j$.
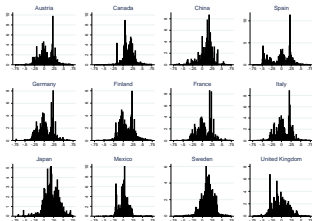
- From now on, we write these terms as:

$$q_{ij}(z, t) = q_{ij}^I(z, t) + q_{ij}^D(z, t) + q_{ij}^S(z, t)$$

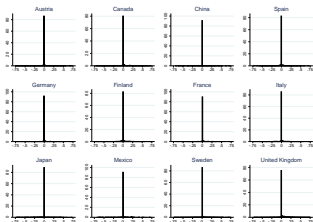- Results are robust to obvious alternatives ▶ Alternative Decompositions

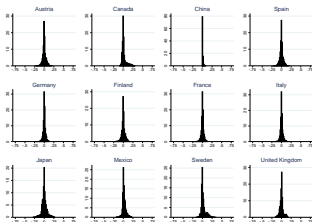# Decomposition $q_{ij} = q_{ij}^I + q_{ij}^D + q_{ij}^S$ for $j =$ United States
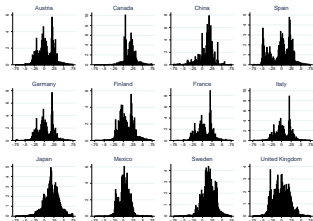
(a) Good-level RER $\left(q_{ij}\right)$

(b) RER At Intro $\left(q_{ij}^I\right)$

(c) Changes in Demand $\left(q_{ij}^D\right)$

(d) Stickiness $\left(q_{ij}^S\right)$

Decomposition $q_{ij} = q_{ij}^I + q_{ij}^D + q_{ij}^S$ for $j = $ Spain
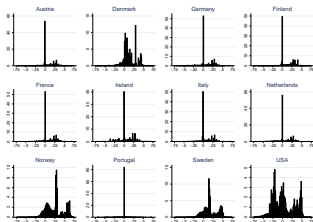
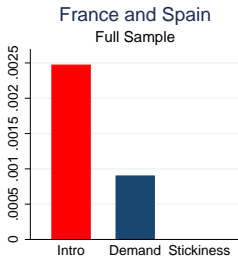(a) Good-level RER $\left(q_{ij}\right)$
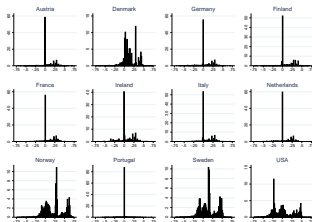
(b) RER At Intro $\left(q_{ij}^I\right)$
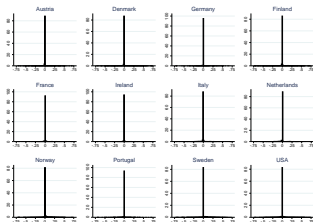
(c) Changes in Demand $\left(q_{ij}^D\right)$
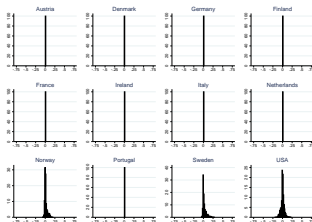
(d) Stickiness $\left(q_{ij}^S\right)$

Decomposing Cross-Sectional Variation in q_{ij}
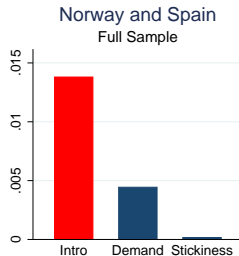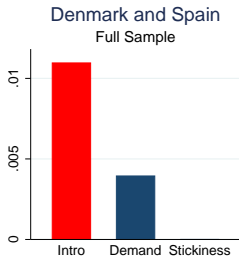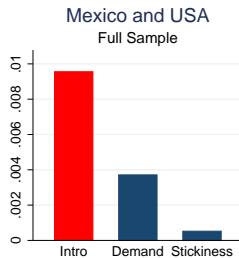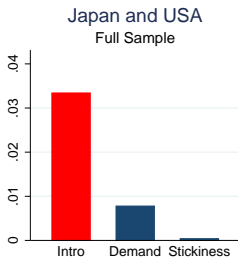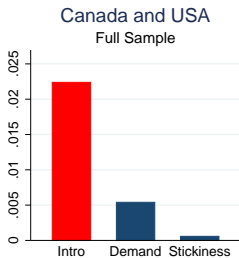
Decomposing Cross-Sectional Variation in q_{ij}
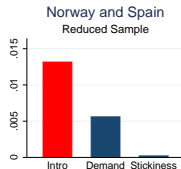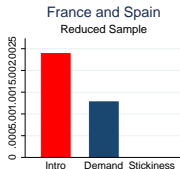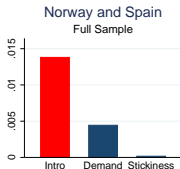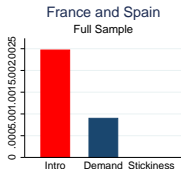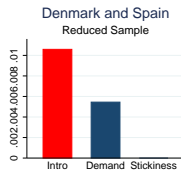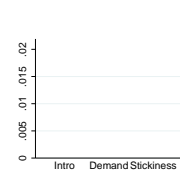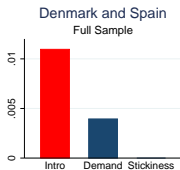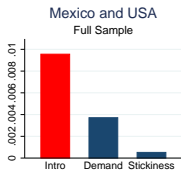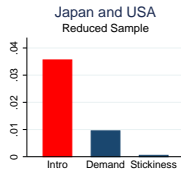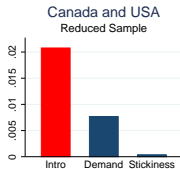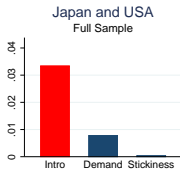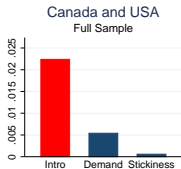
Importance of q^I for RER measurement and PPP Puzzle

- Price indices use *changes*, not *levels*, so omit info in q^I.

- Won't distinguish RER behavior for CU vs. Peg

- Plausible Explanation for PPP Persistence Puzzle?
  - Imagine prices never change. RER=NER for existing goods.
  - Goods frequently enter/exit with q^I i.i.d. with mean $\tilde{q}$
  - True q can't wander too far from $\tilde{q}$, mean-reverts with intros
  - If price indices ignore intros, measured q can wander from $\tilde{q}$

- Puzzle solved? Nope. q^I moves closely with NER in our data.

Good-level RERs at Introduction vs. NER, Raw Data
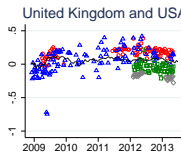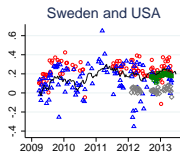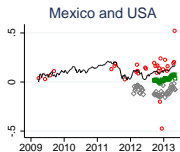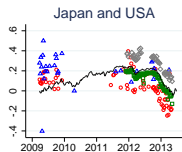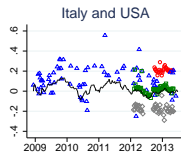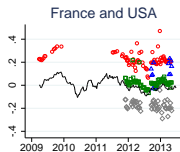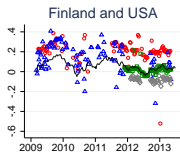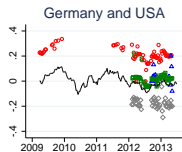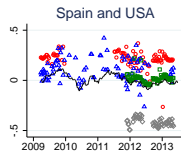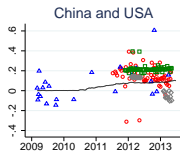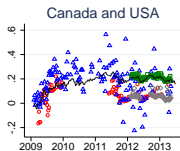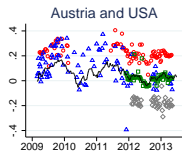
Good-level RERs at Introduction vs. NER, Lowess
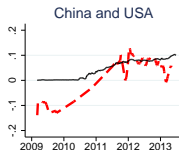
RER at Introduction ——— Log Exchange Rate

Good-level RERs at Introduction vs. NER, Regression

Dependent Variable: Good-Level Log RER at Introduction q_{ij}^l
Independent Variable: Log NER
Fixed Effects: Country Pair Effects

		All Stores (Wtd.)	All Stores (Unwtd.)	Apple	IKEA	H&M	Zara
(i)	All Bilats.	0.826	0.686	0.414	0.819	0.985	0.798
		(0.006)	(0.007)	(0.010)	(0.031)	(0.004)	(0.011)
(ii)	U.S. Bilats.	0.868	0.680	0.493	0.848	1.021	0.971
		(0.022)	(0.025)	(0.030)	(0.048)	(0.027)	(0.052)

Conclusions and Implications

- What determines market segmentation? Being in a currency union appears to be far more important than:
  - Distance
  - Culture
  - Taxes or tariffs
  - NER volatility

- Macro implications
  - Optimal currency areas
  - Cost of "internal devaluations"

- Modeling and measurement of RER
  - PCP vs. LCP modeling
  - RER at Intro tracking NER suggests important role for variable markups and real rigidities.
  - Standard measures of RER may omit critical information