

Assessing Real Exchange Rates: a new perspective

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Work in progress, part of the External Balance Assessment (EBA) project of IMF Research
Department

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Outline

- Institutional context
- What is new
- FE versus POOL regressions
- FE estimation (time dimension)
- Econometric issues and methodology
- Preliminary results
- Misalignments (REER gaps)
- Time permitting
 - Exploring LEVEL REER (Xsection dimension)
 - Further FE results

IMF: NEW ESR and EBA

- The IMF has a new pilot External Sector Report
 - <http://www.imf.org/external/np/spr/2012/consult/esr/index.htm>
- The Research Department provides input via a new External Balance Assessment methodology (pilot, ongoing development)
 - <http://www.imf.org/external/np/res/eba/>
 - Focuses on **CA/Y**, **REER**, **NFA/Y**
- **Previous presentation in this conference by Luis on the CA/Y leg.**
- **This presentation is background work (IN PROGRESS) about the REER leg of EBA**
- It builds on and improves the previous CGER methodology: IMF OP 261 and Ricci et al. (JMCB, forthcoming)
 - <http://www.imf.org/external/pubs/cat/longres.aspx?sk=19582.0>

The innovation

- More determinants and similar to CA ones
- More focus on policies and policy distortions
- Include short term focus (business cycle, capital flows)
- Positive and normative steps
 - Assessment based also on policy gaps from policy benchmarks
- More transparency in whole process
 - Publish data, methodology, and final report
- Focus also on individual euro countries
- Criteria: theory, robustness, consistency across CA/Y and REER regressions

The innovation: more determinants and similar to CA ones

- In specific models, some determinants affect only REER or CA
 - Single good model, no REER, yet intertemporal factors have a channel to affect CA
 - In static trade models, no TB, no CA, yet tradable/nontradable stories affect REER (like Balassa-Samuelson, government consumption)
- Some variables have direct effect on domestic non traded consumption prices, so CPI-REER, and not necessarily CA (unless via GE effects):
 - Administered prices, VAT, in part also tariffs
- In more general models, all variables affect both REER and CA, but to what degree?

The innovation: more determinants and similar to CA ones

- From saving-investment balance (X are determinants)

$$S(NFA, Y, r, X_s) - I(Y, r, REER, X_I) = CA(Y, REER, Y^*, X_{CA})$$

- & BOP constraint

$$CA(Y, REER, Y^*, X_{CA}) + CF(r - r^*, X_{CF}) = \Delta R$$

- Can derive (under some conditions)

$$CA = CA(Y_{gap}, Y_{gap}^*, X_I, X_S, X_{CA}, X_{CF}, \Delta R)$$

$$REER = REER(Y_{gap}, Y_{gap}^*, X_I, X_S, X_{CA}, X_{CF}, \Delta R)$$

Unusual variables in literature, now in EBA

- Capital controls in REER, CA, and NFA regressions
 - Christiansen, Prati, Ricci, Tressel (2010 NBER ISOM)
- Demographics in REER regressions
 - Rose, Supaat, and Braude (2009)
 - Christiansen, Prati, Ricci, Tressel (2010 NBER ISOM)
- Reserves accumulation with capital controls in CA regressions
 - Reinhardt, Ricci, Tressel (2010); Gagnon (2012); Bayoumi et al (2012) show relevance for CA/Y

FE versus POOL regressions

- Most studies use FE, mainly for two reasons
 - Most common, reliable, official, updated REER measures are CPI based, so not comparable across countries
 - FE is quite the econometric standard to avoid (time-invariant) omitted variable bias
- Some literature on POOL regression with LEVEL REER uses PWT based RER/REER and usually encompass mainly GDP per capita as a Balassa-Samuelson proxy (the Penn Regression)
- **But what about LEVEL REER regressions with more determinants?**

FE versus POOL: LEVEL can help

- Helps with...
 - Short sample, limited data availability
 - Structural breaks/large variation
 - Persistent misalignments, due for example to persistent exchange rate manipulations which are hard to measure.
 - Slow moving variables (e.g. VAT)
- ...which imply two problems
 - Mean REER not representative of mean equilibrium (FE tend to underestimated large persistent misalignments)
 - Sensitivity of mean REER (and misalignment) to small sample changes
- With LEVEL, one observation of a country can be enough (if homogeneous to other countries)!

FE versus POOL: issues with POOL

- POOLING is GOOD only to the extent time-invariant-omitted variable bias is limited.
 - *Need sufficient regressors* to eliminate (severity of) omitted variable bias.
 - And often country differences are hard to measure with variables.
- NOTE that FE does not help if omitted variable is time-varying (actually FE would try to tilt fitted line to become close to actual)
 - For example a distortionary policy that is slowly removed over time

FE versus POOL regressions:

BOTTOM LINE – 4 EXERCISES

- We start from (1) FIXED EFFECT panel regressions
 - Comparability with previous results
 - Immunity from standard omitted variable bias critique
- We explore LEVEL REER and their cross-sectional dimension
 - (2) Pure cross section on time averages (XS regression)
 - (3) Extract fixed effects (from panel FE regressions) and regress them on time-averaged determinants, (again XS regression)
 - (4) POOLED regression (both time and XS dimension)

EXERCISE 1:

FIXED EFFECT panel regressions

- The first step is to estimate the relation between the REER and the fundamentals

$$\log(RER_{it}) = \alpha_i + X_{it}\beta + u_{it}$$

- where RER is IMF REER, α_i is a vector of country fixed effects, X_{it} are the fundamentals explaining the real exchange rate, β is the vector of coefficients, and u_{it} is the residual term.

EXERCISE 1:

FIXED EFFECT panel regressions

- Fixed effect OLS **coefficients**
- **Standard errors** corrected via the Newey-West HAC method,
 - which accounts for heteroskedasticity both within countries and across countries, as well as serial correlation within countries
- OLS coefficients are compatible with stationarity or nonstationarity (but cointegration)
- Inference
 - Stationarity: HAC correction
 - Nonstationarity: cointegration tests

Econometrics and Methodology

- (In addition to FE/POOL)
- Stationarity versus nonstationarity
- Endogeneity
- Serial correlation, heteroskedasticity, cross-sectional dependence
- Dynamics
- Heterogeneity

- Issues addressed mainly as robustness

E&M: stationarity?

- Tests of stationarity v/s nonstationarity are inconclusive
- Most literature used to find REER nonstationarity in the past
- In our sample:
 - standard PUR tests find REER stationary (also in recent IMF work Cashin et al IMF/WP/09/78)
 - PUR test based on cross-sectional dependence (CSD) (Pesaran 2007), find REER nonstationary
 - But CSD should be limited for vars relative to trading partners
- OLS *COEFFICIENTS* are ok in both cases
 - If stationary, HAC corrected standard errors are relevant
 - In nonstationary, inference is based on cointegration test. Stationary variables do not harm cointegrating relationship
- ARDL would need heterogenous dynamics and loose degrees of freedom: only a few variables could be investigated

E&M: endogeneity

- In absence of clear instruments, we have two options:
- 1) lag potentially endogenous variables (in OLS)
- 2) or instrument variables via 2SLS with lags of endogenous as well as possible instruments (as **robustness**)

E&M: correcting standard errors

- Under the presumption of stationary variables, inference is based on corrected standard errors with the Newey-West HAC method, which accounts for heteroskedasticity—both within countries and across countries—as well as serial correlation within countries.
- An alternative correction for cross-sectional dependence (Kraay and Driscoll 1998) does not change much the results (sign that CDS is not serious)

E&M: dynamics

- homogeneous dynamics generate biased estimates of long run,
- heterogenous dynamics allow only a few variables (as in a country by country regression), while we need many regressors
- **Robustness:** we check homogeneous long run and heterogenous dynamics w/ PMGE, which allows only a few variables. Most robust are:
 - In long run: health expenditure, capital controls, output gap, financial home bias, terms of trade, growth forecast.
 - In short run: VIX terms

E&M: heterogeneity

- Slope homogeneity is an assumption
 - in part essential (not enough observations for country by country regressions)
 - in part addressed via variable construction relative to trading partners
 - also addressed via interaction terms.
- In POOL, several regressors helps addressing the heterogeneity of the constant, and helps us understanding it.

Sample

- 42 countries
- Including the 11 major euro area countries individually
- 1990-2010

FE results table

VARIABLES

Log commodity Terms Of Trade	0.2***
Lagged trade openness (exp+imp) to GDP (rel to TRD PRT)	-0.3***
Share of administered prices	-1.7***
Cyclically adjusted fiscal balance to GDP (rel to TRD PRT)	-0.4*
Lagged health expenditure to GDP (rel to TRD PRT)	1.9**
Lagged capital account controls (quinn) (rel to TRD PRT)	-0.3***
output gap (rel to TRD PRT)	1.2***
Lagged VIX * Capital account openness	-0.2**
Lagged vox * capital account openness * share of own currency in global reserve	0.7**
Share of own currency in global reserves holdings	0.05
lagged financial home bias (shr dom. debt owned by residents, rel to TRD PRT)	0.2***
Fertility (rel to TRD PRT)	0.06**
5-year ahead WEO GDP growth forecast (rel to TRD PRT)	1.9**
Dummy south africa apartheid (pre-1994)	0.3***
Observations	826

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Newey-West corrected standard errors

FE results

- **Commodity terms of trade** has a positive sign. The size of the coefficient is somewhat lower than standard literature, in part due to the richer model (other variables such as the fiscal balance may capture part of the effect of commodity prices).
- **Trade openness** (lagged) has a negative sign. Average exports and imports to GDP is a proxy for trade liberalization, which lowers the domestic price of tradable goods, thus depreciating the CPI-based REER. As a change in the exchange rate affects differently the numerator and denominator of openness, this indicator is lagged.
- **The share of administered prices** has a negative sign (as administered prices are generally imposed to lower prices). Available only for a few transition economies (for the rest it is assumed to be 0). A decrease in the share of administered prices by 1 percent is associated with a 1½ percent appreciation.

FE results

- **General government cyclically adjusted balance to GDP** is negative (in line with positive in the CA regressions): when the balance increases by 1 percentage point of GDP, the REER depreciates by 0.4%.
- **Health expenditure to GDP** (lagged) has a positive sign (consistent with a negative sign in the CA regressions): an increase in health expenditure by 1 percentage point of GDP is associated with a 2 percent appreciation.
- **Capital account controls** (lagged) is negative (consistent with a positive sign in the CA regressions), and with the idea that this variable mainly captures the effect of capital controls on inflows (lower ability to borrow and run current accounts deficits, and a more depreciated exchange rate).

FE results

- The **output gap** has a positive coefficient (consistent with a negative sign in the CA regression): an increase in the output gap by 1 percentage point of GDP is associated with an appreciation somewhat above 1 percent.
- **VIX/VOX (indicator of global risk aversion), interacted with capital account openness (lagged).**
 - For non reserve currency countries, the effect is negative (depreciation) associated with the need to generate a CA surplus when global risk aversion increases and access to credit becomes more difficult. The effect is stronger the more open the capital account is.
 - For reserve currency countries the effect is in the opposite direction, and appreciates the currency.

FE results

- **Financial home bias** (lagged) has positive sign. It is calculated as the share of domestic debt owned by residents. Preference for holding domestic assets should appreciate the REER. (Other variables in the regression tend to capture international investor preference for the country assets, which would have the opposite effect on the exchange rate). The variable is lagged, as changes in the exchange rate can affect the indicator purely from a composition effect (foreigners' share is more likely to be denominated in foreign currency).
- **Fertility** has a positive sign: the higher the fertility rate, the higher the share of inactive population, which is associated with lower net saving, and more appreciated real exchange rates. The work of Rose, Supaat, and Braude (2009) suggests that fertility is the best proxy for demographic factors in real exchange rate regressions.

FE results

- **Forecast GDP growth** (5-year ahead) has a positive coefficient, consistent with the negative coefficient found in the CA regression (faster growth is associated with a weaker current account and a more appreciated real exchange rate).
- **Dummy for South Africa** until 1994, absorbing a significant structural break at the end of the apartheid. This has very little effect on results, even for South Africa.

FE results: extensions and robustness

- Traditional variables
 - Productivity mainly cross-section
 - NFA: binding constraint (negative NFA or capital controls)
 - Government consumption: health exp. chosen for consistency
- Fiscal balance captures also opposite confidence factors
- Reserve intervention: right sign but not robust
- Interaction with:
 - Capital controls (fertility, output gap)
 - Exchange rate regime (growth forecast, financial home bias)
- Other variables with time pattern
 - Interest rate differential, financial development,
- Other variables with cross-sectional pattern
 - Institutions, VAT

Misalignments and policy gaps

- Consider *Fit* fundamentals, *Pit* policy variables, and P^*it optimal levels of policy variables

- Can decompose REER as:

$$\log(RED_{it}) = \alpha_i + X_{it}\beta + u_{it}$$

$$\log(RED_{it}) = \alpha_i + F_{it}\lambda + P_{it}\gamma + u_{it}$$

$$\log(RED_{it}) = \underbrace{\alpha_i + F_{it}\lambda}_{\text{REER norm}} + \underbrace{P_{it} - P_{it}^*}_{\text{policy gap}} + \underbrace{P_{it}^*\gamma + u_{it}}_{\text{regression residual}} + u_{it}$$

Total EBA GAP

- Then, adjust residual and Total EBA gap for multilateral consistency, if necessary

Misalignments and policy gaps

- Zero residual does not mean OK
 - REER may fit perfectly with existing policies, but policies may need to change
 - Adjusting for policy gaps informs on the level of REER that would prevail in the absence of these policy gaps
- A country policy at optimal level does not mean zero policy gap
 - Note that both P_{it} and P^*_{it} are relative to other countries,
 - hence, a country may have a policy gap even if its policies are at optimal level (think of fiscal policy now)

Misalignment and policy gaps: multilateral consistency

- Important to ensure that the weighted average of residuals are zero in each year (multilateral consistency).
- To a large extent consistency is achieved via careful construction of the variables relative to the trading partner weighted average of the same variable.
- As standard in CGER (see Occasional Paper 167, Chapter 7), multilateral consistency is then ensured by adjusting each exchange rate residual by the global weighted average of residuals.
- The weights are given by the eigenvector associated with the unit eigenvalue of the trade weights matrix.
- *The necessary adjustment is tiny (less than 1 percent), which indicates proper variable construction and good overall fit.*

The road ahead

- Further attention to fiscal and reserve intervention
- Missing variables?
- More policy measures?
- Exploring LEVEL regressions