Discussion of "Learning if We are Rich or Poor": Commodity Price Swings and Financial Frictions in a Naturally Rich Economy

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August 2016

Road Map

- What the paper does

- Comments

  > Motivation

  > Modeling of Financial Frictions

  > Model Quantitative Results vs. SFs

  > Other

What the paper does: Model environment

- Two-good SOE DSGE with one non-state contingent bond, collateral constraint, endogenous oil extraction, and learning

- Builds on Mendoza (1991, 2006, 2010) and Boz and Mendoza (2014)

- Main analytical novelty: oil extraction block → oil output endogenous + oil reserves as another asset affecting NFA path

- Very relevant for countries like Colombia where oil accounts for some 50% of exports close 10% of GDP and non-trivial oil reserves

- Paper's main quantitative contribution: to calibrate the model to Colombian data, allowing for the oil shock to be permanent and agents' learning about how permanent the shock is

- Transmission with inelastic oil extraction and FI

  One bond economy with borrowing constraint

$$P_{oil}^{*}\downarrow \to TOT \downarrow \to Y = y_T + \tau(p^{*}_{oil}x - e) + p_N y_N \to Y\downarrow$$

→ Consumers will try to smooth but face a borrowing limit $B \geq \phi Y$ → $C\downarrow$ → $p_N\downarrow$ → $Y\downarrow\downarrow$

→ Borrowing limit tightens further if on collateral income

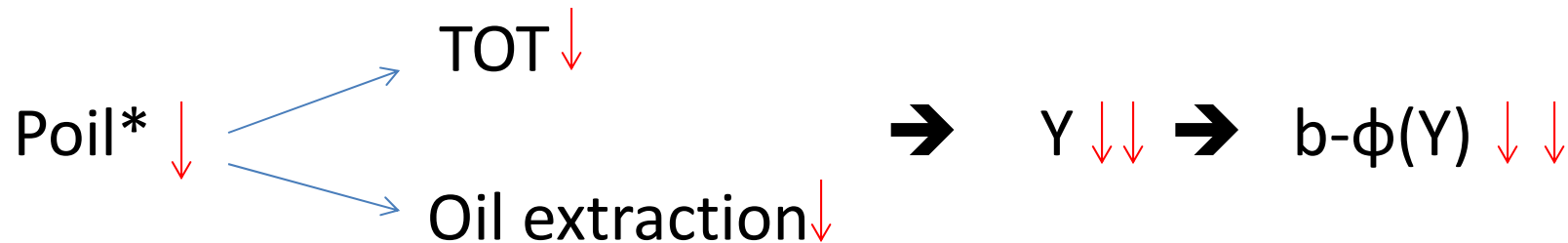→ C falls further → $p_N\downarrow\downarrow$→ RER$\downarrow\downarrow$

→ If p^{*}_{oil} fall permanent: Cfinal < Co

→ TB/Y (and possibly CA/Y) turn around

- Model Mechanics with elastic oil extraction and FI

      Now two assets: b and oil reserves (s)

      Poil affects oil extraction (x) and reserves (s)

$$\text{Poil*} \downarrow \quad \nearrow \quad \text{TOT} \downarrow$$
$$\searrow \quad \text{Oil extraction} \downarrow$$

$$\Rightarrow \quad Y \downarrow\downarrow \quad \Rightarrow \quad b-\phi(Y) \downarrow\downarrow$$

→C falls → P_{NT} falls →RER depreciates → BC tightens → C falls further, etc.

- New: oil extraction is postponed → economy accumulates oil assets → Reduces the cost of future oil extraction and allow reserves to build up with new discoveries → growth path of domestic income rises compensating for the Poil* fall → helps relaxing the inter-temporal budget constraint

It is easy to see by re-writing the IBC (ignoring differential returns between foreign assets and liabilities):

$$\frac{NFA_t}{Y_t} = -E_t \sum_{i=1}^{\infty} \left\{ \exp(\sum_{j=1}^{i} \Delta y_{t+j} - r_{t+j}) \left[\frac{X_{t+i} - M_{t+i}}{Y_{t+i}} \right] \right\}$$

So, as expected disposable income growth (Δy) is higher, the country can afford running a more negative NFA

Key points here:

i) oil extraction adjusts endogenously to Δp^*_{oil} → current income falls by more on impact but future Y is preserved (depending on how permanent the shock, the sensitivity of cost to extraction **s** and the rate of oil discoveries, **d**)

ii) The economy has another asset (oil reserves): helps making markets less incomplete → so putting less pressure on NFA adjustment
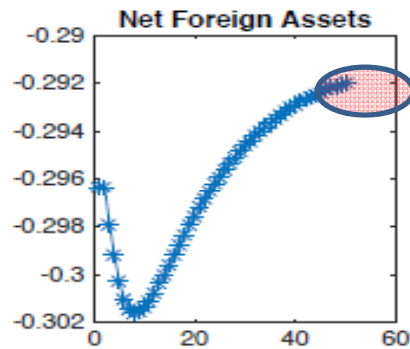
iii) Assume that p^*_{oil} follow a Markov chain. Under FI RE, high p^*_{oil} is anticipated to be followed by low p^*_{oil} → no under-extraction → oil revenues (hence Y) higher in boom

iv) But as agents also internalize that high p^*_{oil} is temporary, that the borrowing constraint can bind → NFA does not decline as much (if at all), i.e., lower CA deficit

v) By assumption: firms extraction policy does not respond to relative prices (more on this below)
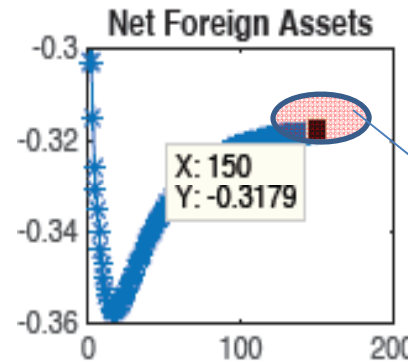
Main quantitative results without learning (old version)
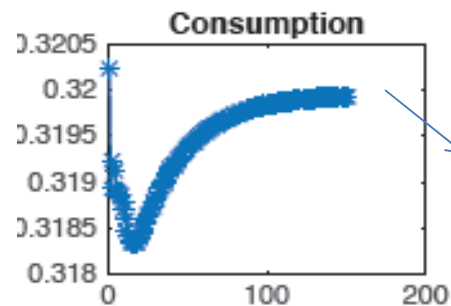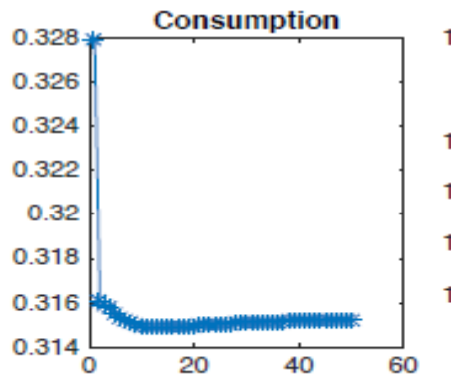
Model with Exogenous oil

Model with Endogenous oil

Net Foreign Assets

Finishes higher!

Net Foreign Assets

X: 150
Y: -0.3179

Finishes lower!

Real Exchange Rate

Real Exchange Rate

Consumption

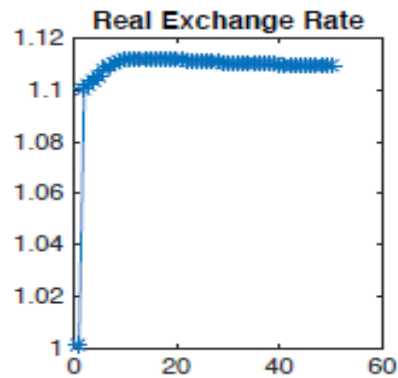### Consumption
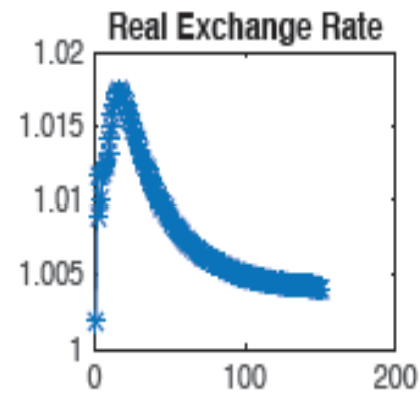
Smaller drop in C, both on impact and lonf-run!

- **Model Mechanics with elastic oil extraction and Bayesian Learning (BL)**

> Still two assets: b and oil reserves (s)

> But learning on shock persistence is gradual

> So, repeated good realizations of the good shock leads to over-estimation of the "true" permanent component of the shock

[remark: new version has oil discoveries deterministic and collateral constraint decreasing on Y, rather than exogenous as in previous chart]

> There is oil under-extraction during boom, consumption is boosted through borrowing during booms → NFA falls more

> As NFL^{BL} << NFL^{FI} the economy is closer to borrowing limit

> Key implications: Crash is bigger and occurs earlier/less protracted (as the economy hits the borrowing limit earlier), i.e., more like a standard SS.

New version: results

Figure 4: Conditional Forecast Functions: Endogenous Revenues Model
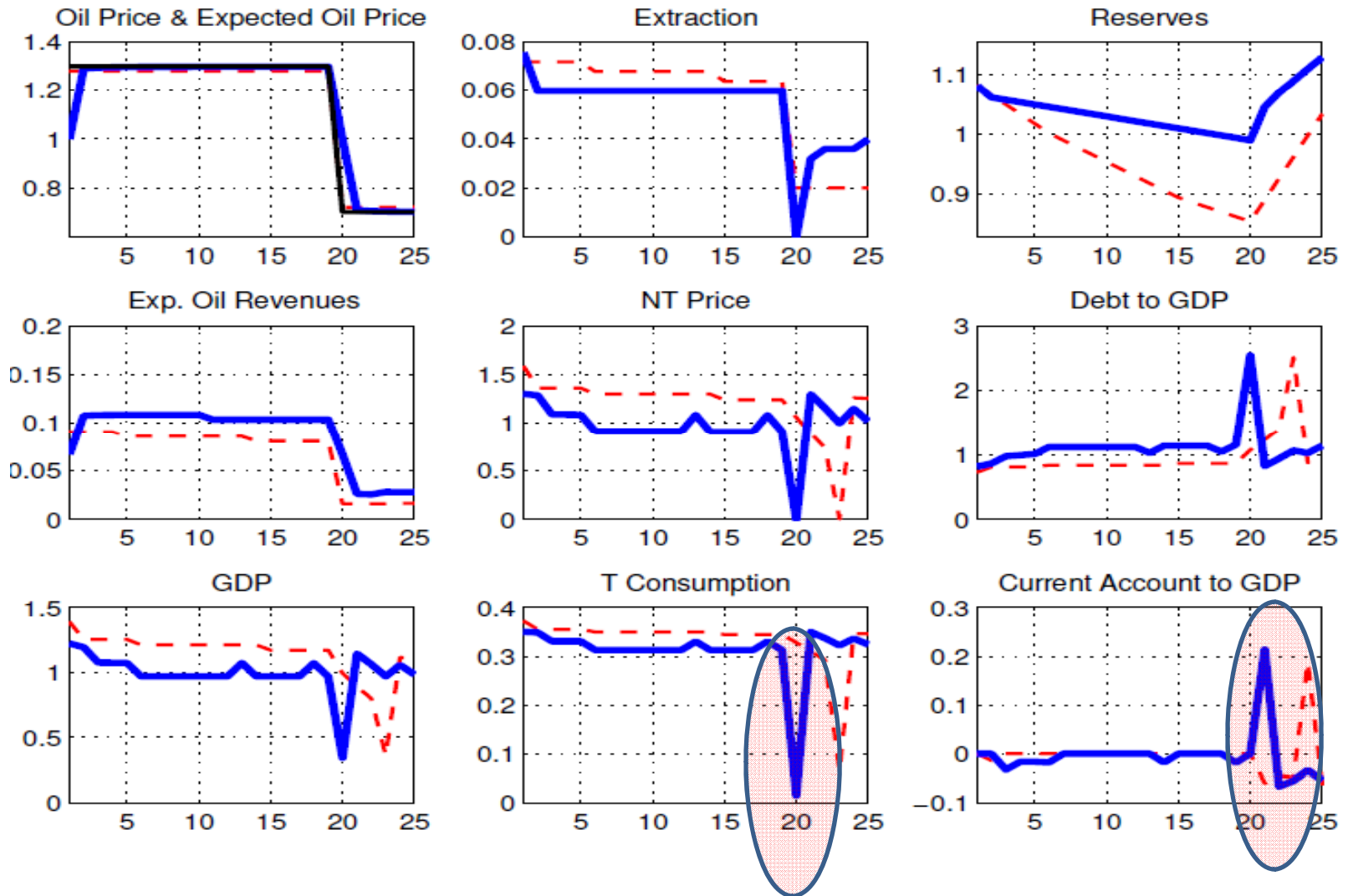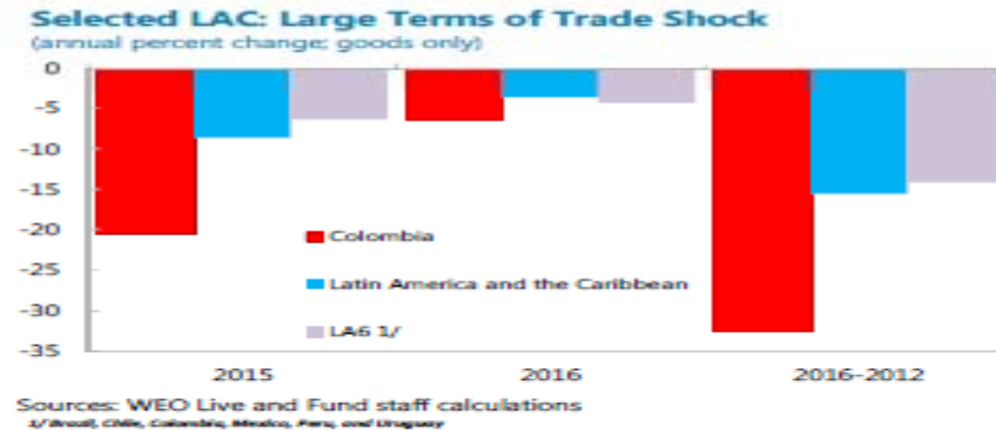

Blue line: with Bayesian Learning

Comment 1

- ## Many things to like

➢ This is the way to go about modeling commodity shocks in an extractive SOE

➢ Introducing the oil extraction block (drawing on Pesaran 1990 and Sickles and Hartely, 2001) is sensible and new

➢ Also like the way they build the model (old version of the paper): from the one-bond with a fixed borrowing ceiling (NFL/Y<40%) & exogenous oil extraction..
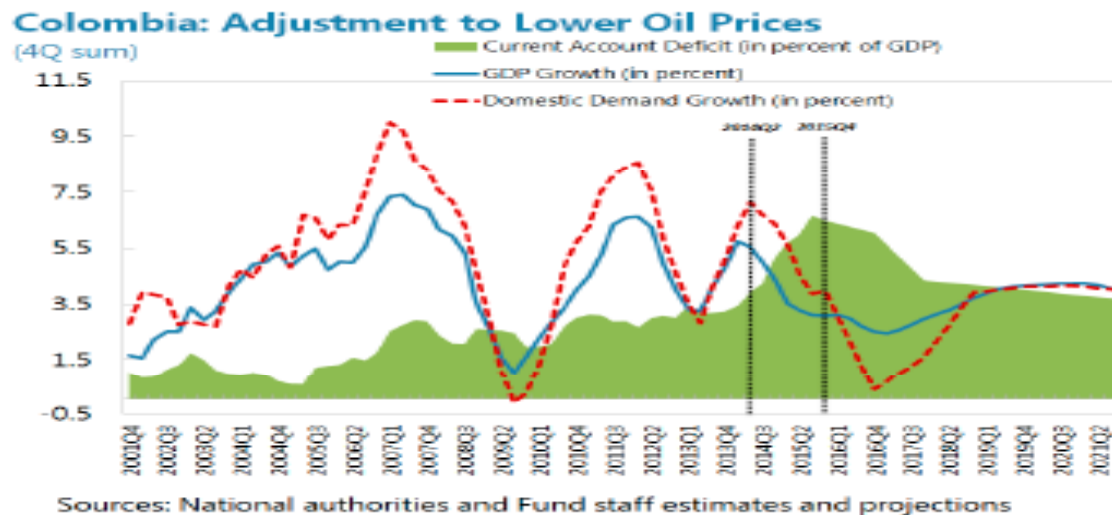
Then the same with endogenous oil extraction, then with learning and endogenous collateral constrains (but some short-cuts here, including deterministic discoveries)

Comment 2: Could motivate and demarcate better what the model explains and what it does not

Point 1: Colombia was about the worst hit

Selected LAC: Large Terms of Trade Shock
(annual percent change; goods only)

Legend:
- Colombia
- Latin America and the Caribbean
- LA6 1/

Sources: WEO Live and Fund staff calculations
1/ Brazil, Chile, Colombia, Mexico, Peru, and Uruguay

Point 2: Y and C decelerated sharply but still growing, not a typical SS!

Colombia: Adjustment to Lower Oil Prices
(4Q sum)

Legend:
- Current Account Deficit (in percent of GDP)
- GDP Growth (in percent)
- Domestic Demand Growth (in percent)

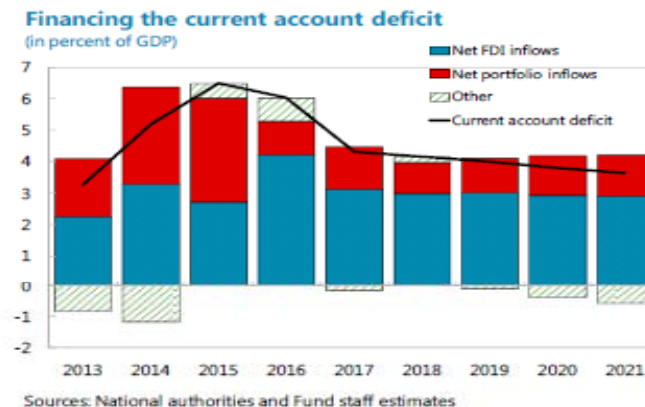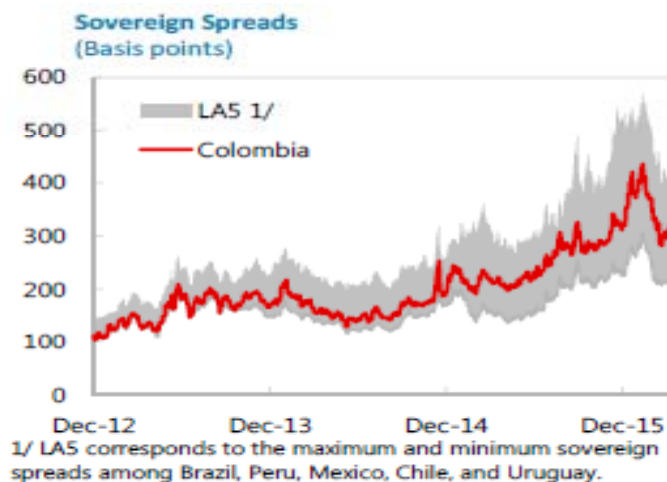Sources: National authorities and Fund staff estimates and projections

Comment 2 (cont.): Highlight strenghts and weaknesses in meeting stylized facts

Point 3: Model with endogenous oil picks up the decrease in NFA with negative oil shock and the impact (real) exchange rate depreciation but not a continuous depreciation
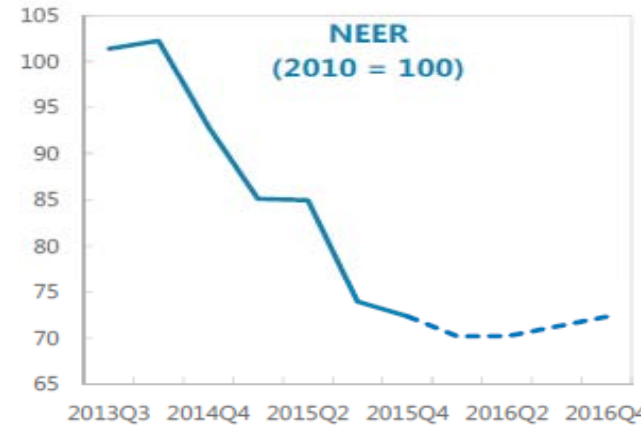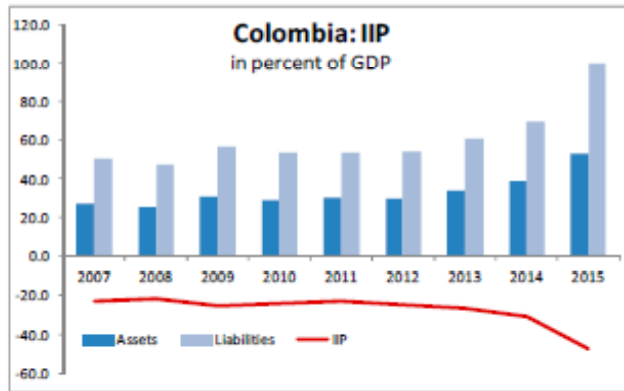
Point 4: Model does not contemplate (by assumption) the rise in default risk and
That the main financing source of post-shock growing CA deficit is FDI, not bond flows

1/ LA5 corresponds to the maximum and minimum sovereign spreads among Brazil, Peru, Mexico, Chile, and Uruguay.

Sources: National authorities and Fund staff estimates

Comment 3: Modeling of Financial Frictions

- Key in the model and for good empirical reasons

- But a non-contingent bond financing does not naturally span the range from full risk to autarky

- Catão and Chang (2015): One parameter costly transfer function does it:

$$C_t^{\sigma}[1 + \varpi \Phi_{Ct}] = \kappa RER_t(C_t^*)^{\sigma} \;, \quad \text{where } \Phi(C,H) = \frac{C}{2}\left(\log\left(\frac{C}{YP_h/P}\right)\right)^2$$

Linearizing: $c_t = \psi\left[\frac{1}{\sigma}rer_t + c_t^*\right] + (1 - \psi)[p_{ht} + y_{ht}]$

$\psi = 1$ → Full international risk sharing

$\psi = 0$ → Financial autarky

- Sure is reduced form and the Lucas critique applies..

- But so is a non-state contingent bond economy and that the collateral constraint is a fixed fraction of disposable income

- Moreover, external financing through bonded debt in EM's has been coming sharply down

EMs external balance sheets
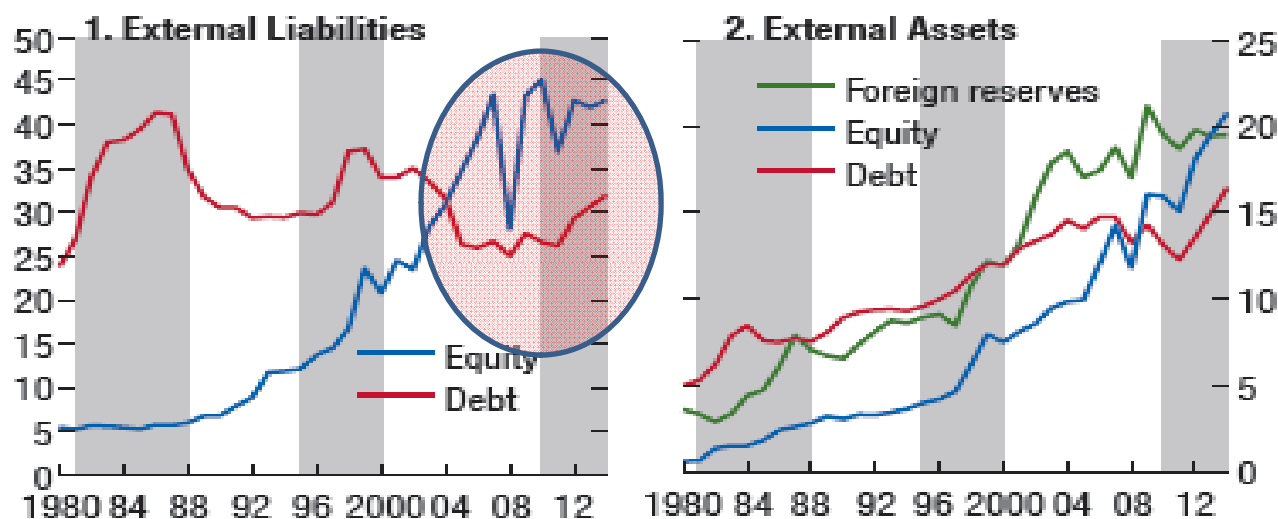
Source: IMF/WEO, April 2016

Comment 4: Model's predictions vs. data

- Model calibrated to annual (not quarterly) data

- So, the magnitudes of TB, CA, NFA, REER, and C changes are rather small (in old model without learning and with exogenous borrowing constraint)

- New version (with learning and endogenous collateral constraint): effects now too large and too abrupt?

- What is accounting for differences? Collateral constraint? Learning?

- Quicker learning seems to fit data better (after all, there is little doubt today that much of the decline from $100/barrel is permanent)!

- In general, issues of fitting model to data need to be fully discussed.

Comment 5: Bits and Pieces

- Why oil reserves is not part of the relevant collateral? (cf. discussion of what is international collateral in the 1980s – Sachs' book I think)

- Discounting of future oil revenues at R? R+spread seems to be more empirically relevant – provide sensitivity analysis

- No discussion of why oil extraction costs do not vary with the p_{NT}? Domestic cost component may not be negligible in practice

- Risk sharing: the way oil sector profit distribution is set up suggests foreigners own some of it. If so there is risk sharing through that channel too. Needs discussing.

- How about policy? Model feature important externality as household take p_{NT} as given. How about taxation of the oil sector to limit overoptimism and under extradtion during boom?

Thanks