

# A new policy framework for RRDCs

## Can an export boom be contractionary?

Martin Davies, Marcel Schröder

WLU, LAU, ANU

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- Model for macro policy in RRDC
- Is standard model of IB-EB useful for understanding policy RRDC?
- Adjust standard or canonical Internal-External balance model to account for key features of RRDCs
- Question: how does policy prescription for export boom for RRDC change?
- Question: how do predictions of model fit with empirical evidence?
- Inspiration: Observation for PNG
  - resource sector is an enclave: firewalled from rest of economy
    - 2015 fastest growing economy in the world, unemployment increasing
  - resources sector: capital owned by foreigners, few national workers
  - large share of resource sector export income accrues to foreign owners
  - resources taxes are low

- Standard IB-EB framework focuses on GDP and current account measured by Trade Balance (Exports less Imports)
- But net factor income in RRDCs large and negative
- Adjust standard model for
  - resources sector is an enclave
  - foreign ownership in resources sector
  - negative net factor income
- incorporation net factor income EB
  - CA balance include explicit term for net factor income
- include enclave in IB and NFI in IB
- Empirics: examine predictions of model

# What is a RRDC?

- Definition of RRDC (IMF 2012): .
  - low- and lower-middle-income country (GNI per capital  $\leq$  USD 4000)
  - exhaustible natural resources comprises at least 20 percent of total exports
- Observation / stylised fact: significant difference between GNP and GDP
  - 29 RRDCs over 20 years:  $\text{GNP}/\text{GDP} = 0.93$
  - range 0.64 (Equatorial Guinea) to 1.01 (Uzbekistan)
  - PNG is 0.94 (IMF says 0.90) 0.87 in 2000; 0.99 in 1978)
  - each of G-7 over last 20 years:  $\text{GNP}/\text{GDP} \approx 1.0$

- World Bank (2011): calculate EREER by leaving resource sector out all together
- Gregory (2012): Australia's mining boom: economic differences between increase in export volumes and prices
  - Australia's mining sector is an enclave, 80% foreign owned

# Why is resources sector an enclave?

- Extractive industries bring skilled labor, goods and services from abroad (Havard et al, 2015)
- limited spillovers to domestic private sector
- v low share of direct employment for locals
- few links to local firms
- local firms find it difficult to provide inputs due to:
  - lack of access to inputs
    - skilled labor
    - management ability
    - access to finance
  - lack of knowledge of international product standards
- domestic economy doesn't use resource sector output

# How to we adjust standard model

## Internal Balance

### *Standard Model*

$$\text{IB: } Y_{GDP} = C(Y_{GDP}) + I + G + EX_{NR}(e) + EX_R - IM(Y_{GDP})$$

### *RRDC Model*

$$Y_{GDP} = C + I + G + EX_{NR}(e) + EX_R - IM$$

$$Y_{GDP} = Y_{NR} + Y_R \quad R = \text{resource}, \quad NR = \text{non-resource}$$

$$Y_R = F(K_R, L_R, R) \quad K = \text{capital}, \quad L = \text{labour}, \quad R = \text{resource}$$

Enclave: all factors in resource sector (apart from resource) are from foreign:  $K_R$  owned by foreigners,  $L_R$  foreign workers

$Y_R = EX_R$  all of resource sector output is exported

$$Y_{GDP} = Y_{NR} + Y_R = C + I + G + EX_{NR}(e) + EX_R - IM$$

simplifies to

$$Y_{NR} = C + I + G + EX_{NR}(e) - IM$$

# How to we adjust standard model

## Internal Balance

Country owns share  $\alpha$  of resources output, and taxes foreign share  $(1 - \alpha)$  at rate  $t_R$   $(Y_R = F(K_R, L_R, R))$

$$\text{net factor income} = - (1 - \alpha) (1 - t_R) EX_R$$

As  $\alpha \rightarrow 1$  then net factor income approaches zero

$$\begin{aligned} Y_{GNP} &= Y_{GDP} - (1 - \alpha) (1 - t_R) EX_R \\ &= C + I + G + EX_{NR} + (\alpha + t_R (1 - \alpha)) EX_R - IM \end{aligned}$$

$$\text{IB: } Y_{NR} = C(Y_{GNP}) + I + G + EX_{NR}(e) - IM(Y_{GNP})$$



# How to we adjust standard model?

## External Balance

### Standard Model

$$EB : CA = EX_{NR}(e) + EX_R - IM(Y_{GDP}) = 0$$

RRDC Model: include NFI in CA

$$CA = EX_{NR}(e) + EX_R - IM(Y_{GNP}) - (1 - \alpha)(1 - t_R)EX_R = 0$$

$$EB : EX_{NR}(e) + (\alpha + t_R(1 - \alpha))EX_R - IM(Y_{GNP}) = 0$$

$$\text{IB} : Y_{NR} = C(Y_{GNP}) + I + G + EX_{NR}(e) - IM(Y_{GNP})$$

$$\text{EB} : EX_{NR}(e) + (\alpha + t_R(1 - \alpha)) EX_R - IM(Y_{GNP}) = 0$$

- Features of model

- incorporates net factor income
  - large and negative due to small  $\alpha$  and large  $EX_R$ : payments to foreign factors of production in resource sector
  - $C$  and  $IM$  depend on  $GNP$
- resource sector is an enclave
  - all domestic fops employed in  $NR$  sector
  - interaction between  $R$  sector and economy limited to  $C$  and  $IM$  channel

RRDC:

$$\text{IB}_R : Y_{NR} = \mu (a + I + G + EX_{NR}(e)) \\ + \mu (c - m) (1 - t) ((\alpha + t_R (1 - \alpha)) EX_R)$$

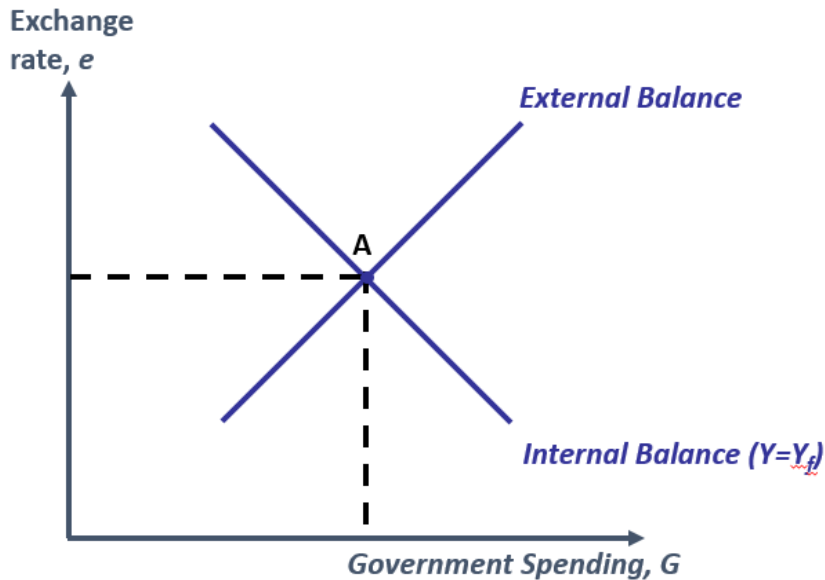
$$\text{IB}_S : Y_{GDP} = \mu (a + I + G + EX_{NR}(e_{GDP}) + EX_R)$$

$$\text{EB}_R : CA = \mu (1 - c (1 - t)) EX_{NR}(e) - \mu m (1 - t) (a + I + G) \\ + \mu (1 - c (1 - t)) (\alpha + t_R (1 - \alpha)) EX_R$$

$$\text{EB}_S : CA = \mu EX_{NR}(e) + \mu EX_R - \mu m (1 - t) (a + I + G)$$

$$\text{multiplier: } \mu = \frac{1}{1 - (c - m)(1 - t)}$$

# Internal and External Balance Framework



# Result: New Equilibrium Exchange Rate Concept

## RRDC Equilibrium Exchange Rate (RREER)

Proposition 1: Comparing a RRDC with a standard economy (that has an integrated resources sector) the equilibrium exchange rate and level of government spending are both greater in the RRDC. That is,  $e^R > e^S$  and  $G^R > G^S$ .

### Proof.

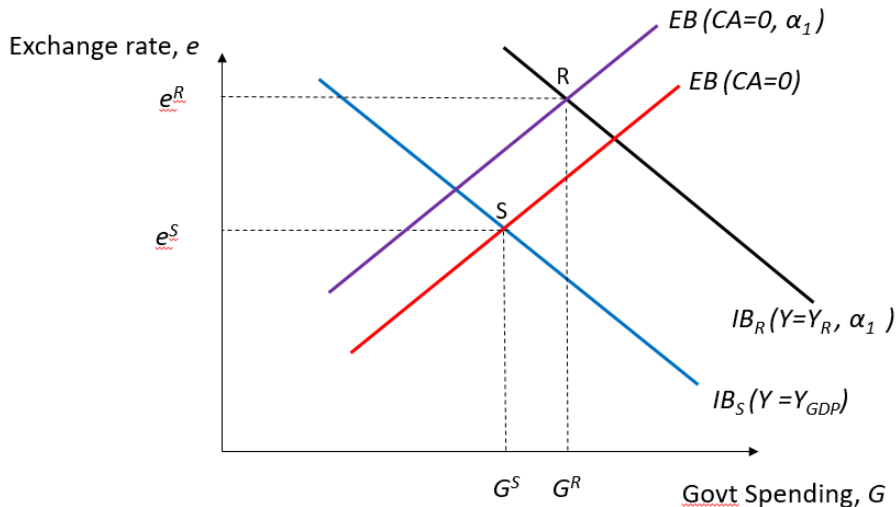
Comparing two countries with identical size,  $Y_{NR}^R = Y_{GDP}^S$ , at the IB-EB equilibrium then

$$\begin{aligned} EX_{NR}(e^S) - EX_{NR}(e^R) &= - \left( \frac{1 - (1 - m(1 - t))}{* (\alpha + t_R(1 - \alpha))} \right) EX_R < 0 \\ \implies e^R &> e^S \\ G^S - G^R &= - (1 - c(1 - t)) (\alpha + t_R(1 - \alpha)) EX_R < 0 \\ \implies G^S &> G^R \end{aligned}$$



# Result: New Equilibrium Exchange Rate Concept

## RRDC Equilibrium Exchange Rate



# Results

## Export Boom

Proposition 2: An export boom requires an appreciation of the exchange rate and an increase in government spending to return the economy to internal and external balance. This contrasts to the policy response in the standard model which requires a larger appreciation and no fiscal response.

### Proof.

$$\frac{de^R}{dEX_R} = -(\alpha + t_R(1 - \alpha))(1 - m(1 - t)) < 0$$

$$\frac{dG^R}{dEX_R} = (1 - c(1 - t))(\alpha + t_R(1 - \alpha)) > 0$$

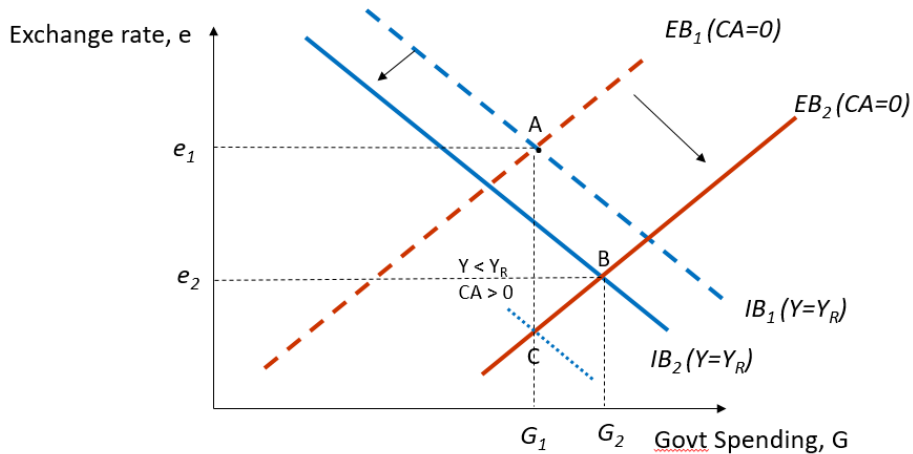
Standard Model (S)

$$\frac{de^S}{dEX_R} = \frac{1}{\Delta} [1 - (c - m)(1 - t)]$$

$$\frac{dG^S}{dEX_R} = 0$$

# Results

## Export Boom





- Resource sector export boom no direct stimulus to domestic economy: firewalled from non-resource sector
- only route via increase in GNP, increases  $C$  ( and  $M$ )
- But export boom causes CA surplus  $\implies$  appreciation of exchange rate  $\implies$  reduces  $EX_{NR}$  ( $e$ ) contractionary
  - requires increase in  $G$  (absorption) for IB-EB
- Standard policy response would be contractionary for RRDC: export boom would be contractionary

# Results

## Increase in Ownership Share

Proposition 3: An increase in home country's ownership share,  $\alpha$ , leads to a current account surplus and overemployment, and requires an appreciation of the exchange rate and an increase in government spending to return the economy to internal and external balance.

Proof.

$$\begin{aligned}\frac{de}{d\alpha} &= -(1 - m(1 - t))(1 - t_R) EX_R < 0 \\ \frac{dG}{d\alpha} &= (1 - c(1 - t))(1 - t_R) EX_R > 0\end{aligned}$$



# Results

## Increase in Ownership Share: corollary

### Corollary

*Comparing two RRDCs which are identical in every way, except that one has a higher ownership share of its resources sector,  $\alpha$ , then in equilibrium that economy will have a lower (more appreciated) equilibrium real exchange rate, and will have higher government spending.*

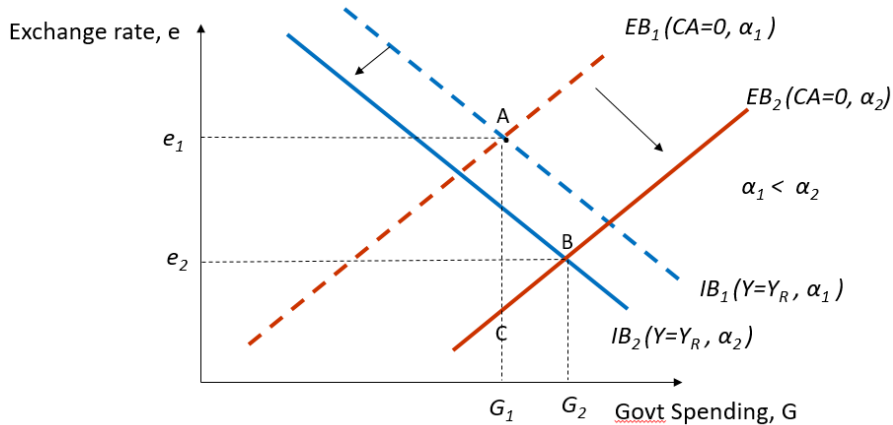
### Proof.

See above. □

- Intuition: there are two economies with the same  $Y_{GDP}$  and the same  $EX_R$  and thus  $Y_{NR}$ . The economy with the higher  $\alpha$  has higher  $Y_{GNP}$  and therefore higher  $C$  and  $M$ . Thus it will have lower  $G$  (why) and higher  $e$

# Results

## Increase in Ownership Share



**Resources Tax:**  $t_R$ , causes a current account surplus and overemployment, and requires an appreciation of the exchange rate and an increase in government spending (absorption) to restore internal and external balance.

**Investment boom:** The response to an investment boom is identical in both the RRDC and standard models, and involves no change in the exchange rate and one-for-one contraction in  $G$ .

- We estimate how foreign ownership affects the equilibrium RER (ERER) in RRDCs.
- We use two popular approaches to estimate the ERER:
  - Purchasing power parity (PPP) adjusted for the Balassa-Samuelson effect (Rodrik, 2008)
  - IB-EB single-equation approach (Edwards, 1989 and others)
- Preliminary results suggest that higher foreign ownership share depreciates the ERER in RRDC as predicted by the model.

- $\uparrow \alpha \Rightarrow \downarrow e$

- To estimate equilibrium EREER, we adjust PPP for the Balassa-Samuelson effect (Rodrik, 2008):

$$\ln(ERER)_{it} = \alpha + \beta \ln(RGDPPC)_{it} + f_t + u_{it},$$

- $i$ : country
- $t$ : 5-year time period (simple averages)
- $ERER = (PPP/XR)$ ,  $ERER > 1$ : Appreciated above PPP
- $RGDPPC$ : Real GDP per capita (PPP)
- $f_t$ : time fixed effect
- Source: PWT 9.0, N=155 countries, T= 9 (1970-2014)

$$\ln(\widehat{ERER})_{it} = \hat{\alpha} + \hat{\beta} \log(RGDPPC)_{it} + \hat{f}_t$$

- $\hat{\beta} = 0.19$ , t-stat > 6

- ERERs are comparable across countries
- How does foreign ownership (FO) affect the ERER across countries?

$$\ln(ERER)_{it} = \alpha + \beta FO_{it} + f_t + u_{it},$$

- RRDC defined as average  $EX_R / (TotalEX) > 20\%$  and non-OECD.
- Sample: 46 countries.
- No data on FO. We use the proxy:
- $FO = \text{Investment Income Payments} / EX_R$
- All else equal, above ratio should be higher for countries with higher FO.
- Result:  $\hat{\beta} = -0.46$ , t-stat > 4
- Result robust to various definitions of RRDC.



- Incorporate IB-EB concepts into estimation approach.
- Need to include FO and other fundamentals in first-stage RER regression:

$$\ln(RER)_{it} = \alpha + \beta' X_{it} + \gamma FO_{it} + f_t + u_{it},$$

- $X$  includes  $\log(\text{RGDPPC})$ , NFA, TOT, Gov't consumption, Trade Openness
- As before, observations are 5-year averages.
- Sample: 46 RRDC
- Results: Only RGDPPC and FO significant at 5% level.
- $\hat{\gamma} = -0.54$ , t-stat=2.3.

- Preliminary results also suggest a negative relationship between FO and gov't consumption/absorption for the sample of RRDCs.
- In the future we plan to investigate in how RRDCs adjust fiscal spending during resource booms.
- It may well be that RRDCs with high FO overly expand their fiscal spending during boom years when they shouldn't as suggested by the model.

# Conclusion

- Simple model: improved way to think about policy in RRDC.
- Incorporates key features of RRDCs
  - resource sector is an enclave: employs foreign factors of production
  - negative net factor income in IB and EB constraints
- Key result: standard policy response to an export boom can be contractionary
  - respond to an export boom is an appreciation and an increase in  $G$
- model allows analysis of policy changes in government ownership share and resource tax rate
- Model predicts that in an RRDC higher ownership share will lead to a lower (more appreciated) EREER and higher  $G$
- Empirics: preliminary results support this prediction.