A new policy framework for RRDCs

Can an export boom be contractionary?

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Motivation

- 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 accures to foreign owners
  - resources taxes are low

Motivation

- 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: GNP/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: GNP/GDP$\approx$1.0

Literature

- World Bank (2011): calculate ERER by leaving resource sector out all togethe
- 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

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

RRDC Model

$$\begin{aligned} Y_{GDP} &= C + I + G + EX_{NR}\left(e\right) + EX_R - IM \\ Y_{GDP} &= Y_{NR} + Y_R \quad R = \text{resource}, \quad NR = \text{non-resource} \\ Y_R &= F\left(K_R, L_R, R\right) \quad K = \text{capital}, L = \text{labour}, R = \text{resource} \end{aligned}$$

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

$$\begin{aligned} Y_{GDP} &= Y_{NR} + Y_R = C + I + G + EX_{NR}\left(e\right) + EX_R - IM \\ &\quad \text{simplifies to} \\ Y_{NR} &= C + I + G + EX_{NR}\left(e\right) - IM \end{aligned}$$

How to we adjust standard model

Internal Balance

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

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

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

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

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

How to we adjust standard model?

External Balance

Standard Model

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

RRDC Model: include NFI in CA

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

RRDC IB-EB Model

$$\text{IB} : Y_{NR} = C\left(Y_{GNP}\right) + I + G + EX_{NR}\left(e\right) - IM\left(Y_{GNP}\right)$$
$$\text{EB} : EX_{NR}\left(e\right) + \left(\alpha + t_R\left(1 - \alpha\right)\right) EX_R - IM\left(Y_{GNP}\right) = 0$$

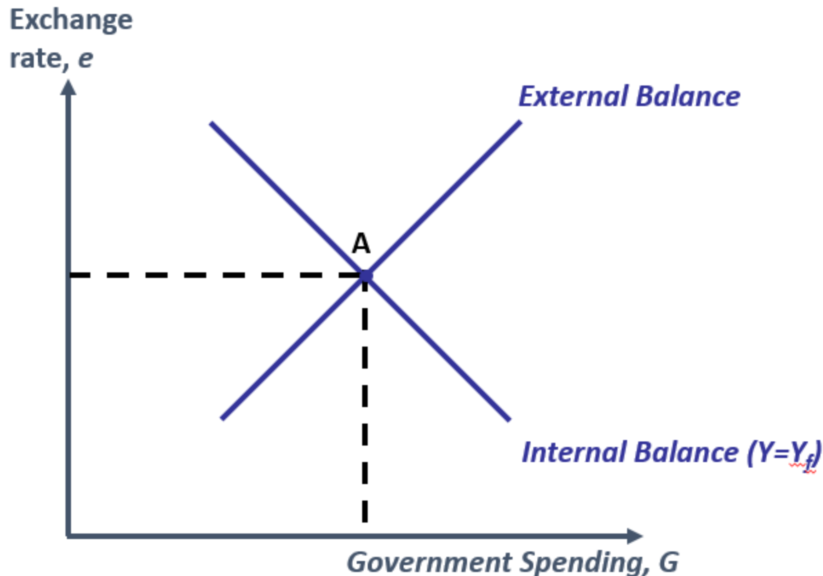
- Features of model
  - incorporates net factor income
    - large and negative due to small α and large EX_R: payments to foreign factors of production in resource sector
    - C and IM depend on GNP
  - resource sector is an enclave
    - all domestic fops employed in NR sector
    - interaction between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

$$
\begin{aligned}
& \text{RRDC:} \\
\text{IB}_\text{R} \quad : \quad & Y_{NR} = \mu \left(a + I + G + EX_{NR} \left(e \right) \right) \\
& + \mu \left(c - m \right) \left(1 - t \right) \left(\left(\alpha + t_R \left(1 - \alpha \right) \right) EX_R \right) \\
\text{IB}_\text{S} \quad : \quad & Y_{GDP} = \mu \left(a + I + G + EX_{NR} \left(e_{GDP} \right) + EX_R \right)
\end{aligned}
$$

$$
\begin{aligned}
\text{EB}_\text{R} \quad : \quad & CA = \mu \left(1 - c \left(1 - t \right) \right) EX_{NR} \left(e \right) - \mu m \left(1 - t \right) \left(a + I + G \right) \\
& + \mu \left(1 - c \left(1 - t \right) \right) \left(\alpha + t_R \left(1 - \alpha \right) \right) EX_R \\
\text{EB}_\text{S} \quad : \quad & CA = \mu EX_{NR} \left(e \right) + \mu EX_R - \mu m \left(1 - t \right) \left(a + I + G \right)
\end{aligned}
$$

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 $G^R > G^S$.

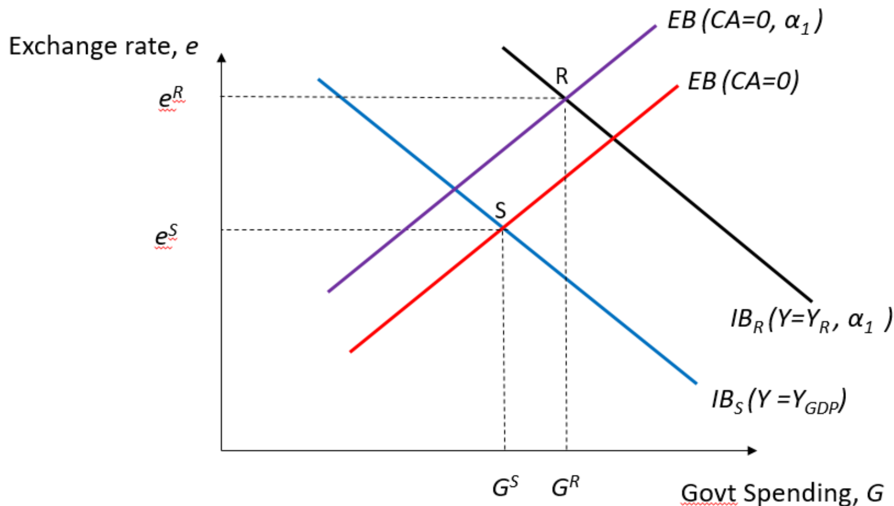
Proof.

Comparing two countries with identical size, $Y^R_{NR} = Y^S_{GDP}$, at the IB-EB equilibrum then

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

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.

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

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

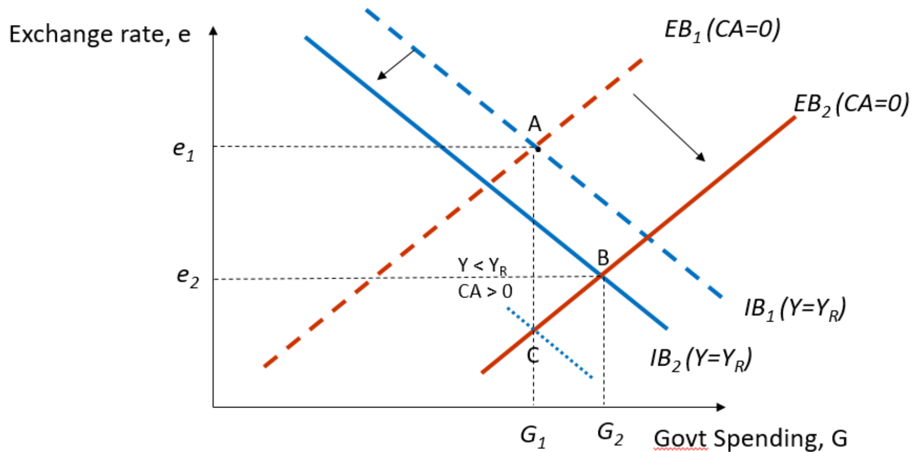
Standard Model (S)

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

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

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 $\Longrightarrow$ appreciation of exchange rate $\Longrightarrow$ 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

Proposition 3: An increase in home country's ownership share, α, 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.

$$\frac{de}{d\alpha} = -\left(1 - m\left(1 - t\right)\right)\left(1 - t_R\right) EX_R < 0$$

$$\frac{dG}{d\alpha} = \left(1 - c\left(1 - t\right)\right)\left(1 - t_R\right) EX_R > 0$$

Corollary

Comparing two RRDCs which are identical in every way, except that one has a higher ownership share of it's resources sector, α, then in equilibrium that economy with have a lower (more appreciated) equilibrium real exchange rate, and will have higher government spending.

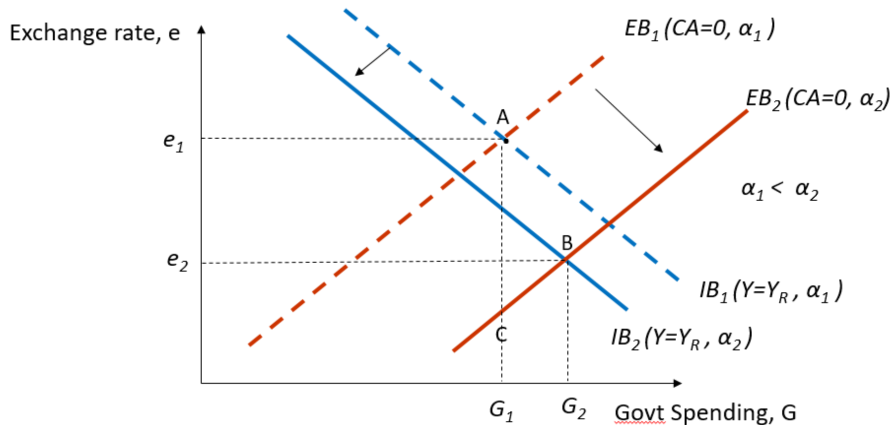
Proof.

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 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



Other Results

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 extermal balance.

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

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) ERER and higher G
- Empirics: preliminary results support this prediction.