The Optimal Currency Area in a Liquidity Trap

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Very preliminary draft

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Determinants of the optimal currency area

- Long debate about the conditions necessary for successful single currency area
- Traditional factors
  - A) Labor mobility (+)
  - B) Country Specific shocks (-)
  - C) Fiscal integration (+)
- Discussion of eurozone suggests that factors B) and C) were achilles heel
- Most commentary on European crisis:
  - Overwhelming affirmation of traditional OCA theory?
  - Huge asymmetry in shocks to Southern versus Northern Europe
  - Inability to adjust relative prices: need for internal devaluation
But what is the counterfactual?

- OCA theory presumes activist monetary policy
- Global Financial Crisis severely hindered use of monetary policy in many jurisdictions
  - Many countries at or close to zero lower bound
- Large debt shocks pushing natural real interests negative
- Comparison should be between SCA and flexible exchange rate system at ZLB
- Makes flexible exchange rates look even better?
  - Krugman: Europe in LT - needs exchange rate adjustment
  - Svensson ‘foolproof’ plan for Japan requires exchange rate flexibility
This paper

- OCA in a liquidity trap
- Plain vanilla NK 2 country model
- Assemble model so that OCA theory holds exactly with activist monetary policy
  - Country specific demand shocks
  - Always better to have flexible exchange rates
  - A. Exchange rate adjusts to stabilize country specific shocks
  - B. Monetary policy can be used actively to offset shocks
- But now assume that we have large (country-specific) shocks
- Pushing region into ZLB
  - Then it turns out the SCA dominates flexible exchange rates
  - Macro shocks more stabilized in absence of ER adjustment
  - Ex ante, when large shocks dominate, EU higher under a SCA
Understanding this result

- Combination of zero lower bound and integrated international capital markets
  - With activist monetary policy, country experiencing shock has fall in its relative real interest rate
  - Depreciation of exchange rate - helps to absorb shock
- But when large shocks and no interest rate adjustment
  - Relative real interest rates rise in country of shock
  - Exchange rate appreciates - exacerbates the response to the shock
- Absence of monetary instrument (plus open capital markets) removes ability to direct the exchange rate
- By contrast, in SCA, no nominal exchange rate at all
  - Shock causes a real exchange rate depreciation
  - RER response same in and out of LT
- SCA acts as kind of precommitment - removing possibility for perverse ER response
Caveats

- Not an argument for SCA
- But key defects in eurozone related to sovereign risk, moral hazard and regulatory negligence
- Can make case that relative price (RER) adjustment not at centre of eurozone defects (Berka Devereux Engel 2012)
- Here, just saying that in case of large shocks, efficient relative price adjustment not guaranteed.
Related literature

- Standard model of SCA (Benigno 2004)
- Compare with standard model of flexible ER (Clarida et al. 2002)
- Assume large shocks and temporary ZLB (Eggertson 2010)
- Related to recent literature on ZLB (Fujiwara et al. 2011, Erceg et al. 2011)
Model Description

Standard Two Country New Keynesian Model:

- Complete Assets Markets
- Calvo Price Adjustment
- Home bias in preferences
- Time Preference Shocks
- Simplicity allows full closed form objects
- But logic is very general
Model

Home Preferences

\[ U_t = E_0 \sum_{t=0}^{\infty} (U(C_t, \xi_t) - V(N_t)) \]

\( \xi_t \) is a preference shock, and \( U_{12} > 0 \) (proxy for deleveraging shock)

Composite consumption defined as

\[ C_t = \Phi C_{Ht}^{v/2} C_{Ft}^{1-v/2}, \quad v \geq 1 \]

Simplifying assumptions for analytical solution

Standard Euler equations, labor supply, price setting
Natural Real Interest Rates

World average and relative, \( x_t^W = \frac{x_t + x_t^*}{2} \) and \( x_t^R = \frac{x_t - x_t^*}{2} \).

Shock continues (ends) with probability \( \mu \), \( (1 - \mu) \)
Take example of home country shock
Home natural rate

\[
\tilde{r}_t = \bar{r} + \left( \frac{\Delta + (\phi + \sigma)(v - 1)}{(\phi + \sigma)\Delta} \right) (1 - \mu)\phi c_y \frac{\varepsilon_t}{2}
\]

Foreign natural rate is:

\[
\tilde{r}_t^* = \bar{r} + \left( \frac{\Delta - (\phi + \sigma)(v - 1)}{(\phi + \sigma)\Delta} \right) (1 - \mu)\phi c_y \frac{\varepsilon_t}{2}
\]

For \( v = 1 \), natural real interest rates are identical
Connected through capital mobility

Degree of openness determines strength of connection
Then in what follows assume that $v < \bar{v}$, so $r = r^* = 0$
World Averages and Relatives:

Averages:

\[ \pi^W_t = k((\phi + \sigma)\hat{y}^W_t - \varepsilon^W_t) + \beta E_t \pi^W_{t+1} \]

\[ \sigma E_t(\hat{y}^W_{t+1} - \hat{y}^W_t) = E_t(\varepsilon^W_{t+1} - \varepsilon^W_t) + E_t(r^W_t - E_t \pi^W_{t+1} - \rho) \]

Relatives:

\[ \pi^R_t = k((\phi + \sigma_D)\hat{y}^R_t - \frac{(v - 1)}{D}\varepsilon^R_t) + \beta E_t \pi^R_{t+1} \]

\[ \sigma_D E_t(\hat{y}^R_{t+1} - \hat{y}^R_t) = \frac{(v - 1)}{D} E_t(\varepsilon^R_{t+1} - \varepsilon^R_t) + E_t(r^R_t - \pi^R_{t+1}) \]
Monetary policy with positive interest rates

With multiple currencies, each country follows interest rate rule

\[ r_t = \rho + \gamma \pi_t \]

Therefore:

\[ r^W_t = \rho + \gamma \pi^W_t \]

, \hspace{1cm}

\[ r^R_t = \gamma \pi^R_t \]

Under a single currency:

\[ r^{SCA}_t = \rho + \gamma \pi^W_t, \hspace{0.5cm} r^{R,SCA}_t = 0 \]
Some convenient properties

- Behaviour of world economy is identical under a SCA and multiple currencies
- True both with positive interest rates and when constrained by ZLB
- Under multiple currencies, nominal interest rate defined by

\[ s_t - s_{t-1} = \pi_t^R + \tau_t - \tau_{t-1} \]
Solution of Relative Economy

- Under multiple currencies, analogous solution.
- But with SCA, $r^{R,SCA}_t = 0$, so relative equations are indeterminate

$$\pi^{R,SCA}_t = k((\phi + \sigma_D)\tilde{y}^{R,SCA}_t - \frac{(v - 1)}{D}\varepsilon^R_t) + \beta E_t \pi^{R,SCA}_{t+1}$$

$$\sigma_D E_t(\tilde{y}^{R,SCA}_{t+1} - \tilde{y}^{R,SCA}_t) = \frac{(v - 1)}{D} E_t(\varepsilon^R_{t+1} - \varepsilon^R_t) + E_t \left(0 - \pi^{R,SCA}_{t+1}\right)$$

- Need backward condition given by:

$$\pi^R_t = - (\tau_t - \tau_{t-1})$$
Note: property of a SCA

- Produces responses of relative variables akin to response of level variables under ZLB
- Nakamura and Steinsonn 2012 - state level GS multipliers in the US

- So SCA leads to less stable relative variables (OCA theory)
- But, as we see, this is *not true* when, under multiple currencies, relative interest rates constrained by ZLB
Savings shocks: multiple currencies, activist monetary policy

Assume that $\varepsilon^W < 0$, and $\varepsilon^R < 0$

- Shock to world saving and relative saving
- Solutions for world averages:

\[
\hat{y}^W = \frac{[(1 - \beta \mu)(1 - \mu) + k(\gamma - \mu)]}{\Delta} \varepsilon^W
\]

\[
\pi^W = \frac{(1 - \mu)\phi k}{\Delta} \varepsilon^W
\]

where $\Delta \equiv \sigma(1 - \beta \mu)(1 - \mu) + (\gamma - \mu)k(\phi + \sigma) > 0$
Multiple currencies, activist policy

Solutions for world relatives

\[ \hat{y}^R = \frac{[(1 - \beta \mu)(1 - \mu) + k(\gamma - \mu)]}{\Delta_D} \frac{(v - 1)\varepsilon^R}{D} \]

\[ \pi^R = \frac{(1 - \mu)\phi k}{\Delta_D} \frac{(v - 1)\varepsilon^R}{D} \]

where \( \Delta_D \equiv \sigma_D(1 - \beta \mu)(1 - \mu) + (\gamma - \mu)k(\phi + \sigma_D) > 0 \)
Multiple currencies, activist policy

Solution for terms of trade

\[ \hat{\tau} = \frac{-k\phi(\gamma - \mu)}{\Delta_D} \frac{2(v - 1)\varepsilon^R}{D} \]  \hspace{0.5cm} (1)

- For \( \varepsilon^R < 0 \), the terms of trade depreciates
- Also nominal exchange rate depreciates
- Both world averages and world relatives are determined by parameters of monetary rule \( \gamma \)
Multiple currencies, activist policy

- Deviations from efficient levels

\[ \hat{y}^{W} = \frac{\phi}{\phi + \sigma} \Omega \varepsilon^{W} \]

\[ \hat{y}^{R} = \frac{\phi}{\phi D + \sigma} \Omega_{D} (v - 1) \varepsilon^{R} \]

\[ \hat{\tau} = \frac{\phi (v - 1)}{\phi D + \sigma} \sigma_{D} \Omega_{D} 2 \varepsilon^{R} \]

- \( \Omega < 1 \), and \( \Omega_{D} < 1 \).

- Relative to efficient response:
  - \( y^{W} \) and \( y^{R} \) fall too much
  - \( \tau \) rises too little
  - Note that \( \gamma \) affects deviations
Single Currency Area, activist policy

- Response of world averages exactly the same
- World relatives solved by

\[ \hat{\tau}_{t-1} - \hat{\tau}_t = k \left( \frac{\phi D + \sigma}{2\sigma} \right) \left[ \hat{\tau}_t + \frac{(v - 1)\phi}{(\phi D + \sigma)2\varepsilon_R} \right] + \beta E_t(\hat{\tau}_t - \hat{\tau}_{t+1}) \]

- Has simple solution given by

\[ \hat{\tau}_t = \lambda \hat{\tau}_{t-1} + \chi 2\varepsilon_R \]

\[ 0 < \lambda < 1, \quad \chi = -\frac{k}{2} \frac{(v-1)\phi}{D_1 D D_1} < 0 \]

- Response does not depend on \( \gamma \)
Single Currency Area, activist policy

- Deviations from efficient levels

\[
\tilde{\tau}_t = \lambda \tilde{\tau}_{t-1} + (v - 1)2\varepsilon^R \frac{\phi}{\phi + \sigma_D} \frac{\sigma(1 - \beta \lambda + \beta(1 - \mu))}{D\Delta_{D1}}
\]

\[
\tilde{y}_t^R = \lambda \frac{D\tilde{\tau}_{t-1}}{2\sigma} + (v - 1)\varepsilon^R \frac{\phi}{\phi + \sigma_D} \frac{(1 - \beta \lambda + \beta(1 - \mu))}{D\Delta_{D1}}
\]

- Deviations are again negative

- Greater in absolute terms than under multiple currencies and flexible exchange rates
Comparison under activist policies

**Figure 1: Demand Shocks under a Taylor Rule**

- $\pi_{\text{sca}}^R$
- $\pi_{\text{flex}}^R$
- $y_{\text{sca}}^R$
- $y_{\text{flex}}^R$
- $\tau_{\text{sca}}$
- $\tau_{\text{flex}}$
- $y^W$
- $\pi^W$
Solutions in a liquidity trap

- Assume shocks push down both rates to zero bound
- Solution for world averages - obtained by link to future exit from liquidity trap

\[ \hat{y}_W = \frac{[(1 - \beta \mu)(1 - \mu) - k \mu] \varepsilon}{\Delta_1} \]

\[ \pi_W = \frac{(1 - \mu) \phi k \varepsilon}{\Delta_1} \]

where \( \Delta_1 > 0 \).
- Response exceeds that under activist policy
World relatives in a LT: multiple currencies

- Multiple currencies

\[
\hat{y}^R = \frac{[\mu^c(1 - \mu) - k\mu] (v - 1)\varepsilon}{\Delta_{D1} 2D}
\]

\[
\pi^R = \frac{(1 - \mu)\phi_k (v - 1)\varepsilon}{\Delta_{D1} 2D}
\]

where \( \Delta_{D1} > 0 \)

- Again, exceeds that under activist policy
Response of terms of trade

- Multiple currencies

\[ \hat{\tau} = \frac{k \sigma(\mu) (v - 1) \varepsilon}{\Delta_D} \frac{2D}{2D} \]

- The terms of trade appreciates

- Likewise, nominal exchange rate appreciates

\[ \hat{s}_t - \hat{s}_{t-1} = \pi_t^R + (\hat{\tau}_t - \hat{\tau}_{t-1}) \]

- Even though home inflation falls, nominal exchange rate falls by more, so get a terms of trade appreciation
Basic intuition

- Although interest rates cannot move, capital markets still integrated
- So up to 1st order, interest rate parity holds

\[-E_t \pi_{t+1} = -E_t \pi^*_{t+1} + E_t (\widehat{\tau}_{t+1} - \widehat{\tau}_t)\]

- Fall in relative home PPI inflation leads to a rise in home relative real interest rates
- requiring an anticipated terms of trade deterioration.
- Implies an immediate appreciation.
In terms of deviations

\[ \tilde{y}^W = \frac{\phi}{\phi + \sigma} \Omega_1 \varepsilon^W \]

\[ \tilde{y}^R = \frac{\phi}{\phi D_1 + \sigma} \Omega D_1 (v - 1) \varepsilon^R \]

\[ \tilde{\tau} = \frac{\phi (v - 1)}{\phi D + \sigma} \sigma_D \Omega D_1 2 \varepsilon^R \]

\( \Omega_1 < 1, \) and \( \Omega D_1 < 1. \)

Exceeds gaps under activism
Now comparison with SCA

- Solutions for world averages exactly as in multiple currencies case
- Solutions for world relatives exactly as in policy activist case
- Now can show that gaps more negative under flexible exchange rates than in SCA
Comparison of MC and SCA under LT

Figure 4: Demand Shocks under a Liquidity Trap
Result

- Flexible exchange rates impart greater instability
- Response of exchange rate compounds original shock
- But since interest rates zero, countries have no lever to affect exchange rate (with open capital markets)
- Hence, SCA acts as an efficient limitation on perverse ER movement
## Welfare evaluation

<table>
<thead>
<tr>
<th>Policy</th>
<th>Taylor Rule</th>
<th>Zero Bound Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Currency</td>
<td>0.0495</td>
<td>0.774</td>
</tr>
<tr>
<td>Single Currency Area</td>
<td>0.0629</td>
<td>0.592</td>
</tr>
</tbody>
</table>
Extensions

- Limiting capital mobility
  - Without capital mobility, interest rates move in different directions
  - Foreign interest rate may adjust
  - Efficient response my a) dominate outcome with capital mobility, b) dominate SCA

- Fiscal adjustments
  - Can introduce capital taxes subsidies to induce efficient response
  - Note that need these even with multiple currencies
  - Quite different than taxes for ‘internal devaluation’

- Empirical evidence
  - Some suggestion that low interest rate currencies appreciated: US, Japan
Caveats

- Not an argument for SCA unconditionally
- Message is that exchange rate adjustment not always efficient
- SCA can prevent inefficient adjustment
- Other aspects of SCA may be more damaging (moral hazard, decentralized regulation)