A Real Options Perspective on the Euro

by Fernando Alvarez and Avinash Dixit

Discussion by Dave Backus
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NYU STERN

Perpetual options

- State x_t is Markov
- Value of underlying asset (ex-dividend)

$$V(x_t) \quad = \quad E_t m(x_t, x_{t+1}) \left[d(x_{t+1}) + V(x_{t+1}) \right]$$

- Bellman equation for perpetual option with strike k

$$J(x_t) \quad = \quad \max \left\{ \underbrace{E_t m(x_t, x_{t+1}) J(x_{t+1})}_{\text{wait}}, \underbrace{V(x_t) - k}_{\text{buy now}} \right\}$$

- With structure: threshold property, exercise if $V(x_t) \geq V^*$

$V^* >> k$ ("value of waiting"), V^* increasing in volatility

Alvarez-Dixit: model

- Country i has state $X_{it} \sim \text{AR}(1)$
- Policy Z_{it} generates deviation $x_{it} = X_{it} - Z_{it}$
- With independent monetary policies set $Z_{it} = X_{it}$, get

$$u_i(x_{it}) \quad = \quad -x_{it}^2 \quad = \quad 0$$

- With common monetary policy set $Z_{it} = n^{-1} \sum_j X_{jt}$, get

$$\begin{aligned} u_i(x_{it}) &= \alpha - x_{it}^2 \\ U = \sum u_i &= n\alpha - \sum x_{it}^2 \end{aligned}$$

Alvarez-Dixit: breakup option

- For the zone, breakup option has cost nk [their Φ]
- Breakup indicator

$$Y_t \quad = \quad \sum x_{it}^2 \quad (!) \quad \text{(square-root process)}$$

- Bellman equation (perpetual option)

$$J(Y_t) \quad = \quad \max \left\{ \underbrace{n\alpha - Y_t + \delta E_t J(Y_{t+1})}_{\text{stay together}}, \underbrace{0 - nk}_{\text{break up}} \right\}$$

- Break up if $Y_t \geq Y^*$ [they call it $\overline{Y}$]

Alvarez-Dixit: results

- Small premium over now-or-never

$$Y^* > \widehat{Y}$$

- Ambiguous effect of volatility
  - Y^* can be increasing or decreasing in volatility
  - But $Y^* - \widehat{Y}$ is increasing
- Exit by a single country at cost k may[?] come earlier
  - Side payments to misaligned countries?
- System will eventually break up

What does this have to do with the euro?

- One view: debt crisis, not euro crisis
  - High debt ratios in many countries
  - Greece, Ireland, and Portugal locked out of debt markets
  - Sovereign default is never clean
- Another view: the euro ...
  - Enabled debt issue on attractive terms
  - Reduced flexibility of prices and wages [this paper]
  - Eliminated inflation finance
  - Created uncertainty about budget constraints

Open questions

- How much exchange rate "misalignment" do we have?
- How much do we need? ("We've been repriced")
- What if two groups had high and low σ? Asymmetric loss functions?
- What happens to euro-denominated debt if you leave?
- Do we really need continuous time here?

Real effective exchange rates