

## Definition of spatial price transmission

Spatial price transmission: „...the degree to which demand and supply shocks arising in one region are transmitted to another region.“  
(Fackler & Goodwin, 2000)

## Relevance

- Poverty impacts: e.g. the 2007/08 and later global food price crises (Minot 2010; FAO)
- Competition policy: defining the extent of markets
- Crucial (often secret) ingredient in sectoral and macroeconomic analysis (underlies aggregation and links between markets)
- Scientific curiosity: How do markets work?

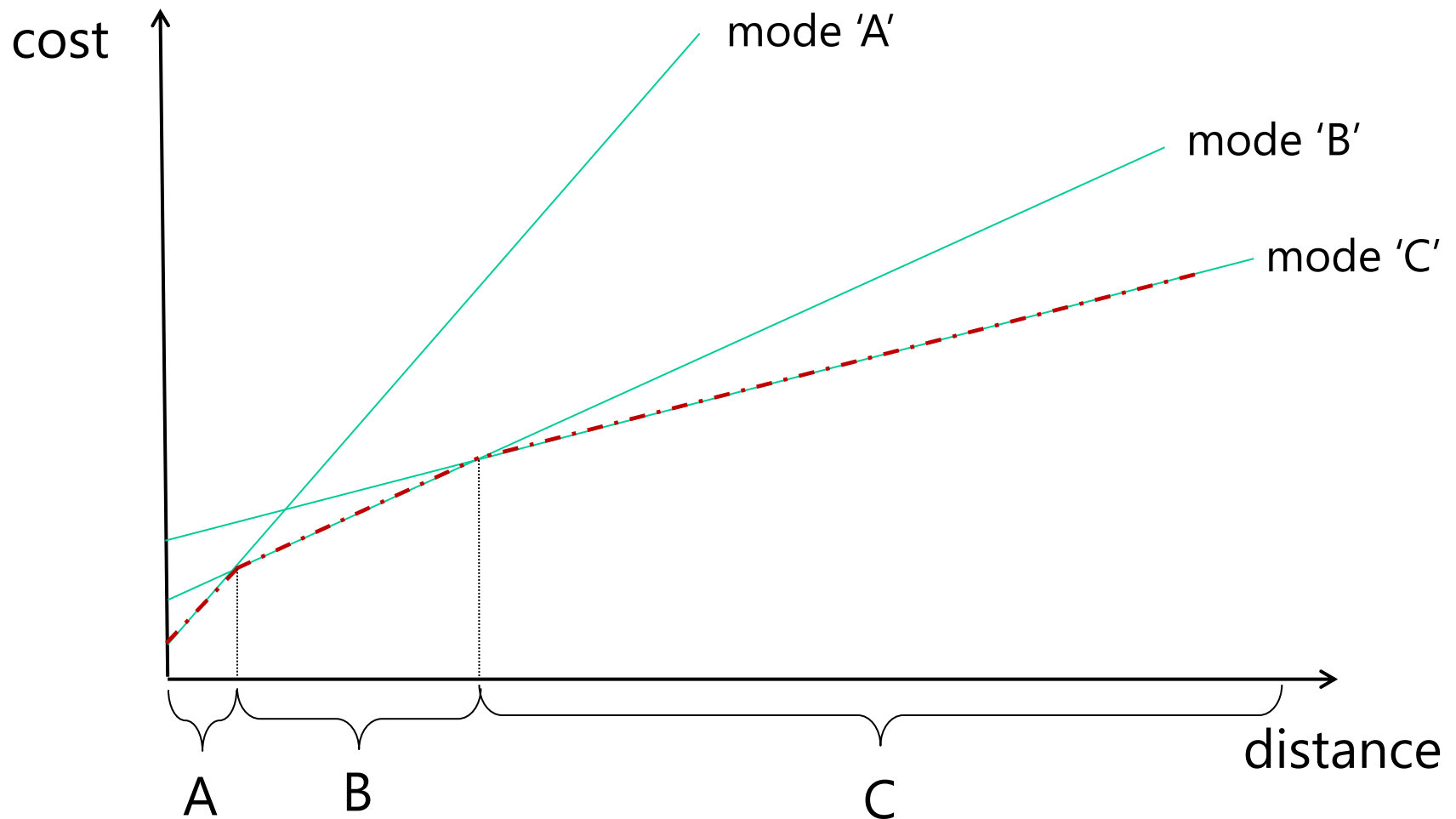
## Theoretical underpinnings – spatial equilibrium

- Foundation: the spatial arbitrage condition (SAC)
- $P_A - P_B \leq T_{BA}$
- If  $P_A - P_B > T_{BA}$ , then trade from A to B will cause  $P_A$  to fall and  $P_B$  to increase until the SAC is restored
- Implications:
  - Price transmission is regime-dependent
  - If prices are non-stationary, non-linear cointegration
  - Current 'workhorse' – the Threshold VECM (TVECM) 3

## Transport costs in spatial equilibrium

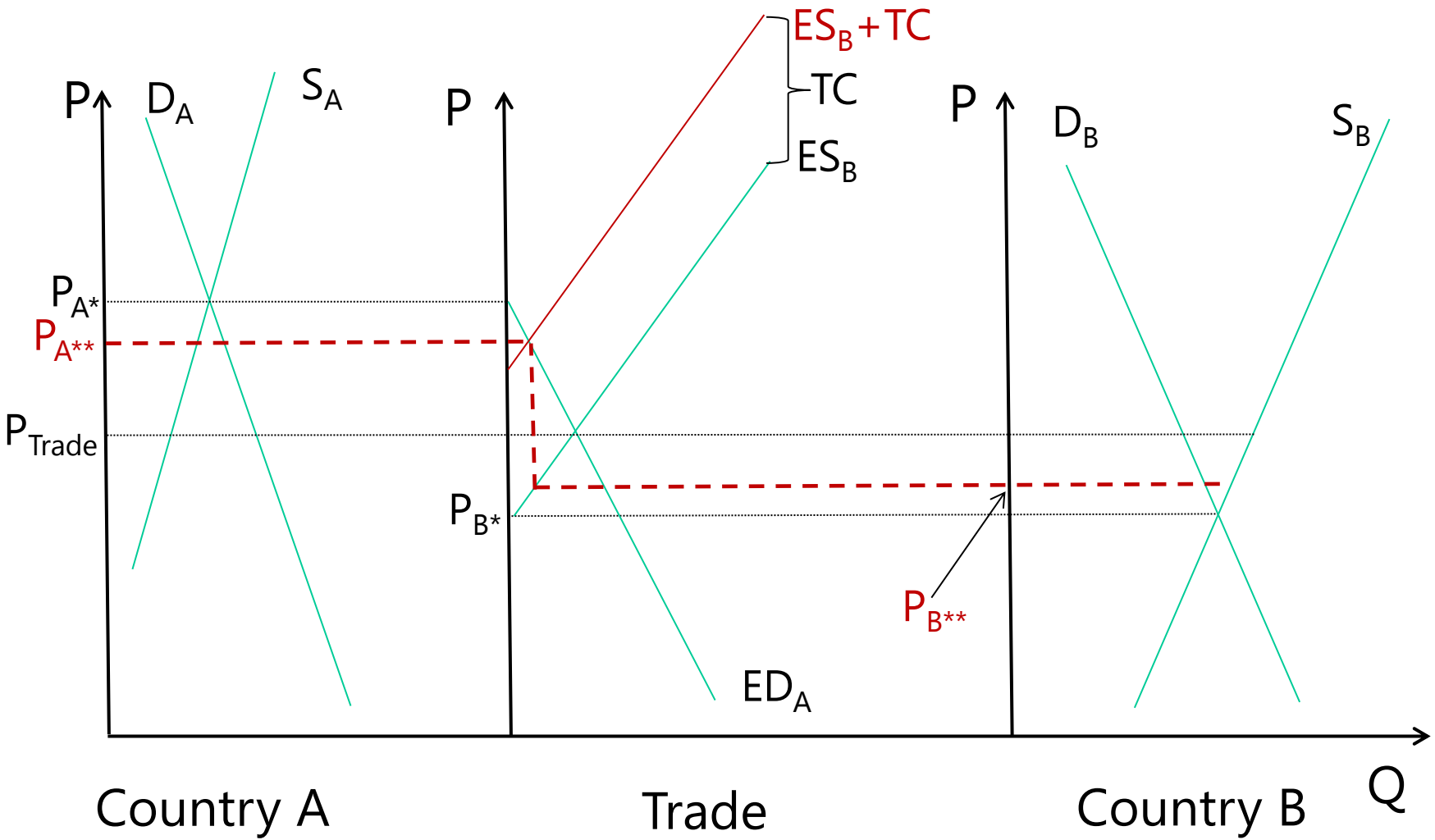
- Controversy over the use of 'transport' costs in this setting
- Clearly, there are more than just physical transport costs involved: for example search costs, contract enforcement costs, insurance costs, etc.
- Some prefer the term 'transaction' costs, but others jealously reserve this term for other uses. Some use 'transfer' costs
- Whatever. We refer to all of the costs besides the cost of the traded commodity itself, that are incurred in moving that commodity from one market to another for sale
- These costs are driven by technology, infrastructure and institutions

## Some thoughts about transport costs



Different modes most efficient over different ranges of distance!

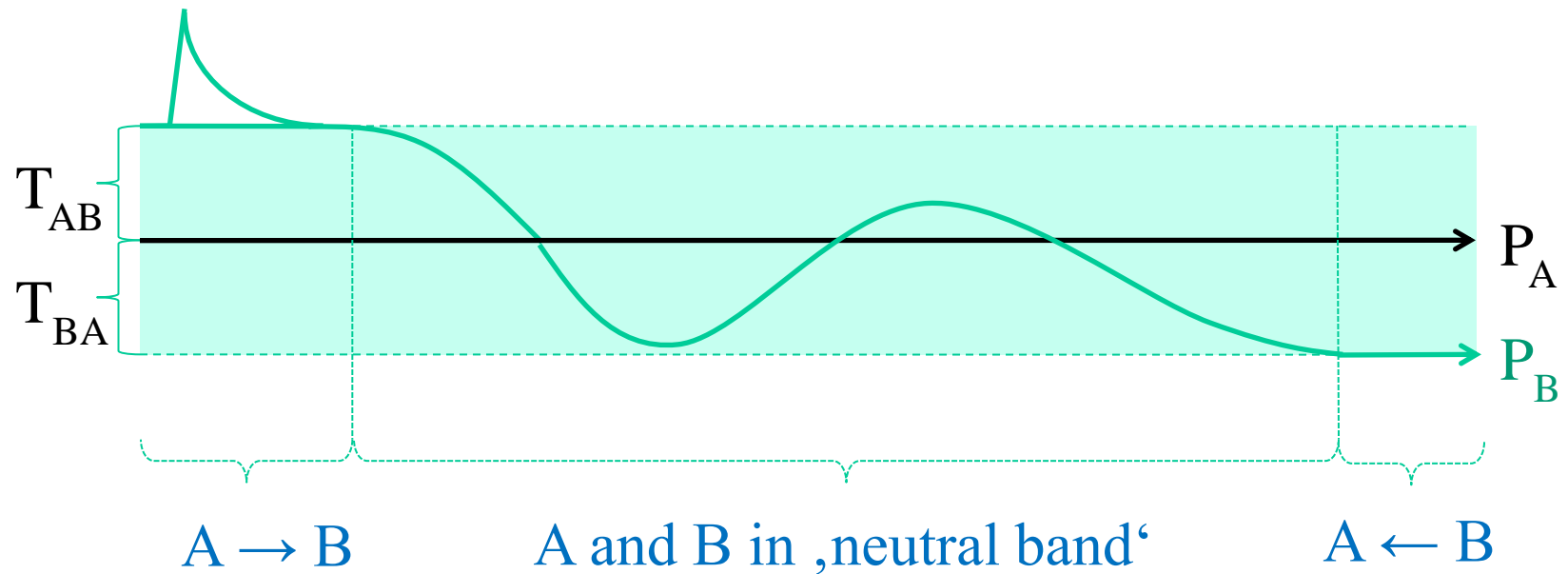
# Trade and transport costs



## Importance of transport costs

- If these costs exceed the difference between the two autarchy prices, trade ceases and the countries revert to autarchy
- Transport costs can be especially relevant for landlocked countries
- Consider the case of a landlocked country that switches from net import to net export – a good harvest can have catastrophic consequences for farmers
- In international grain and oilseed trade, shipping cost can play a major role. Currently shipping capacity is in oversupply, 5 years ago it was scarce

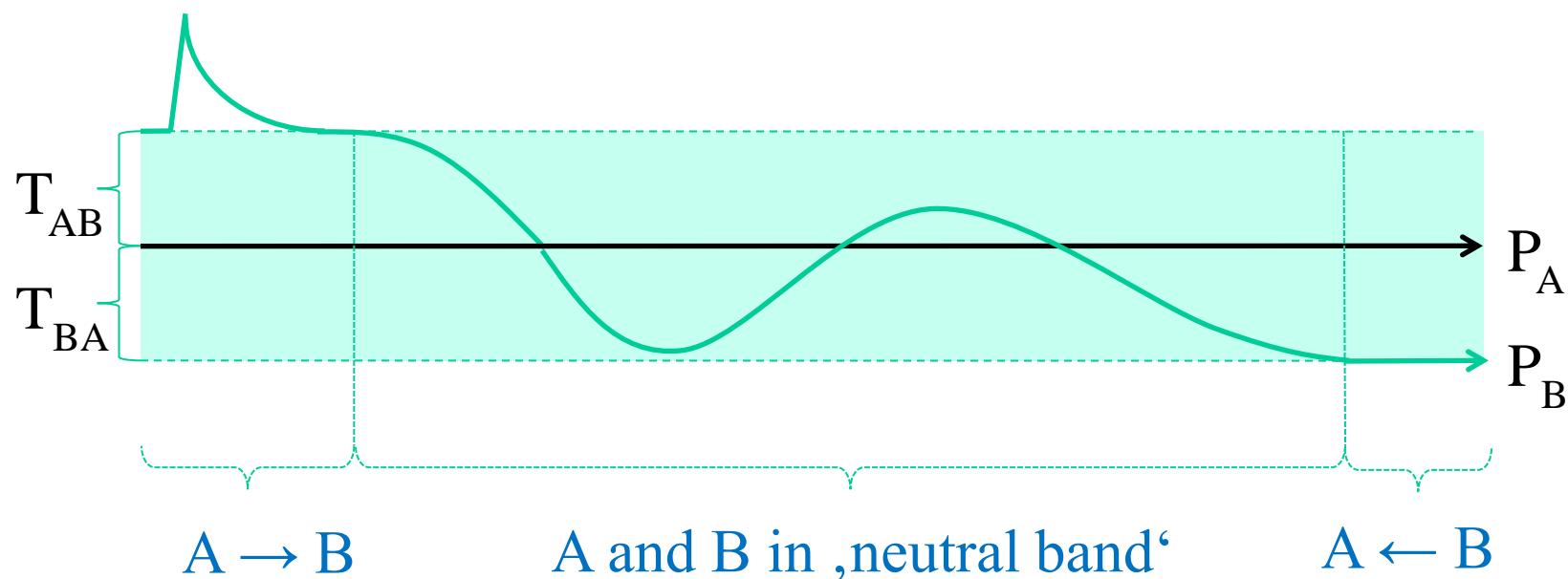
## Graphical depiction of SAC



- Paradox: SAC is an equilibrium condition, but we need to observe disequilibria to estimate the corresponding TVECM
- We therefore also need data of sufficiently high frequency



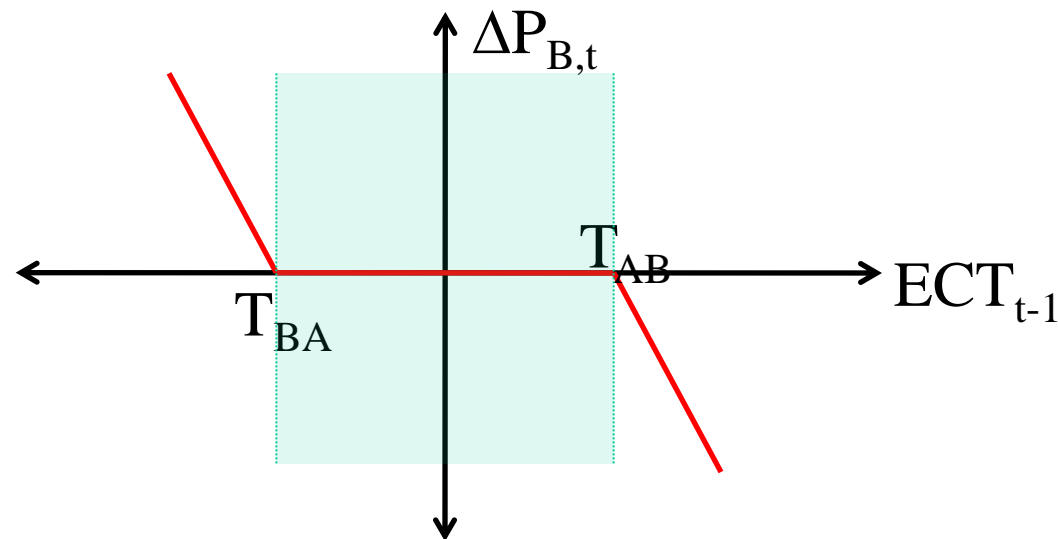
## Graphical depiction (cont'd)



- Thresholds provide estimates of transfer costs ( $T_{ij}$ )
- Assumption:  $T_{ij}$  is constant
- Often questionable: Seasonality, policy changes, *force majeure*, technology (e.g. cell phones – Jensen, Aker)
- $T_{ij}$  might vary among traders  $\rightarrow$  smooth transition

## Another way of looking at it

- Basic threshold price transmission model: A 'neutral band' flanked by arbitrage regimes



- In the neutral band trade does not occur and prices move independently (random walks)
- Contrast to arbitrage regimes characterised by error correction that is driven by trade
- Would be ideal if we could combine analysis with trade data, but trade data generally too low frequency

# The threshold vector error correction model (TVECM)

The standard linear vector error correction model (VECM)

$$\begin{bmatrix} \Delta p_t^D \\ \Delta p_t^W \end{bmatrix} = \begin{bmatrix} \varphi_D \\ \varphi_W \end{bmatrix} + \begin{bmatrix} \alpha_D \\ \alpha_W \end{bmatrix} [p_{t-1}^D - \beta_0 - \beta_1 p_{t-1}^W] + \sum_{i=1}^k \begin{bmatrix} \delta_{Dj} & \rho_{Dj} \\ \delta_{Wj} & \rho_{Wj} \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^D \\ \Delta p_{t-i}^W \end{bmatrix} + \begin{bmatrix} \varepsilon_{Dt} \\ \varepsilon_{Wt} \end{bmatrix}$$

The threshold VECM (TVECM)

$$\begin{bmatrix} \Delta p_t^D \\ \Delta p_t^W \end{bmatrix} = \begin{cases} \begin{bmatrix} \varphi_D^1 \\ \varphi_W^1 \end{bmatrix} + \begin{bmatrix} \alpha_D^1 \\ \alpha_W^1 \end{bmatrix} [ect_{t-1}] + \sum_{i=1}^k \begin{bmatrix} \delta_{Dj}^1 & \rho_{Dj}^1 \\ \delta_{Wj}^1 & \rho_{Wj}^1 \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^D \\ \Delta p_{t-i}^W \end{bmatrix} + \begin{bmatrix} \varepsilon_{Dt}^1 \\ \varepsilon_{Wt}^1 \end{bmatrix} & \text{if } ect_{t-1} \leq \tau_L \\ \begin{bmatrix} \varphi_D^2 \\ \varphi_W^2 \end{bmatrix} + \begin{bmatrix} \alpha_D^2 \\ \alpha_W^2 \end{bmatrix} [ect_{t-1}] + \sum_{i=1}^k \begin{bmatrix} \delta_{Dj}^2 & \rho_{Dj}^2 \\ \delta_{Wj}^2 & \rho_{Wj}^2 \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^D \\ \Delta p_{t-i}^W \end{bmatrix} + \begin{bmatrix} \varepsilon_{Dt}^2 \\ \varepsilon_{Wt}^2 \end{bmatrix} & \text{if } \tau_L \leq ect_{t-1} \leq \tau_U \\ \begin{bmatrix} \varphi_D^3 \\ \varphi_W^3 \end{bmatrix} + \begin{bmatrix} \alpha_D^3 \\ \alpha_W^3 \end{bmatrix} [ect_{t-1}] + \sum_{i=1}^k \begin{bmatrix} \delta_{Dj}^3 & \rho_{Dj}^3 \\ \delta_{Wj}^3 & \rho_{Wj}^3 \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^D \\ \Delta p_{t-i}^W \end{bmatrix} + \begin{bmatrix} \varepsilon_{Dt}^3 \\ \varepsilon_{Wt}^3 \end{bmatrix} & \text{if } \tau_U \leq ect_{t-1} \end{cases}$$

## The threshold vector error correction model (TVECM)

- Estimation is not trivial
- Main approach in the literature – grid search: Estimate model for all possible values of the thresholds, and choose the values that produce the best fit (econometrically speaking = profile likelihood)
- However, this method produces biased estimates
- Key problem – the need for an arbitrary trimming parameter to assure a sufficient number of observations in each regime
- Bayesian alternatives appear promising