



Environmental Kuznets Curve: A Comparison between Consumption- and Production- Based CO₂ Emission

University of Groningen

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Slide 1

RUG1

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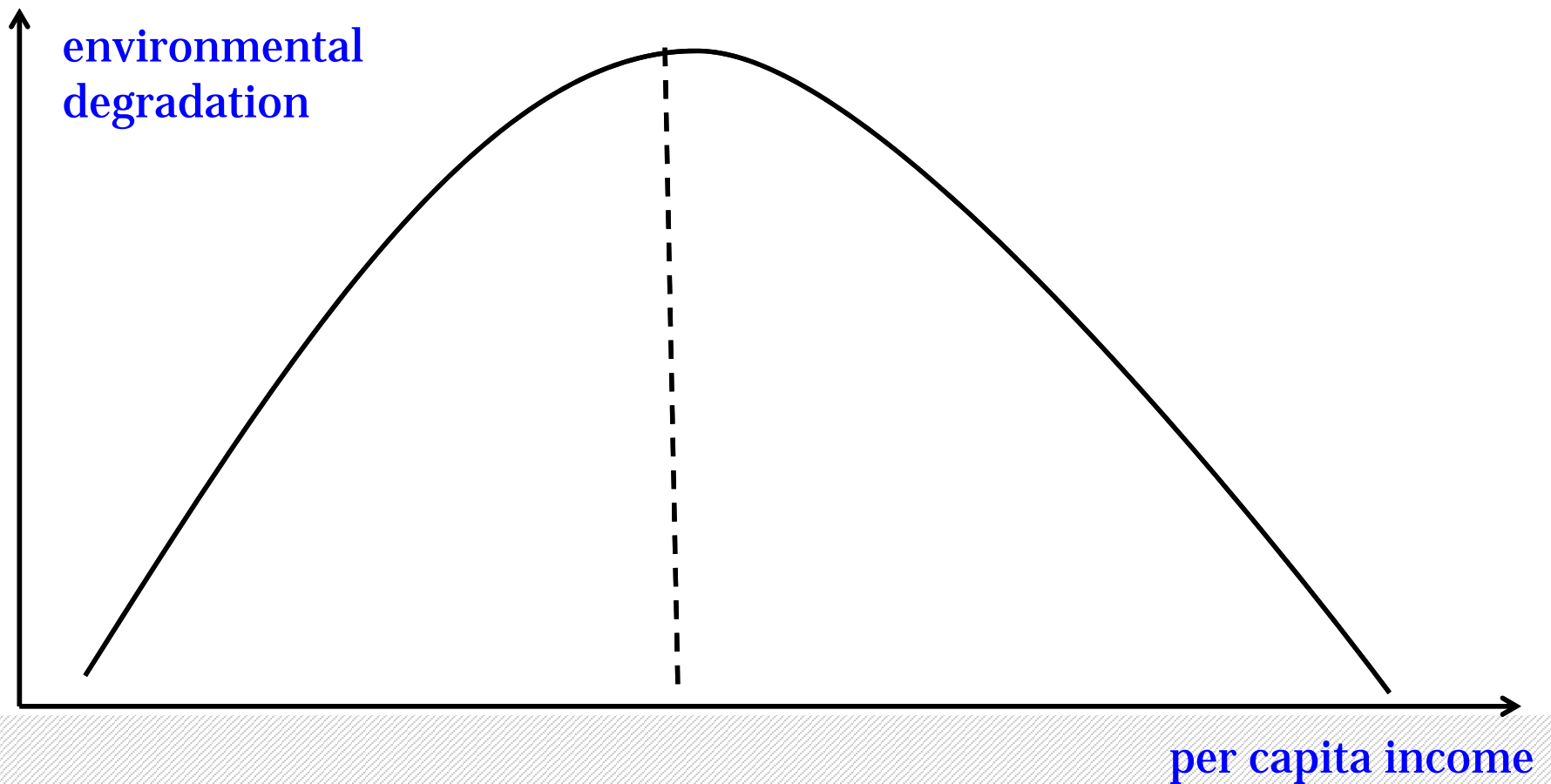
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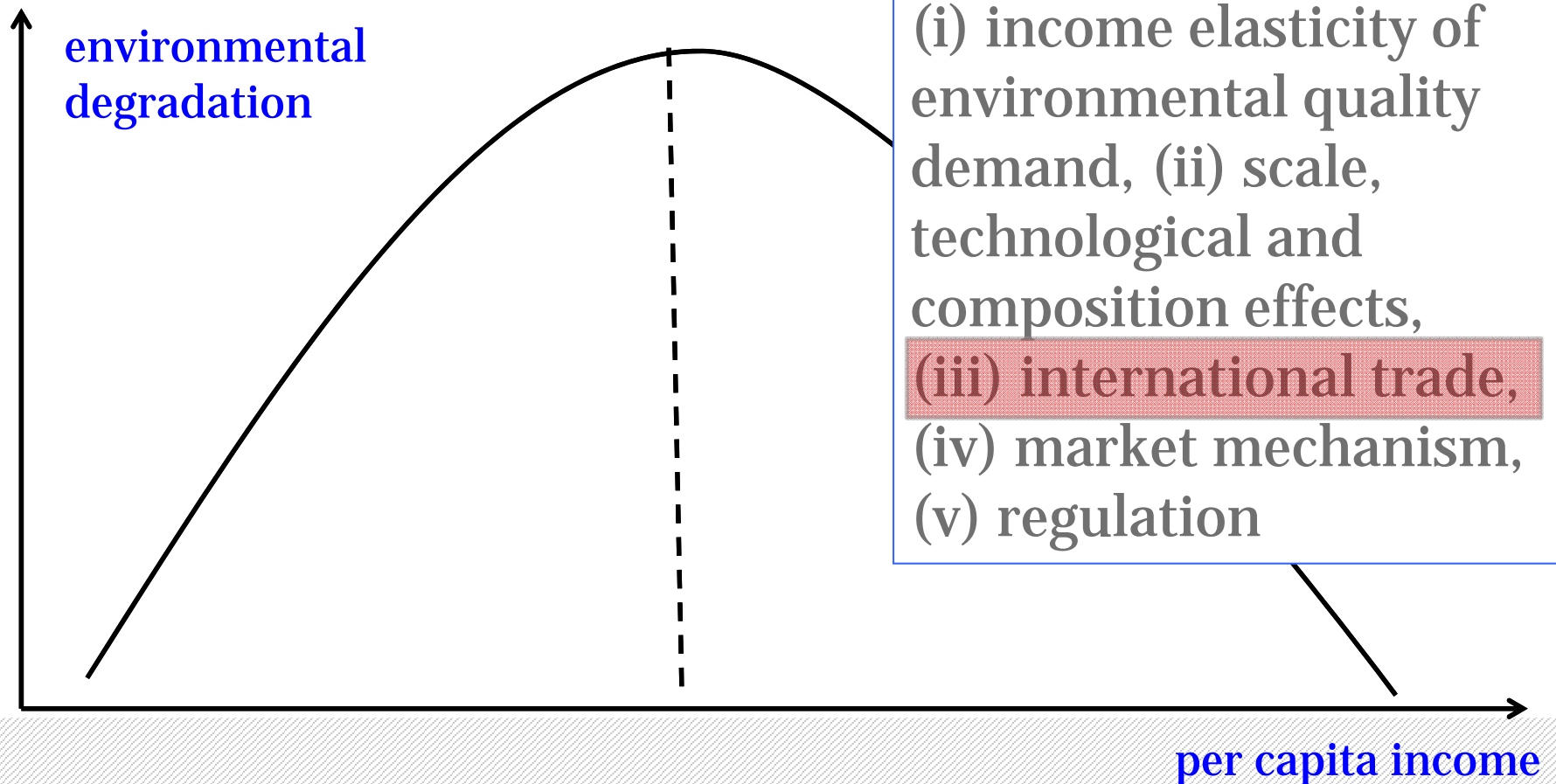


Environmental Kuznets Curve



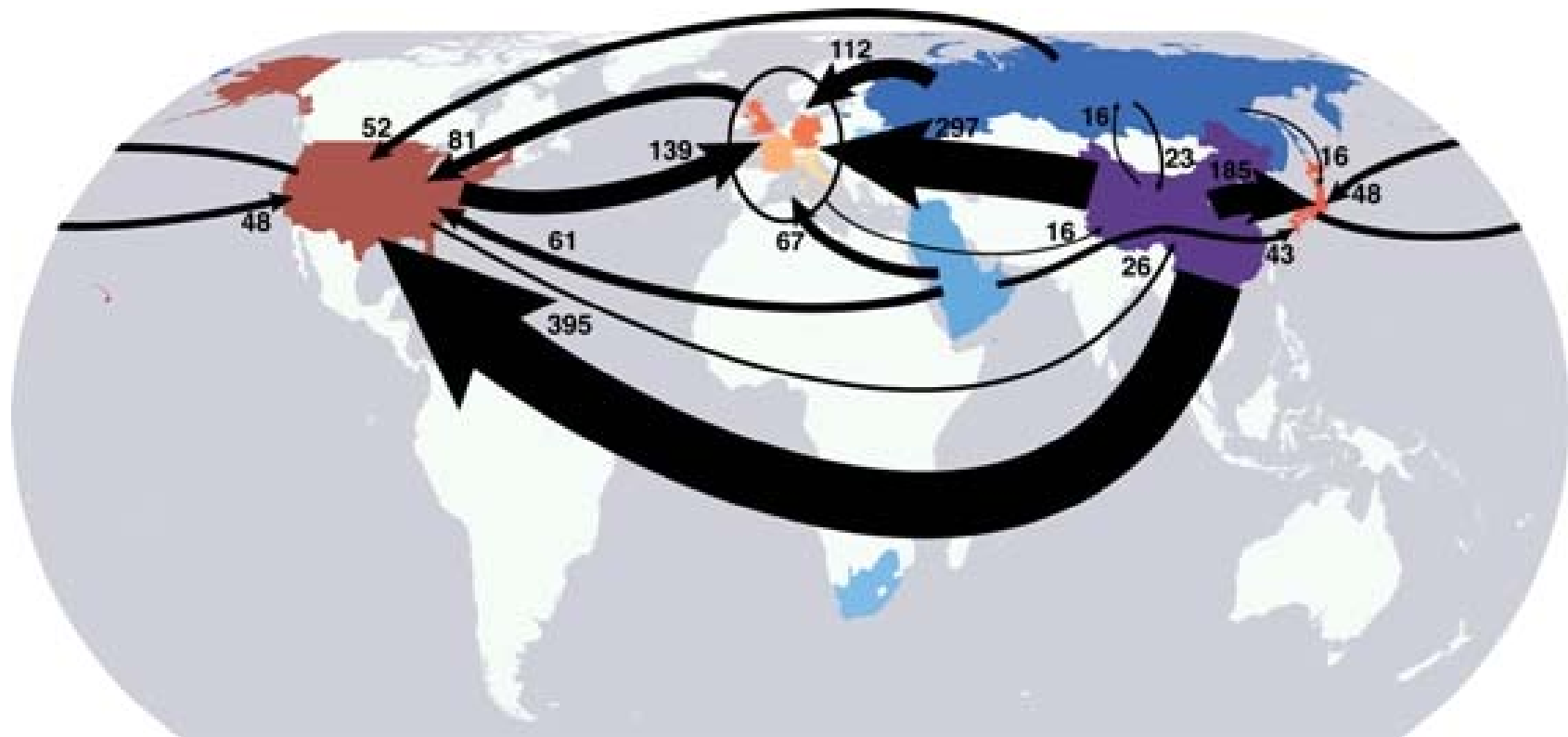


Environmental Kuznets Curve





- › International Trade → Emission Outsource
- › US: 2.5 tons per person EU: 4 tons per person



Source: Steven J. Davis and Ken Caldeira (2010). Consumption-based accounting of CO2 Emissions. PNAS.



Research Question

- › Is the inverted-U-shaped curve still exist using the consumption-based emissions?
- › If so, different from using production-based emissions? How different?

Test EKC using production-based and consumption-based CO₂ emissions.

Compare the shape and turning point.



Literature

- › EKC with Ecological Footprint (Global Footprint Network):

Wackernagel et al. (1997), York et al. (2004), Bagliani et al. (2008), Caviglia-Harris et al. (2009), and Hervieux and Darne (2013)

$$E_c = E_p + (im - ex) * EI$$

- EI: world average emission intensity
- Can not capture the full global supply chain and is able to cover feedback effects
- Better estimation of consumption-based emissions with WIOD



Model

$$y_{it} = \alpha y_{i,t-1} + x'_{it} \beta + u_i + \varepsilon_{it}$$

- › where y_{it} is CO₂ emissions for country i at time t , and x_{it} is a vector of explanatory variables
- › The error terms, u_i and ε_{it} represent the typical error term decomposition that includes unobserved individual heterogeneity.
- › Arellano and Bond's **two-step difference GMM estimator**
- › **fixed effects** estimation assuming an auto-regressive pattern is present in the error term



Model

- > For the **two-step difference GMM model**, the differencing removes any fixed individual effects:

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \Delta x'_{it} \beta + \Delta \varepsilon_{it}$$

- > For the **fixed effects model** with autoregressive errors, the error term is assumed to take the form:

$$\varepsilon_{it} = \rho \varepsilon_{i,t-1} + v_{it}$$

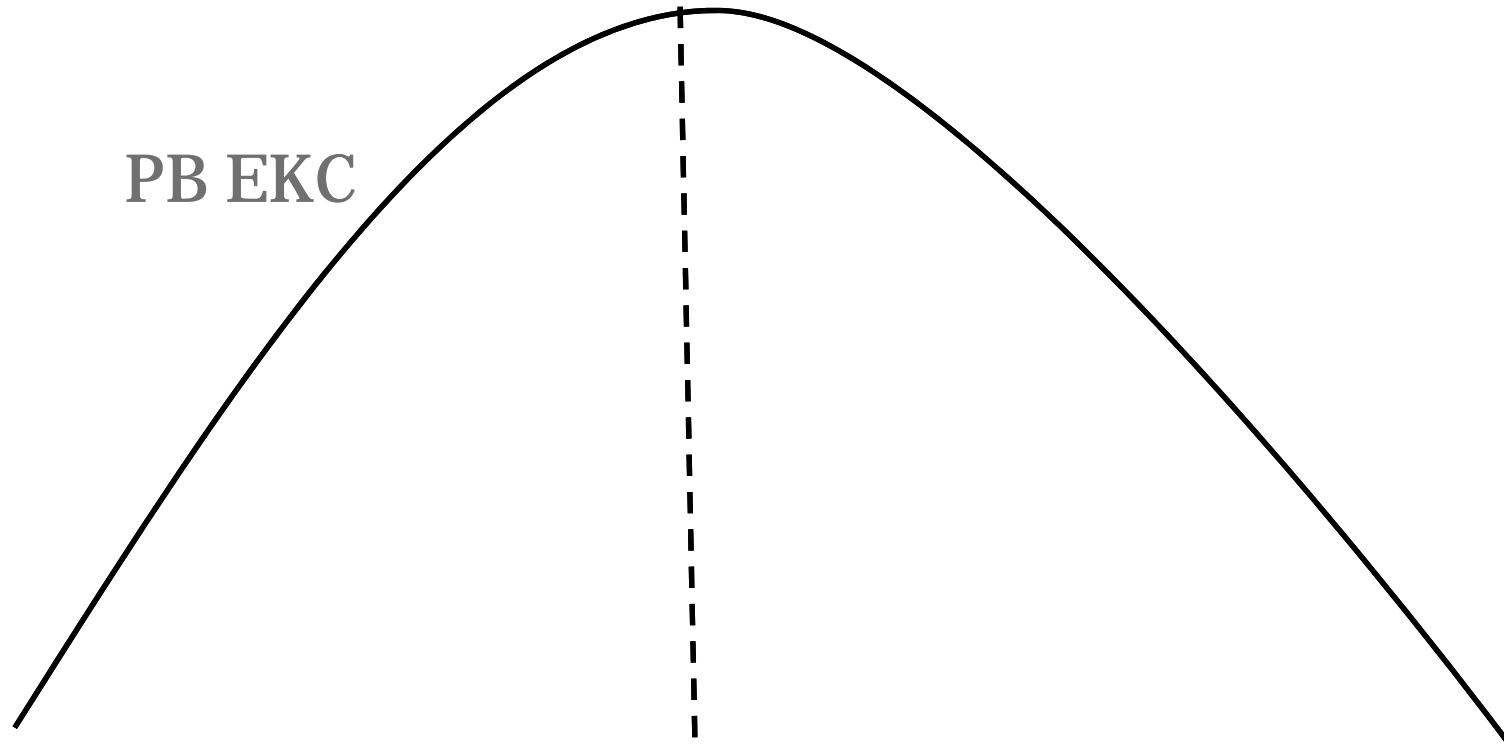


Production-based Emissions v.s. Consumption-based Emissions

- › There are evidence of a invert-U-shaped curve for both production-based and consumption-based CO₂ emissions.
- › The turning point of consumption-based CO₂ emission are further than the turning point of production-based CO₂ emission.
- › The invert-U shaped curve are flatter for the consumption-based emissions

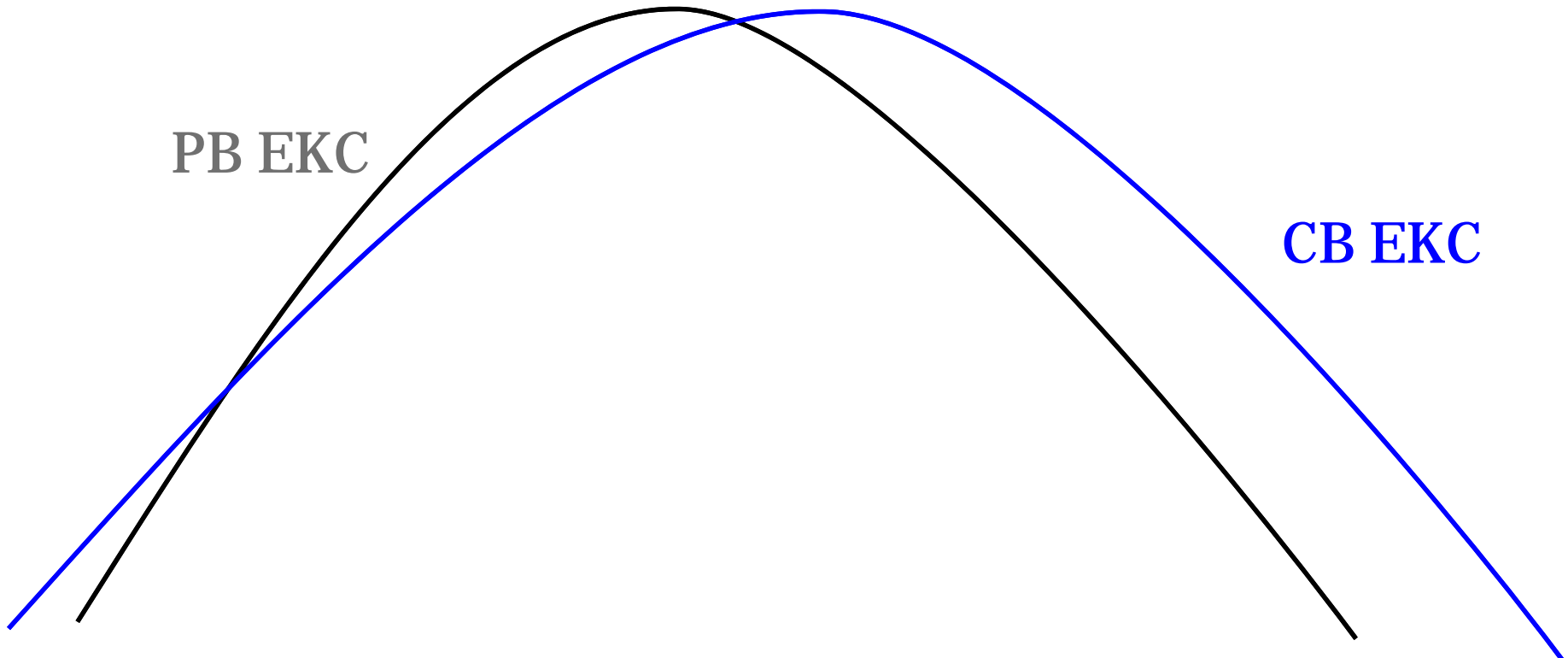


Production-based v.s. Consumption-based EKC



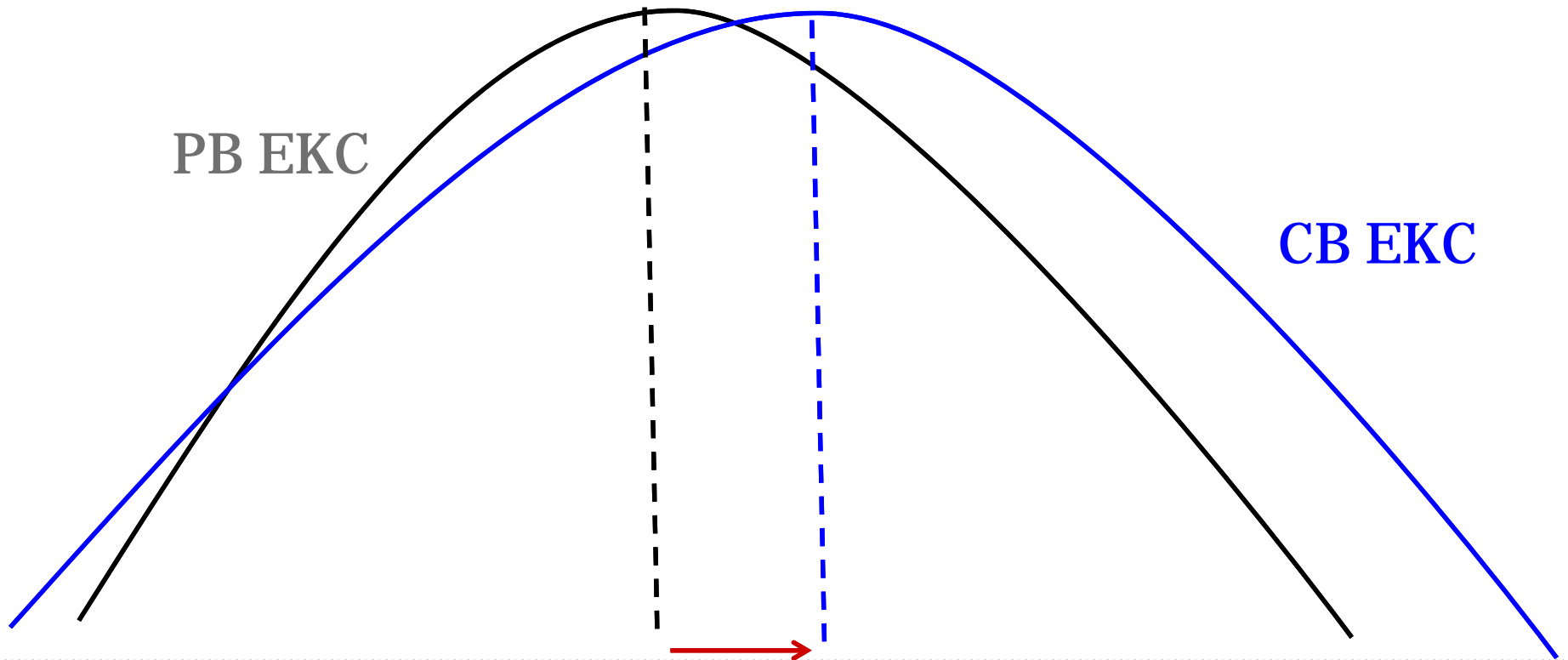


Production-based v.s. Consumption-based EKC





Production-based v.s. Consumption-based EKC





Limitations

- › Not enough years of consumption-based emissions.
Cannot apply time-series model for each country
- › Medium-term rather than long-term



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**Thank you for your attention!
Questions & Comments?**

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