Revisiting the impacts of economic growth on environmental degradation: New evidence from 115 countries

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Research Questions

-Identify the impacts of economic growth of environmental degradation in Environmental Kuznets Curve (EKC)

-Testing the short & long run causal relationship between environmental degradation (CO_2, CH_4 & $PM_{2.5}$) and GDP, GDP2, energy consumption, trade openness & urbanization.

Motivations

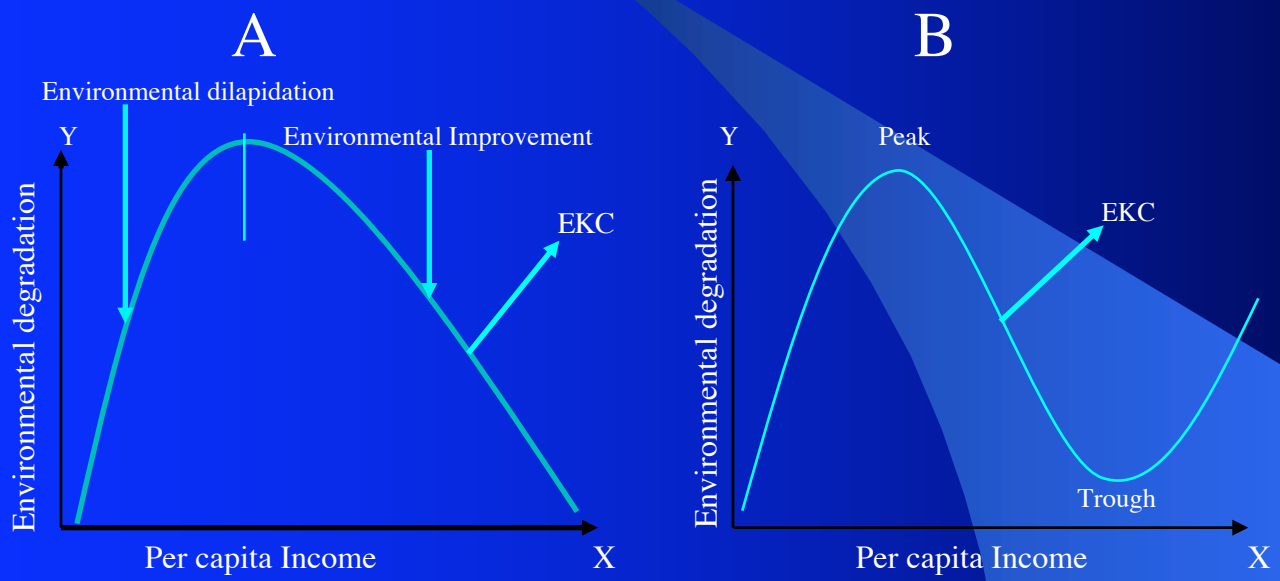
- Impact of global worming for the decades
- Meetings – Kyoto Protocol, Paris agreement

-Not close to solving the issue

- Health impact especially from PM2.5
- Approximately 865000 premature deaths are occurred by particulate matter (PMs) per year and 60% of these deaths occurred in Asia (WHO, 2007).

Theoretical Framework

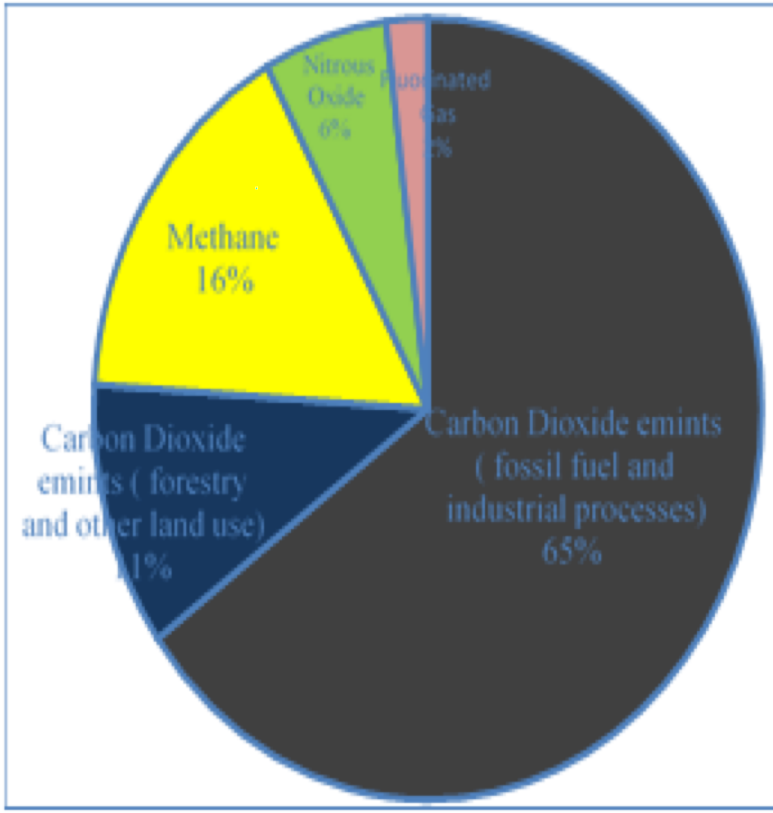
- As per the environmental Kuznets curve (EKC) hypothesis, environmental degradation and economic growth are related through the inverted U-shaped curve.
- Initially environmental degradation rises with increasing level of income or economic growth. After reaching a certain maximum point, then it begins to decline with further increase of economic growth (Kuznets, 1955) .



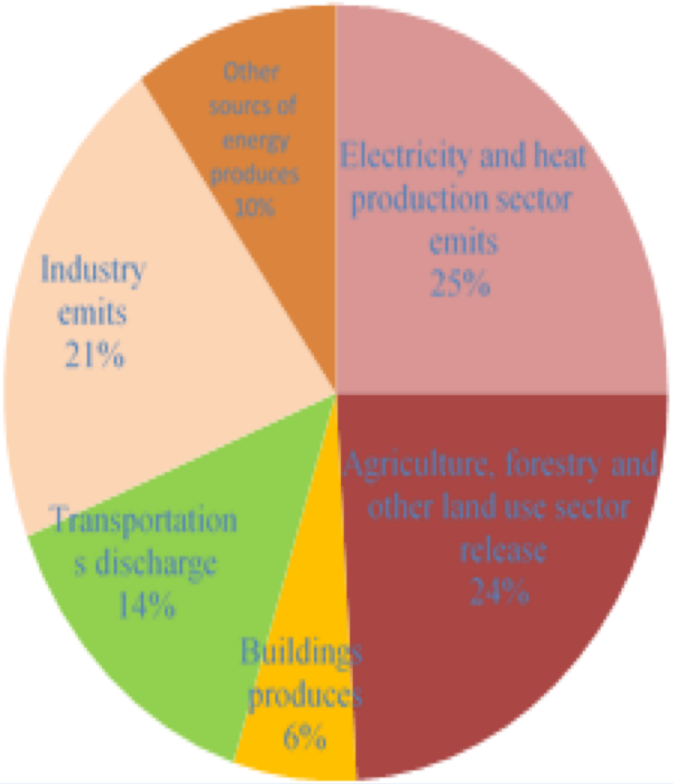
(A) a complete trajectory of inverted U-shape EKC, (B) Peaks and trough of EKC for shaping cubic polynomial association of environmental degradation through per capita income

Global GHGs emissions, by A) sources and B) sectors (%)

A



B



Source: IPCC (2014) [p. 46 & 47]

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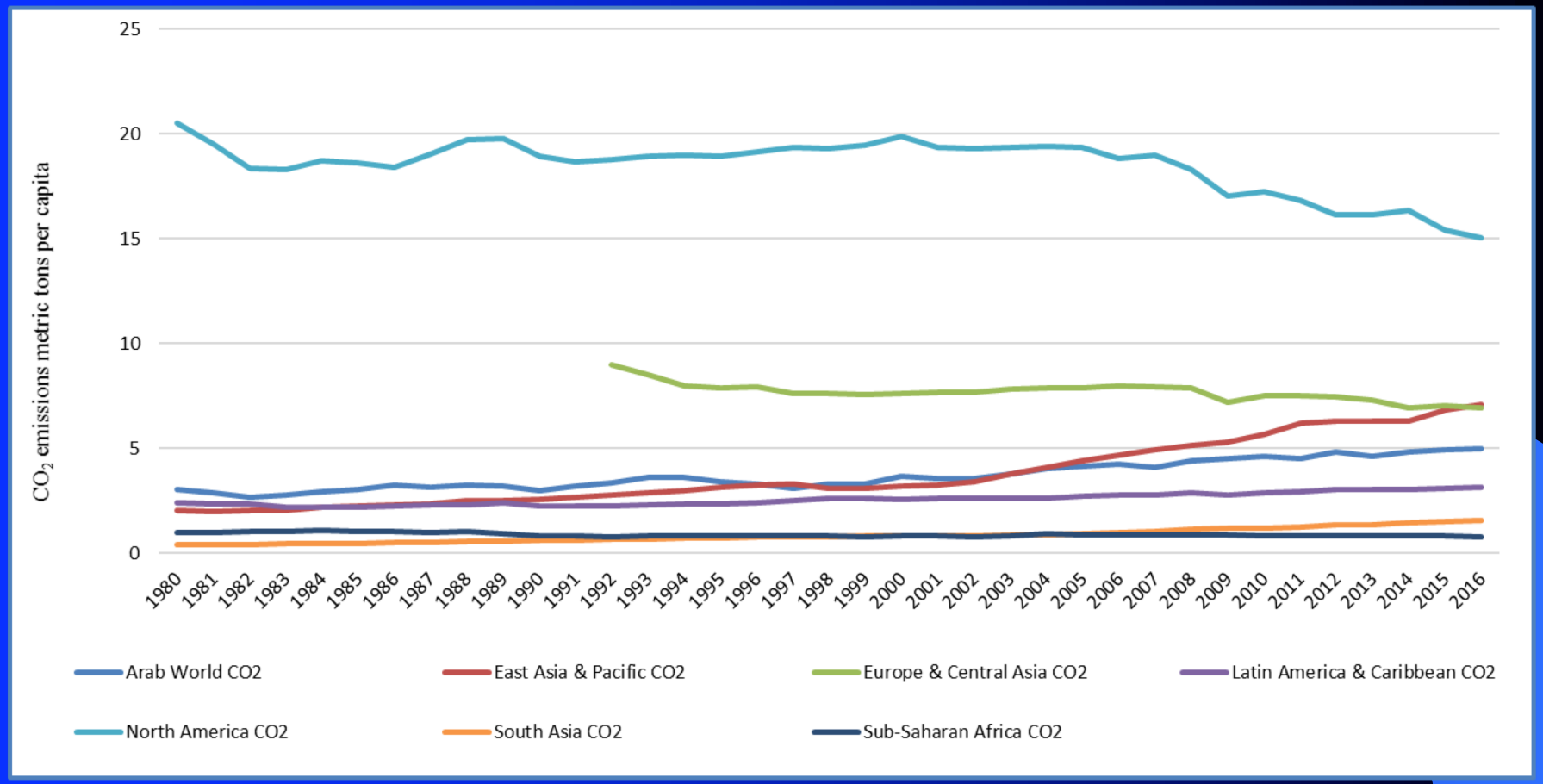
Worldwide per capita carbon dioxide (CO_2) emissions, 1980-2016



Source: World Development Indicators, (WDI, 2017)

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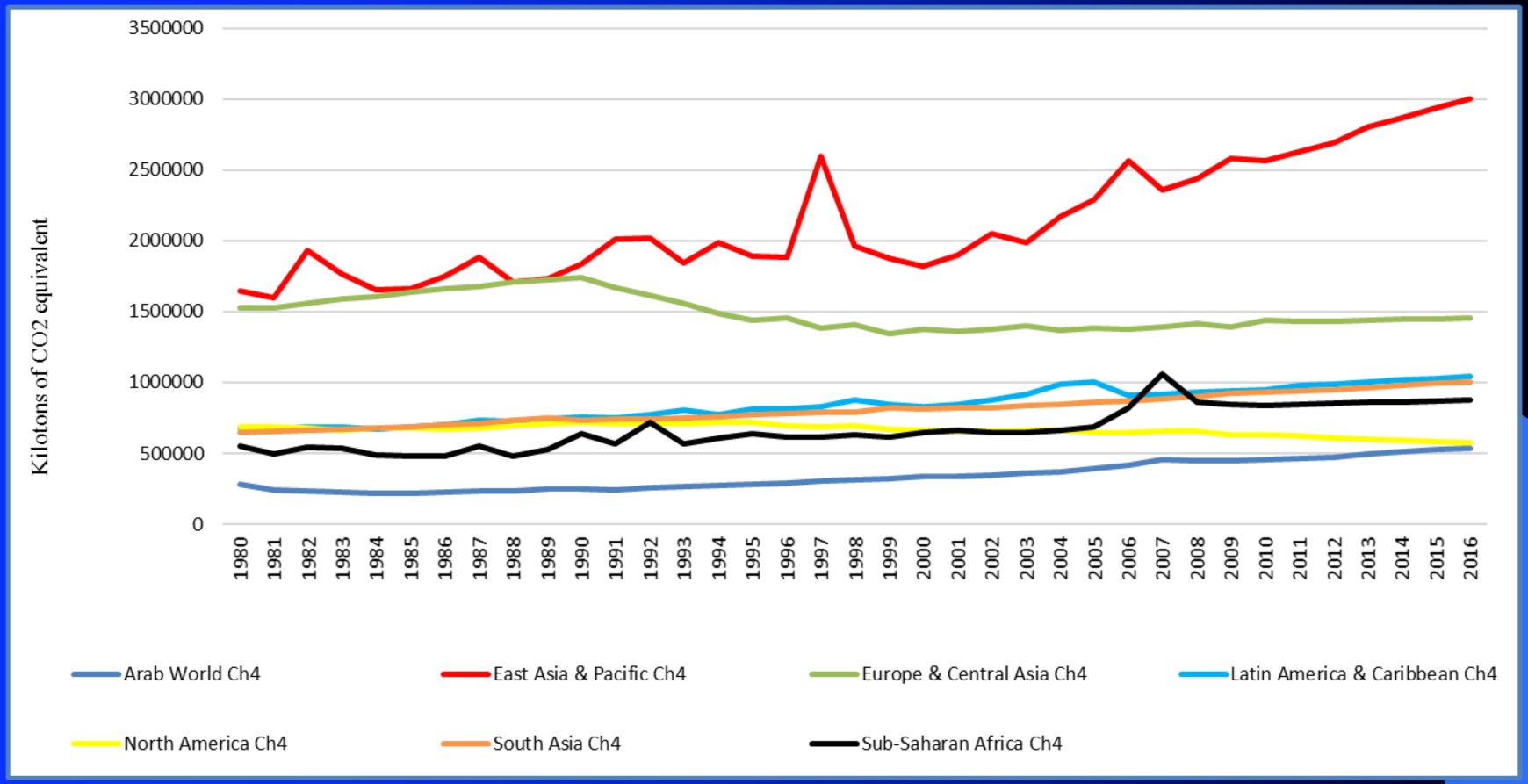
Worldwide methane (CH_4) emitters, 1980-2016



Source: World Development Indicators, (WDI, 2017)

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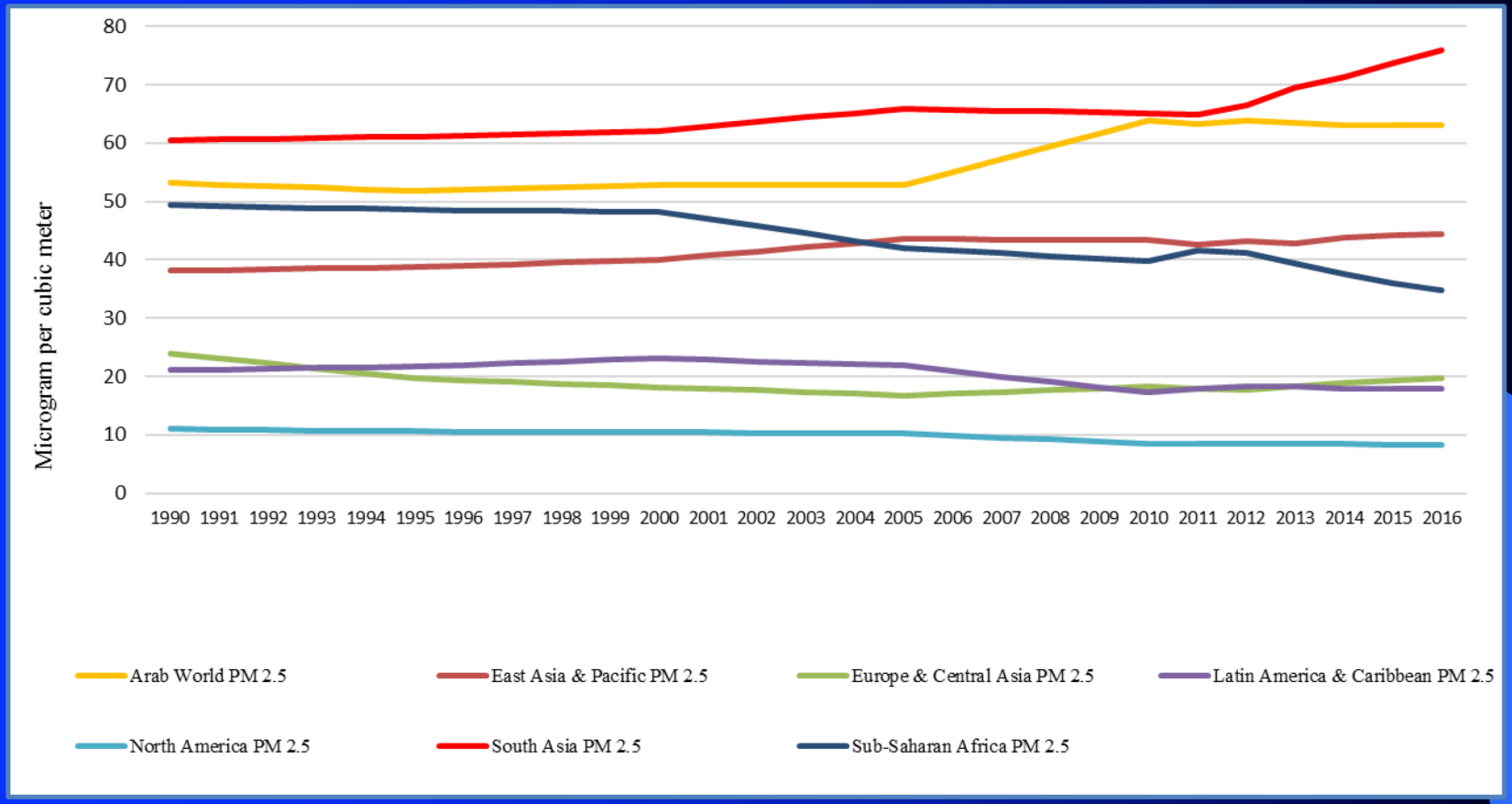
Global particulate matter ($PM_{2.5}$) emissions, 1990-2016



Data & Methodologies

Data:

- Panel data from 115 countries
- Data sample period from 1990 to 2016
- World Development Indicators (CD-ROM, 2018)

Regression Model:

$$ED = f(\text{GDP}, \text{GDP2}, \text{EC}, \text{TO}, \text{UR})$$

Where, ED = Environmental Degradation (CO2, CH4, PM2.5)

GDP= Gross Domestic Product per capita constant 2010 US dollar

EC = Energy Consumption kilogram of oil equivalent per capita

TO = Trade Openness is the share of total export & import of GDP

UR = Urbanization is the share of urban population of total

CO2= Carbon-dioxide in metric tons per capita

CH4= Methane in kilogram tons of CO2 equivalent

PM2.5=Particulate matter in microgram per cubic meter

Data & Methodologies (Cont.)

Methodologies

- Cross-sectional Dependence Tests: Pesaran (2004) , Frees (1995), and Friedman (1937)
- Panel unit root tests: Fisher ADF & PP, IPS (2003), Pesaran (2007)
- Panel cointegration tests: a) Pedroni (2004) panel cointegration test
  b) Westerlund (2007) panel cointegration test
- Panel Dynamic Ordinary Least Square (DOLS) test
- VECM based Granger causality test
- Impulse Response & Variance Decomposition test

Main Findings

- Pesaran (2004), Frees (1995) & Friedman (1937) CD test reject the null hypothesis of cross-sectional independence.
- Pedroni (1999, 2004) and Westerlund (2007) panel cointegration test reveal the long run cointegration relationship between the variables
- DOLS result reveal that GDP growth & energy consumption have significant positive impact causing CO2, CH4 & PM2.5 in all the panel income groups
- TO causes CO2 emissions especially in low & lower-middle income countries
- VECM based Granger causality test evidenced:

  -Low income sub-panel: GDP↔CO2; EC↔CO2; TO↔CO2

  -Lower-middle income sub-panel: GDP↔CO2; TO↔CO2

  -Upper-middle income sub-panel: GDP↔CO2; EC↔CO2

Main findings Contd.

Impulse response function's (IRF) results in different panel income countries:

- IRF measure volatility of each variable by itself & impact on other variables
- We measure IRF for 10 years time

- A positive standard deviation shock given to the residual of GDP growth, the response of CO2, CH4 & PM2.5 can be seen high

- But response of CO2, CH4 & PM2.5 emissions in respective to GDP2 growth are negative after certain period in existence of EKC.

- High income countries show slightly positive trend in CH4 & PM2.5 emissions in response to GDP2 growth.

Policy Implications

- Most of the countries' CO_2 emissions are energy leaded.
- So, establish energy efficient policies
- Reducing energy use from fossil fuel is the significant measure reducing CO_2 & PM2.5
- Switching economic transition towards greener productivity
- Consumption of cleaner energy i.e. gas, renewable energy
- Switching hydroelectricity in developing countries helps to reduce emission
- Organic farming practices & effective manure management to combat against CH_4
- Preventing submergence of rice field along with sufficient fertilizer management can help to reduce CH_4 emission.

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Thank you

Questions/Feedback/ Comments

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