

HOW DOES CLIMATE CHANGE ALTER INTERNATIONAL INVESTMENT FLOWS?

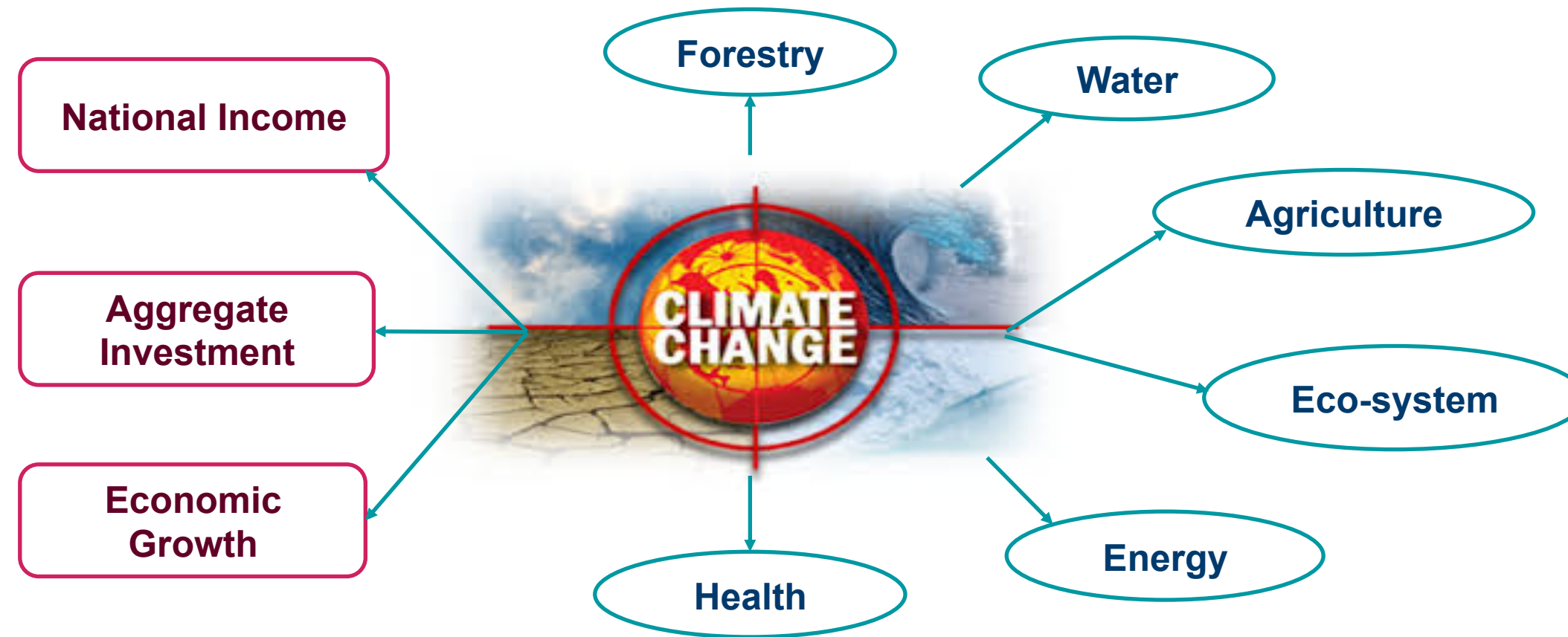
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Climate Change Impacts: Evidence

(Gallup et al., 1999; Dell et al., 2009:2012; Nordhaus, 2006; Hsiang, 2010; Heal and Park, 2014)



(IPCC, 2007; McCarthy et al., 2001; Stevanović et al., 2016; Deressa and Hassan, 2009; Tol, 2002; Watson et al., 1996)

Given the evidence, it is imperative to understand the significance of climate change and its impact on competitiveness of cross-border economic activities (e.g., foreign direct investment (FDI), international trade).

The relevance of FDI flows to climate change

FDI flows pattern are changing across sectors, economies and regions as:

(i) many real-sector activities are sensitive to climate change directly or indirectly, affecting investment flows either positively or negatively or both.

(ii) there is a substantial rise in climate and environment related FDI flows.

Overall, there is an increased attention to private investment to protect the environment, slow-down climate change and mitigate and adapt to its impacts.

(i) Climate sensitivity of real sector activities

- The 2016 World Investment Report (UNCTAD, 2016) underlines climate change as a particular external factor influencing global FDI flows.
- IPCC 2nd AR (Moreno et al., 1996) identified industries having: (i) climate-sensitive 'markets', (ii) climate-sensitive 'inputs' and (iii) direct sensitivity.
- The IPCC 4th AR (IPCC, 2007) reiterated the rising asymmetric impacts across sectors (e.g. agriculture, tourism, transportation, energy, infrastructure).
- Negative ROI forecast for many sectors, e.g., coal, oil, utilities (Mercer, 2015).
- Financial and investment risks in six broad classes (Ernest and Young, 2016)
- Global financial assets at risk stands at \$2.5 trillion (LSE by :Dietz et al., 2016)/ \$4.2 trillion (The Economist by: EIU, 2015).

(ii) Increased climate and environment related FDI flows

- Green FDI, Low-carbon FDI, Climate-smart FDI.
- Increasing financial support by the private sector – according to the Climate Policy Initiative (CPI) reports from 2011 to 2015.
- There are different scattered FDI estimates available; not comprehensive due to data unavailability and tracking difficulties.
- Available estimates suggests major recipients are Developing economies, in particular Asia and Europe.

(ii) Increased climate and environment related FDI flows

| Estimates Source | Year | Estimates of FDI flows |
|-----------------------------|-----------|--|
| UNCTAD (2010) | 2003-2009 | A cumulative \$344 bn with a steep rise over the period. |
| OECD Golub et al. (2011) | 2005-2007 | <i>Environmental</i> : \$40 bn annually (2.8% of total) compared to \$2 bn in 1989-91 (0.8% of total); and <i>EGW</i> : \$600 bn (41% of total) compared to \$58.4 bn (36.1% of total) in 1989-91. |
| UNFCCC (2014) | 2011 | \$10-37 bn (5%-17% of total) FDIIs. |
| UNFCCC (2016) | 2013-2014 | Global climate-finance flows were \$650 bn in 2011-12, \$687 bn in 2013 and \$741 bn in 2014. |
| BNEF-UNEP (2015) | 2004-2014 | Private investment in renewable energy totalled \$2019 bn. |
| fDi Intelligence (2016) | 2015 | Global FDI flows of about \$76 bn. |

Research objective and significance

To investigate how climate change affects the global FDI patterns

- Global, Regional level**
- By income level; Developed vs Developing**

Significance of the Research

- There is very limited evidence on the link between climate change and aggregate investment (Dell et al., 2012).
- Provision of estimates of the impact of climate change on aggregate FDI inflows to validate their increasing relevance.
- Insights on the heterogeneous impacts across countries from different geographical regions and income groups; relevance discussed by IPCC (1996, 2nd AR; 2007 4th AR).

Methodology (1): *Variables and Data*

| | | | | |
|---------------------------------|--|-------------------------------|---|---------------------------------|
| Dependent Variable | | Climate Variables | | |
| Aggregate FDI inflows | | Name | Detail | Source |
| Source: UNCTAD | | Temperature | In degree Celsius, mean | NCEP, NOAA/NCAR, USA/CSIRO (AU) |
| | | Precipitation | In millimetre, mean | |
| 102 Countries | 1990 to 2014 | Control Variables | | |
| | | Name | Detail | Source |
| | | GDP per capita (lnGDPpc) | Market Size and Potential (at 2010 constant US\$) | WDI, WB |
| | | Population size (lnPop) | Domestic demand and potential (Total population) | |
| | | Infrastructure (infra) | Facilities and capacities (Urbanization rates) | |
| | | Financial development (bm) | Financial depth and breadth (Broad money as % of GDP) | |
| | | Trade ratio (tr) | Trade openness (Total trade as ratio of GDP) | UN and WDI |
| | | Global financial crises (GFC) | Global financial and economic instability (GFC dummy) | - |
| Climate zone fixed-effects (CZ) | Geo positioning (Dummies for 4 zones: Topical, Sub-tropical, Temperate, and Polar and Sub-polar) | Belda et al. (2014) | | |

Methodology (2): Estimation Process

$$\ln FDI_{it} = \alpha + \beta_1 \log GDP_{pcit} + \beta_2 pop_{it} + \beta_3 infra_{it} + \beta_4 bm_{gdp}_{it} + \beta_5 tr_{it} + \beta_6 GFCdummy_{it} + \beta_7 temp_{it} + \beta_8 prec_{it} + CZ_i + Y_t + \mu_{it}$$

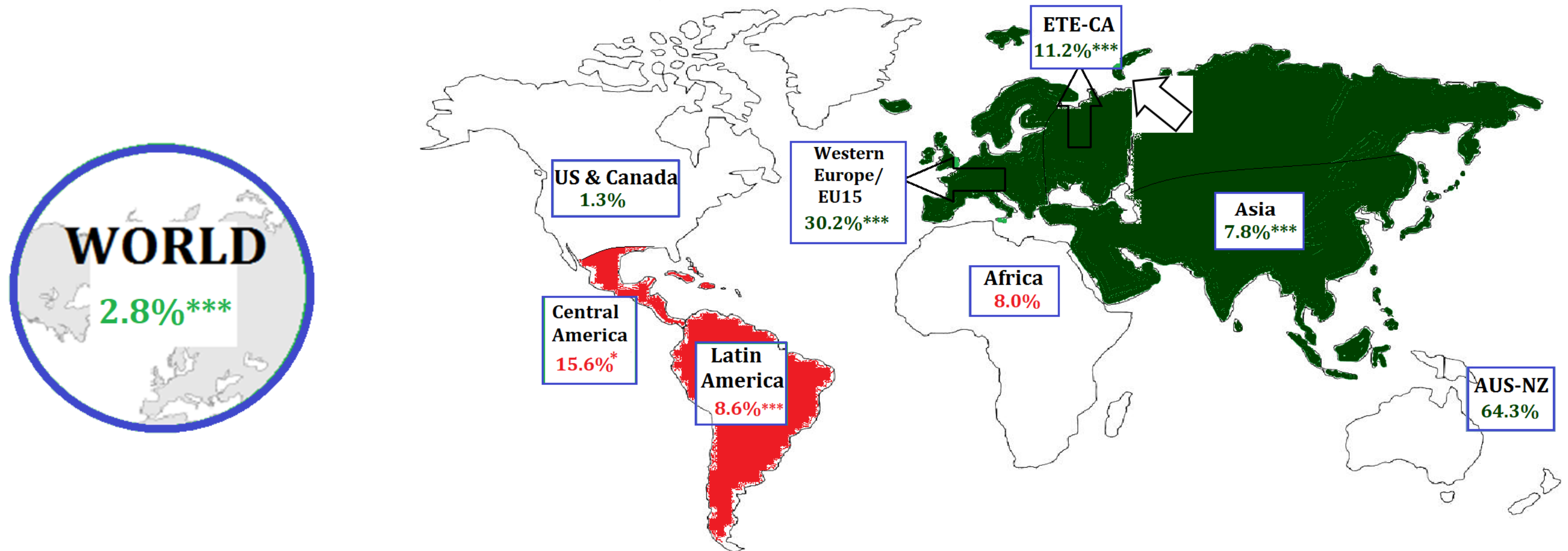
3 Step Estimation

Using regression with **Prais Winsten Panel Corrected Standard Errors (PCSE)**; accounting for Heteroskedasticity, Serial correlation, Cross-section dependence and Multicollinearity

| 1. World | 2. By Region | 3. By Economic Levels |
|----------------------|---|---|
| All Countries | (i) USA-Canada (ii) Central America (iii) Latin America (iv) Western Europe/EU-15 (v) ETE-Central Asia (vi) Africa (vii) Asia (viii) Australia-New Zealand | (i) Developed Countries (HICs) (ii) Upper Middle Income Countries (UMICs) (iii) Lower Middle Income Countries (LMICs) (iv) Low Income Countries (LICs) |

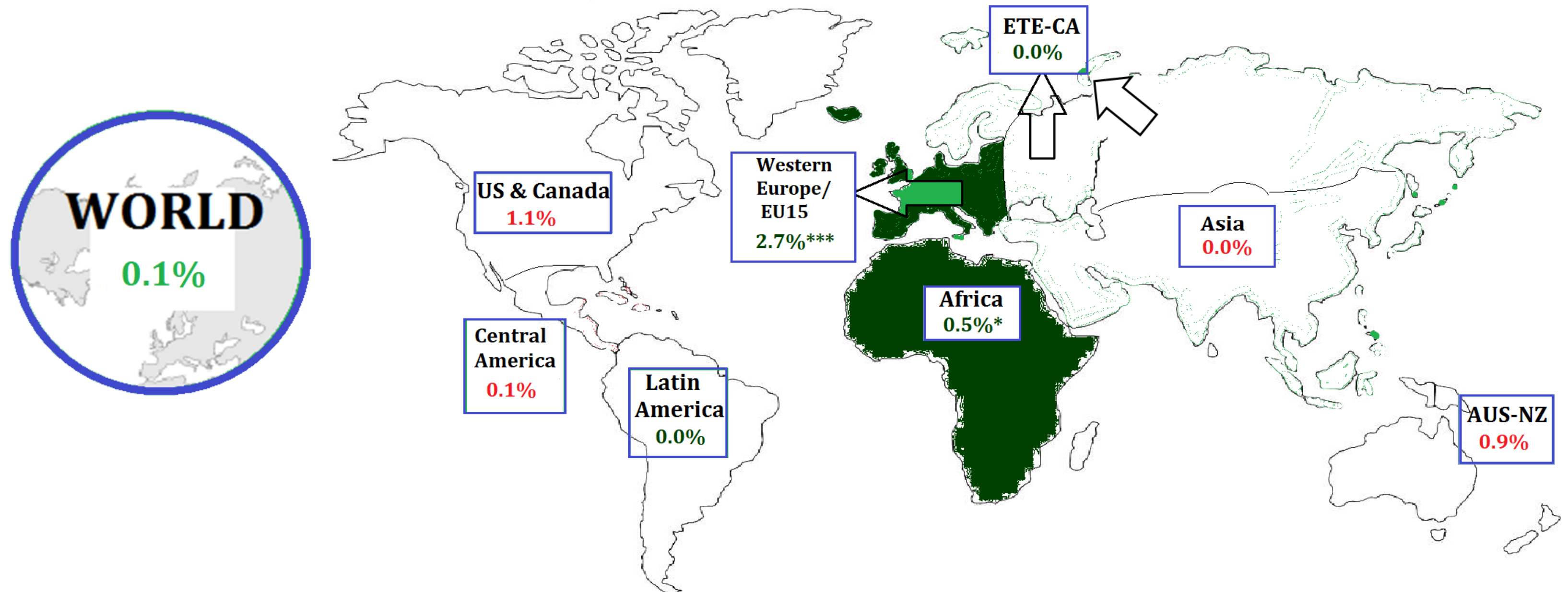
RESULTS (1): Regional Impacts of Temperature

Colour Codes: **GREEN**: Positive Impacts; **RED**: Negative Impacts
Significance Levels: *** = 1%, ** = 5%, and * = 10%
Only significant regions are shaded

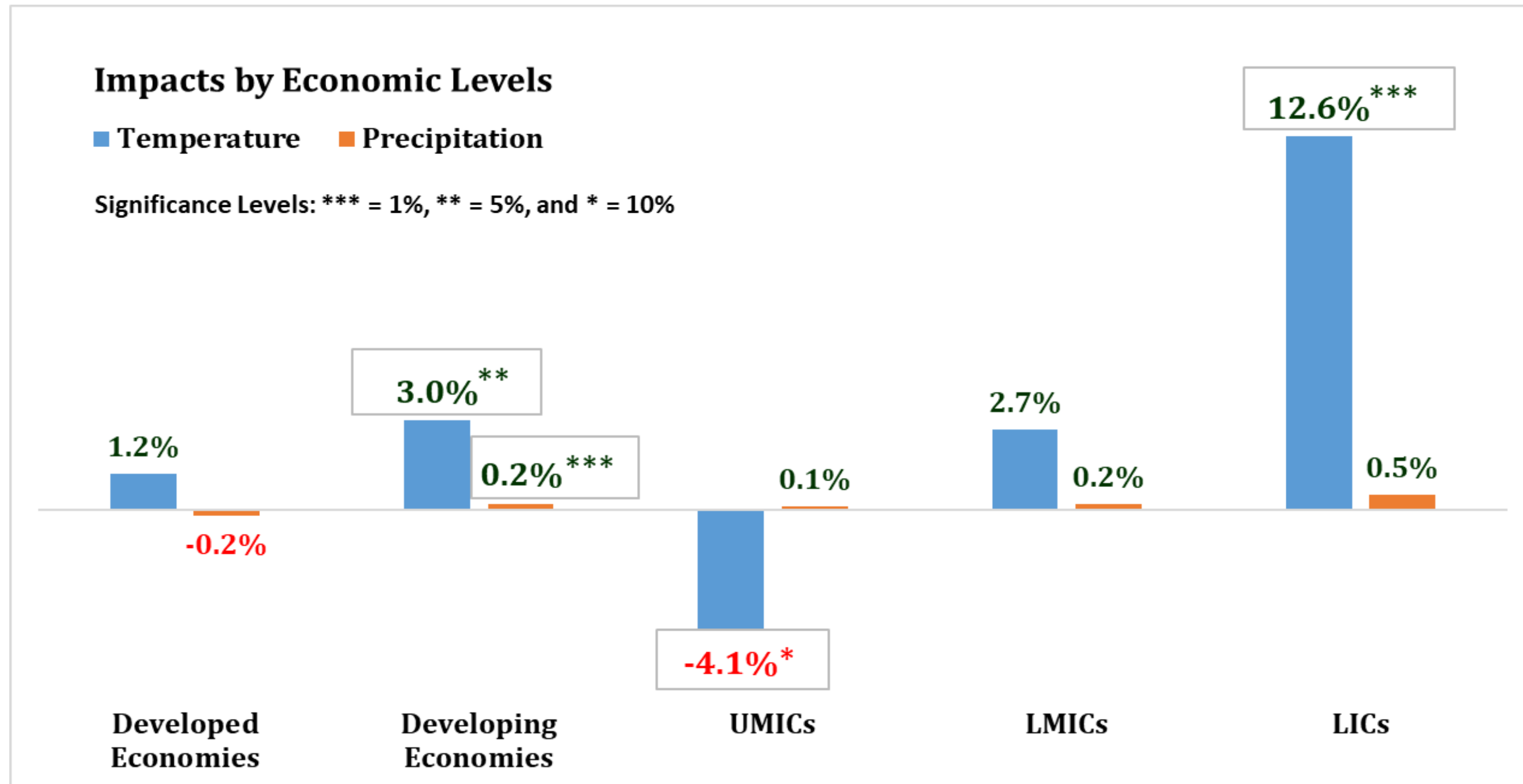


RESULTS (2): Regional Impact of Precipitation

Colour Codes: **GREEN**: Positive Impacts; **RED**: Negative Impacts
Significance Levels: *** = 1%, ** = 5%, and * = 10%
Only significant regions are shaded



RESULTS(3): Impact by Economic Levels



Findings

- Temperature increases positively impact global FDI inflows. This is more prevalent in Asia, Europe, and Lower Income Countries (LICs).
- This finding is consistent with factual data showing that
 - Europe and Asia have received higher level of investments in renewable energy and carbon-decoupling projects; and
 - Developing economies have received higher level of investments oriented to climate resilience and mitigation projects.
- Precipitation increases alter the global distribution of FDIs, particularly in Western Europe and Africa; and Developing economies in general.

Conclusion

- Available data and studies show that the FDI's role is increasing in developing regional physical capacity and resilience (Stadelmann, 2013; Corfee-Morlot et al., 2009).
- Results indicate that Climate Change has an effect on the global allocation of International Investments.
- The findings of evidence that climate change impacts FDI flows differentially by region and economic level. Further research on sectoral FDIs could provide valuable insights.
- There is a need for tailored investment policies at both national and international levels to ensure climate change mitigation financing to most needed economies.

Thank you for listening



QUESTIONS AND ANSWERS



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