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FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL

# Quantifying the Evidence on Environmental Migration: A Meta-Analysis on Country-Level Studies


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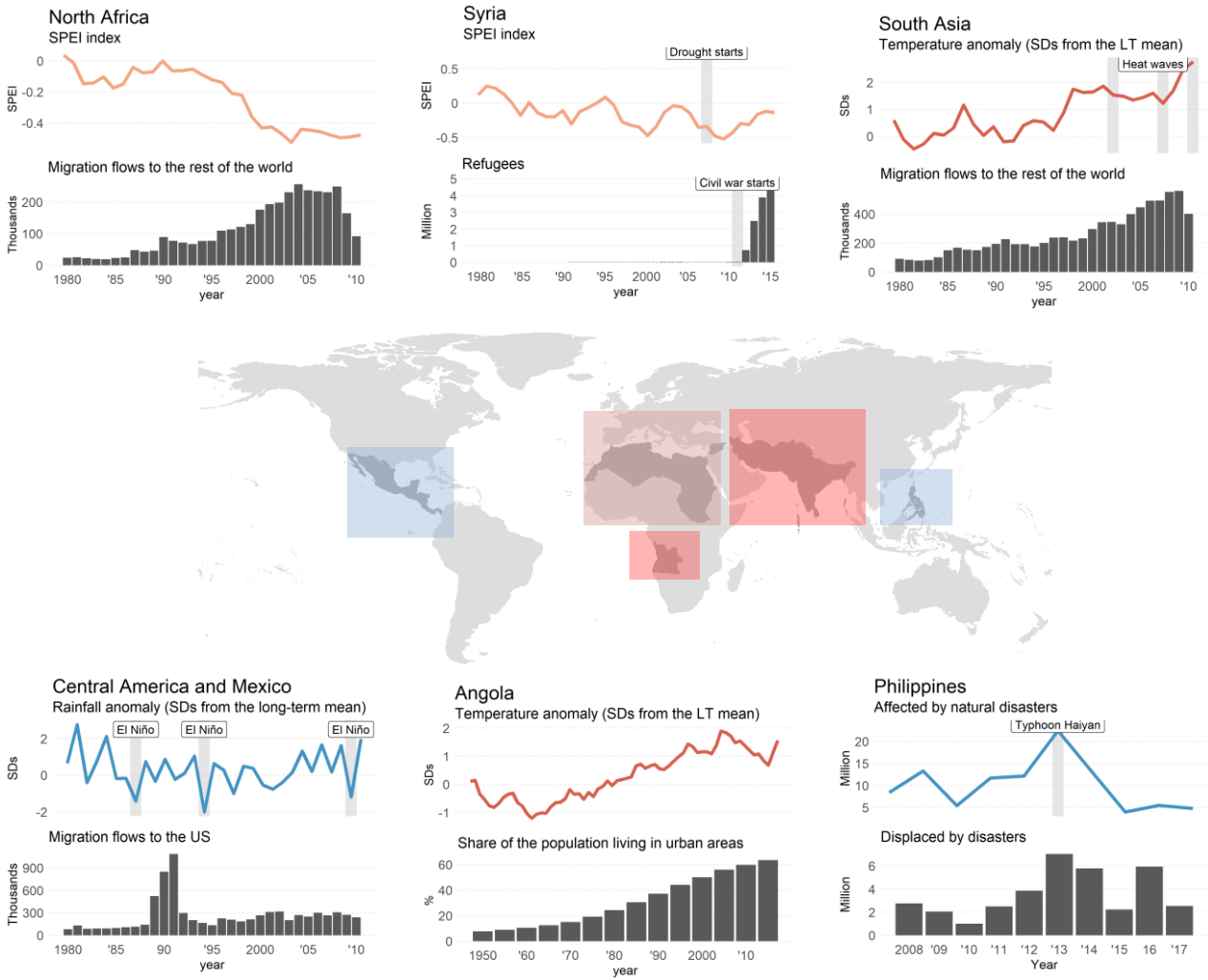
# Environmental Migration Worldwide



# Motivation

- Increasing **number of quantitative studies** in the past years
- Ranging from case-studies in highly localized settings to macro studies analyzing global migration flows
- Majority agrees that **environmental conditions are important** for human mobility
- Very different conclusions in what way and how strongly migration depends on environmental factors

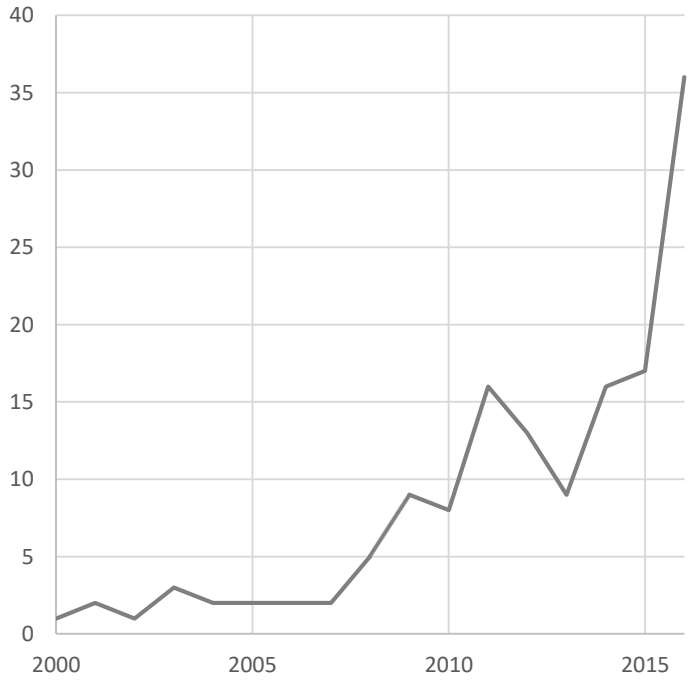



Fig - Number of quantititative studies on environmental migration since 2000

# Contribution and Aims

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- Comprehensively synthesize the statistical evidence on environmental migration using **a meta-analytical approach**
- Obtain statistical **estimates of the size** of internal and international environmental migration worldwide
- Study **heterogeneities** across studies and explore mechanisms focusing on:
  - Type of environmental shocks
  - Migration type
  - Contextual characteristics

# Meta-Analytical Approach

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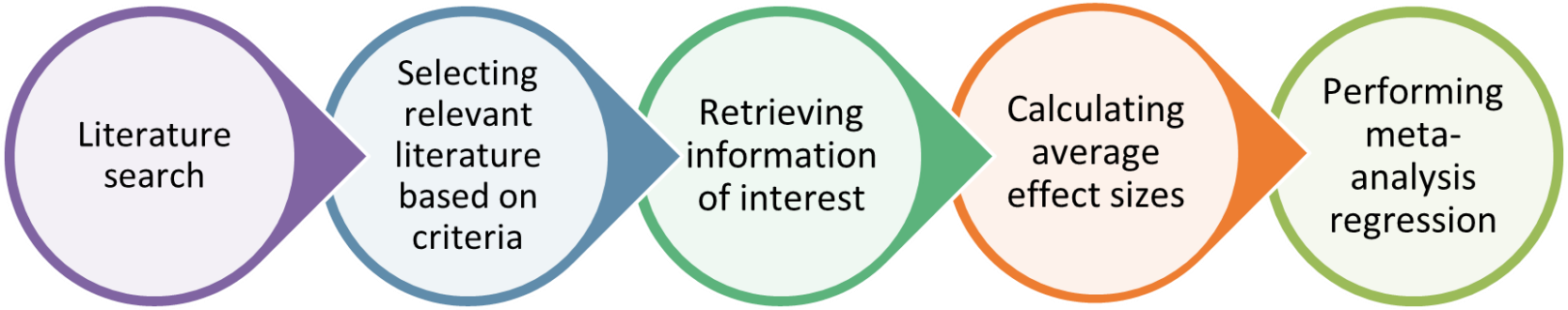
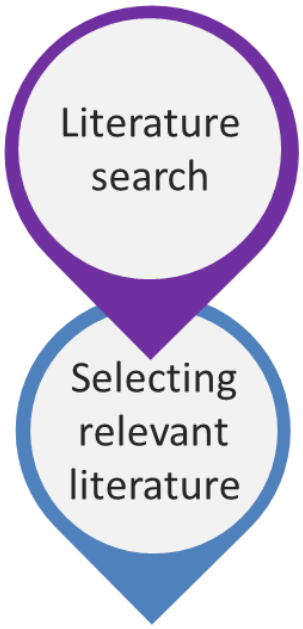
- Meta-analysis **synthesizes and pools the evidence** from quantitative studies allowing for a unified and comprehensive interpretation of existing findings (Hsiang et al. 2013)



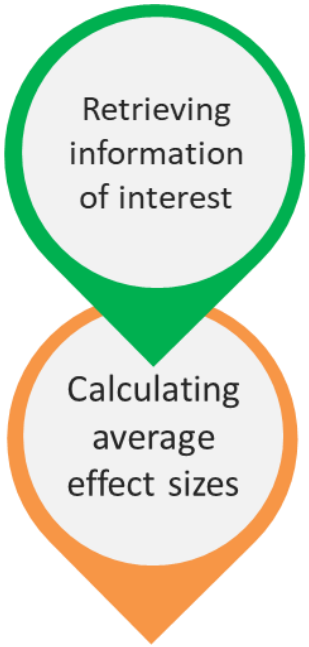

- Two recent meta-analyses on climate induced migration by Beine and Jeusette (2018) and Sedova and Kalkuhl (2018)
- **Our contribution**: Use of original coefficients and standardization allowing to study the size of the environemntal effects

# Step 1 & 2 - Screening Studies




- Broad search using scientific search engines identifying more than 150 relevant studies. Followed by step-by-step selection and screening
- For comparability, focus on **macro studies** estimating environmental effects over time using country-level data. Studies look at international and internal migration
- Total: 30 studies with more than **1800 separable coefficients** as study-lines

# Step 3 & 4 - Obtaining Effect Sizes




**Study lines:**

$$M_{jt} = \alpha + Env_{jt}\beta + X_{jt}\gamma + \theta_j + \delta_t + \varepsilon_{jt}$$

Migration rate | Environmental effect | Additional controls | Error terms

- Inclusion of all $\beta$ coefficients related to any environmental factor (pooling), i.e. precipitation, temperature, draught, rapid-onset
- **Main challenge**: coefficients are not comparable across study lines ➔ **Standardization** of coefficients to reach comparability

# Step 4 - Standardization of Coefficients


**1. Retrieving summary statistics** on distribution of key variables from papers, by contacting authors, and from original data online

$$\beta_{im}$$
$$\sigma_{M,im}$$
$$\sigma_{E,im}$$

$$\beta_{stan,im} = \beta_{im} \cdot \frac{\sigma_{M,im}}{\sigma_{E,im}}$$

**2. Calculating standardized coefficients** (harmonized scale): sd change of migration outcome by 1 sd change in env. factor

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# Step 5 - Meta-Regressions

Performing meta-regression

$$\beta_{stan,im} = \mu + D_{im}\delta + u_{im}$$

**Characteristics of environmental factors**: Type, lag, and interactions

**Migration type**: internal vs international, destination region

**Specification**: model controls for past migration, income, conflict, etc.

**Context**: wealth level, agricultural dependence, region

**Further controls:** Sample size, fixed effects, year, published, table, etc.

# Study Line Composition

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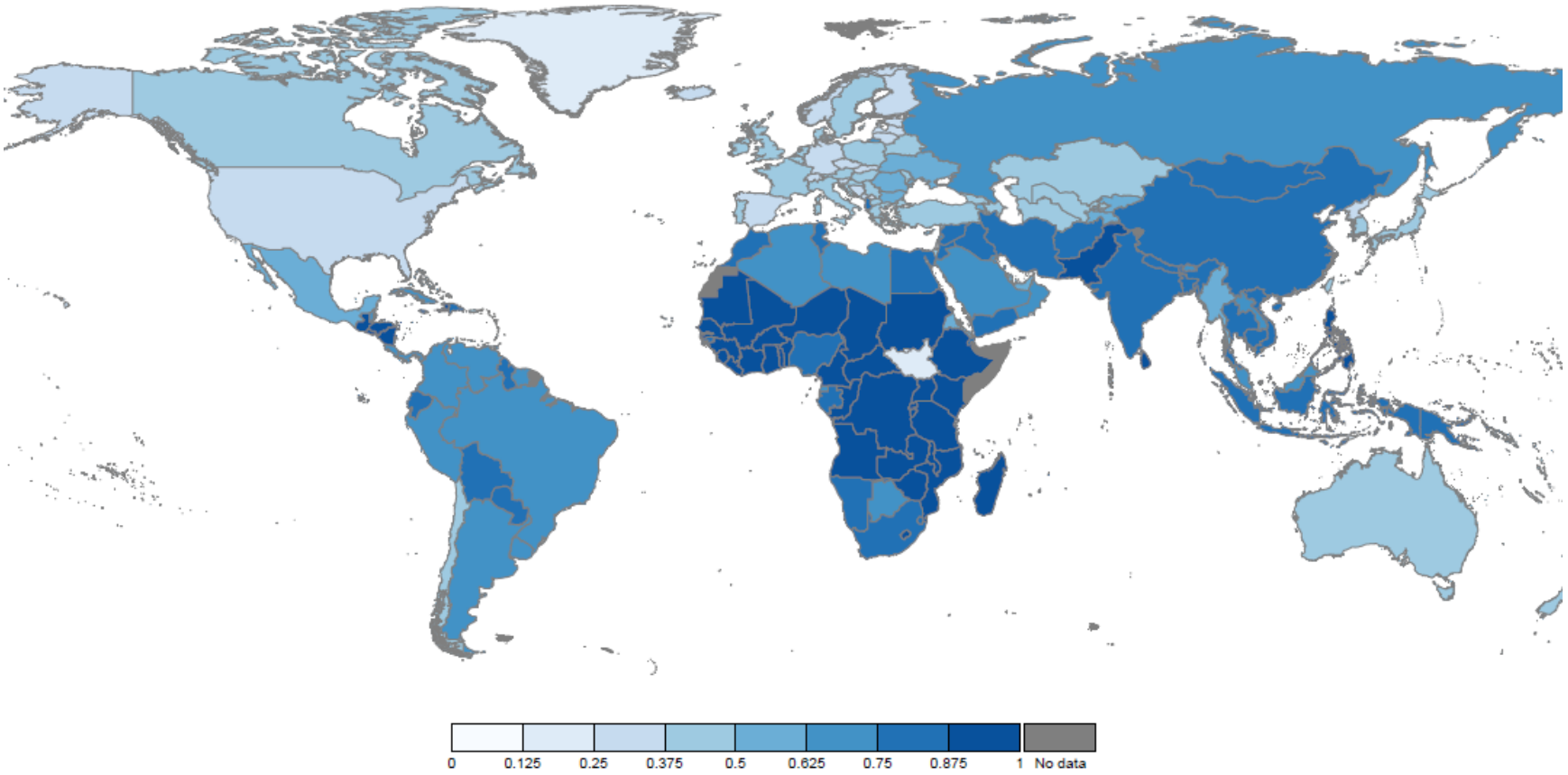
Studies focus on different parts of the world



# Measuring Sample Composition

- **Regions**: Share of countries in study-line sample from:
  - Sub-Saharan Africa
  - Latin America and Caribbean
  - Middle East and North Africa
  - South/East/Southeast Asia
- **Wealth**: Share of countries which are:
  - Low-income
  - Middle-income
- **Agriculture**: Share of countries in sample, which are agriculturally dependent (top quartile of all countries in terms of agr. share in GDP)
- **Conflict:** MEPV data 1960-2000, % countries with conflicts for 10>years

# Sample Compositions

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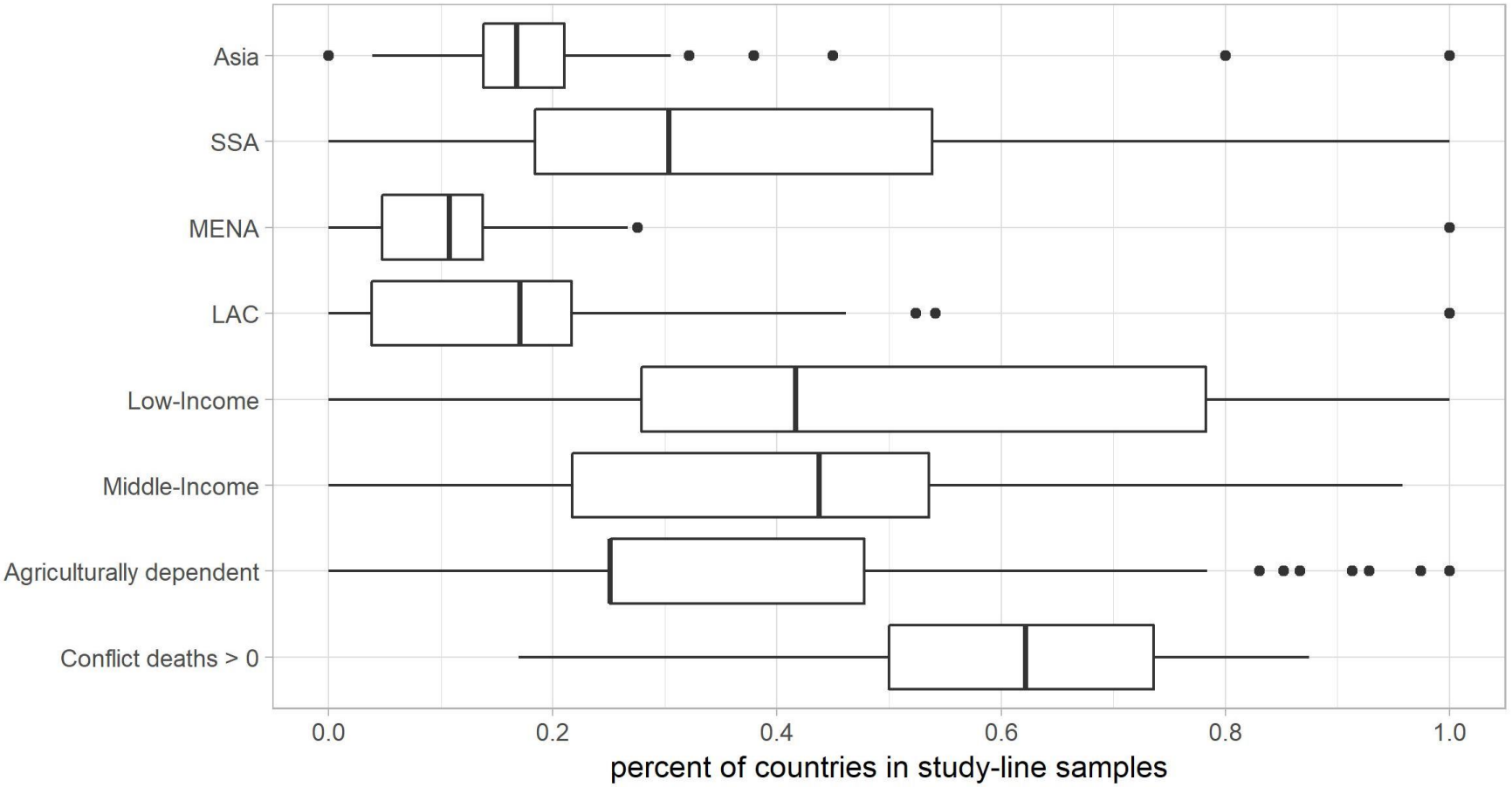
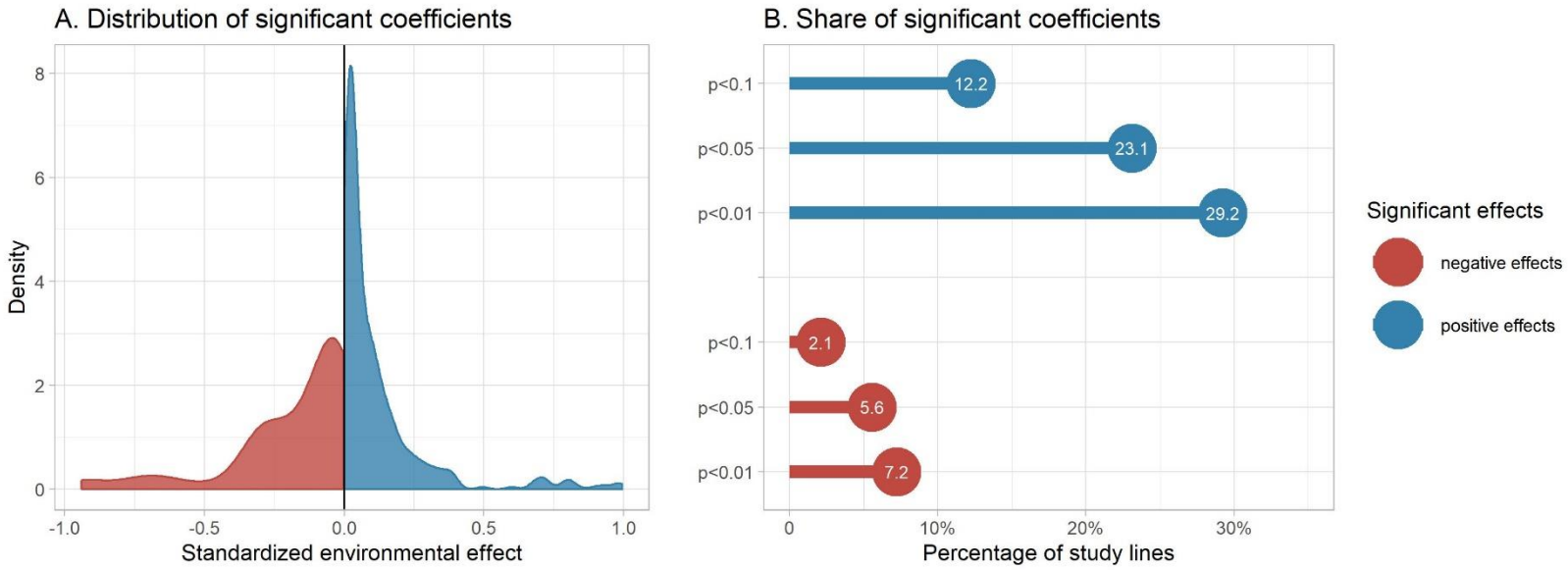
## Samples span a wide range of characteristics



# Average Standardized Effect Sizes

A large share of studies report a significant positive relationship between environmental hazards and migration



# Heterogeneities Across Studies

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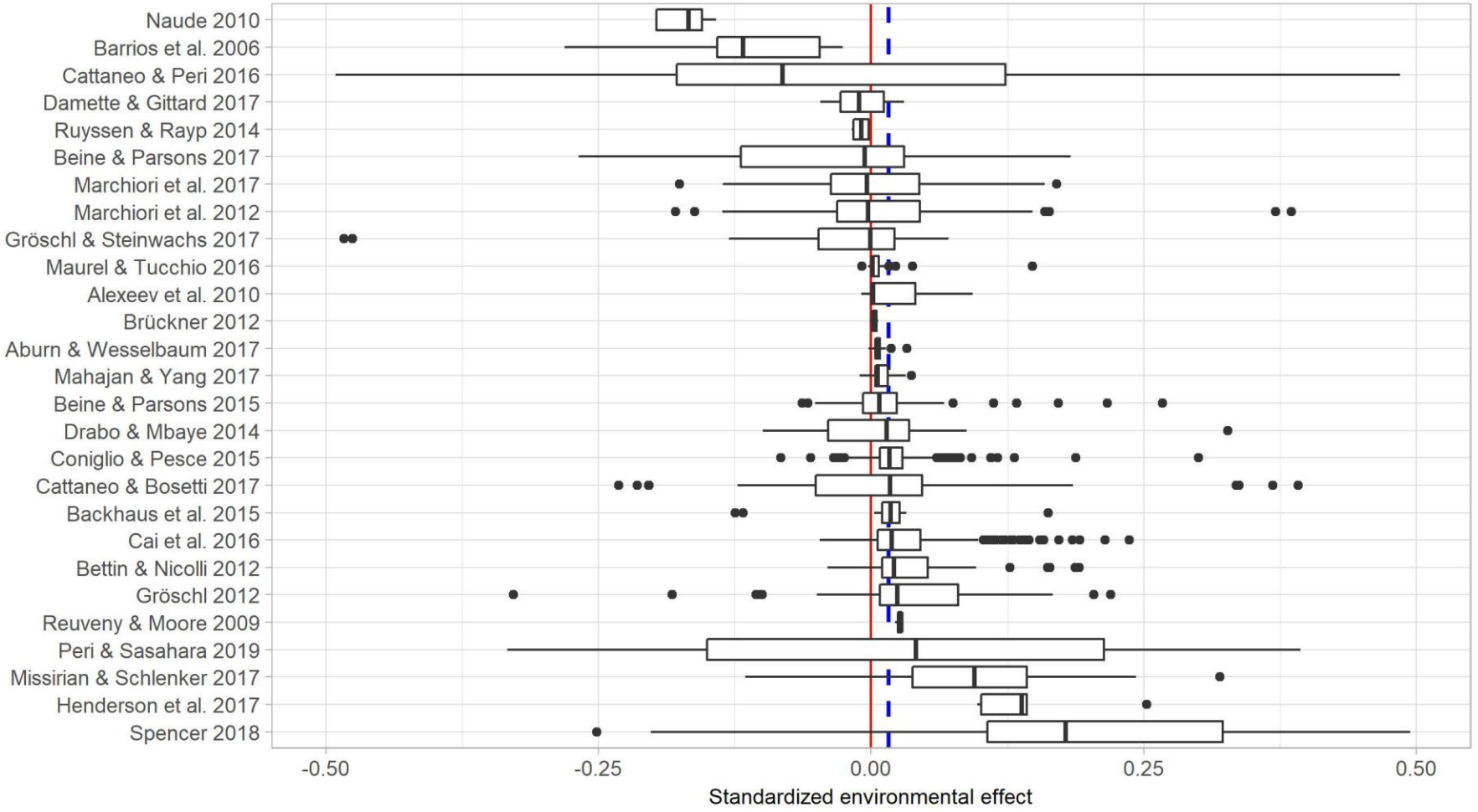
## Distribution of standardized effects across and within studies



# Type of Environmental Hazards Matter

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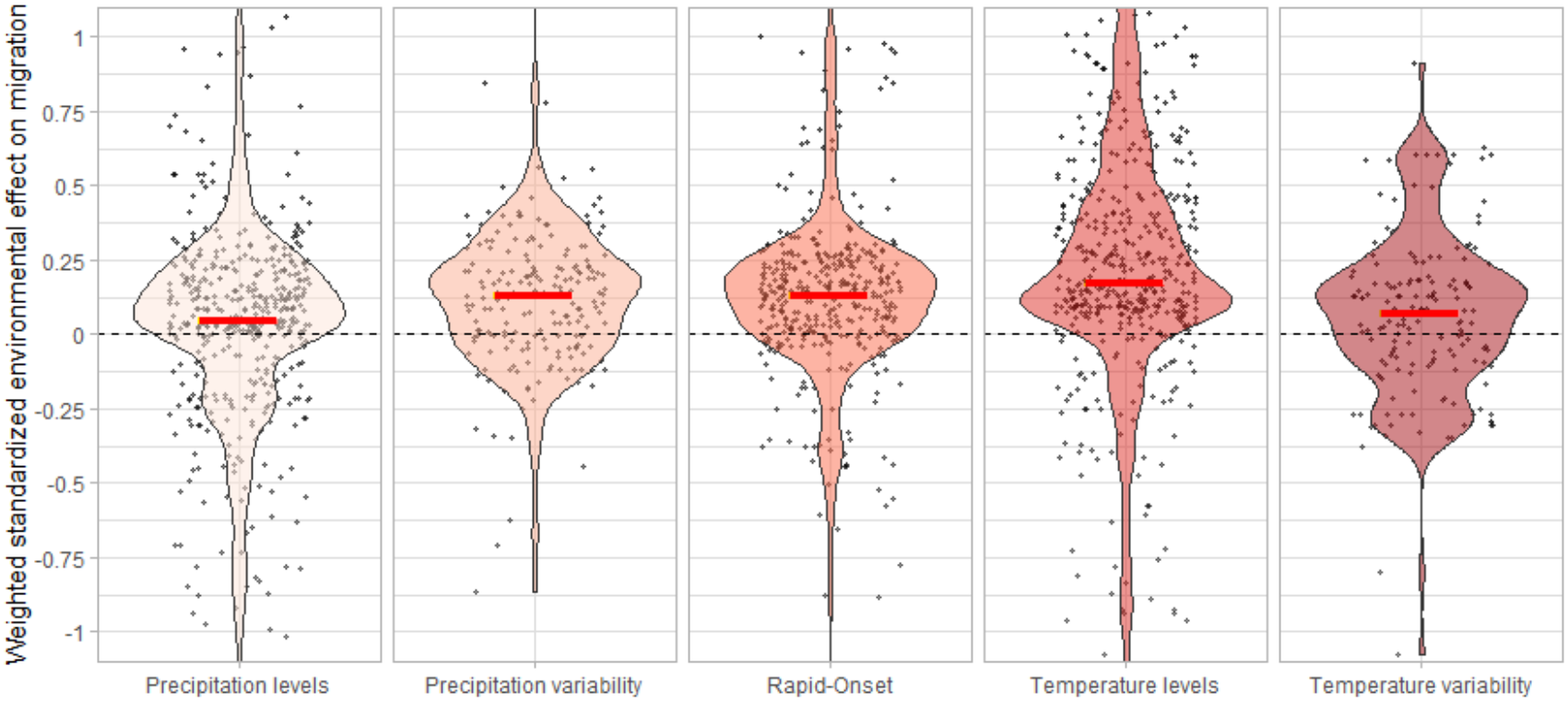
Raising temperatures, changes in precipitation variability, and rapid-onset events have the strongest effect on migration outcomes



# Context Shapes Relationships

## Fixed Effects Meta Regressions (extended table)

| | Outcome: Standardized environmental effect | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| **Migration destination** (*ref: international, high&low-income*) | | | |
| Internal migration | 0.004** (0.002) | | |
| International, destination only low-income countries | 0.006 (0.016) | | |
| International, destination only high-income countries | -0.002 (0.012) | | |
| **Sample composition 1** | | | |
| % countries from Asia in sample | | | |
| % countries from SSA in sample | | | |
| % countries from MENA in sample | | | |
| % countries from LAC in sample | | | |
| **Sample composition 2** | | | |
| % low-income-countries in sample | | | |
| % middle-income-countries in sample | | | |
| % agriculturally dependent countries in sample | | | |
| % conflict countries in sample | | | |
| # observations | 1,776 | | |
| R-squared | 0.093 | | |
| Adj. R squared | 0.071 | | |

Notes: Meta-regression coefficients with cluster robust standard errors in parentheses. Clustering based on year of publication. The dependent variable is the weighted standardized coefficients derived from the original study lines. All models control for study fixed effects. P-values: * 0.1 ** 0.05 *** 0.01

# Sample Composition Effects

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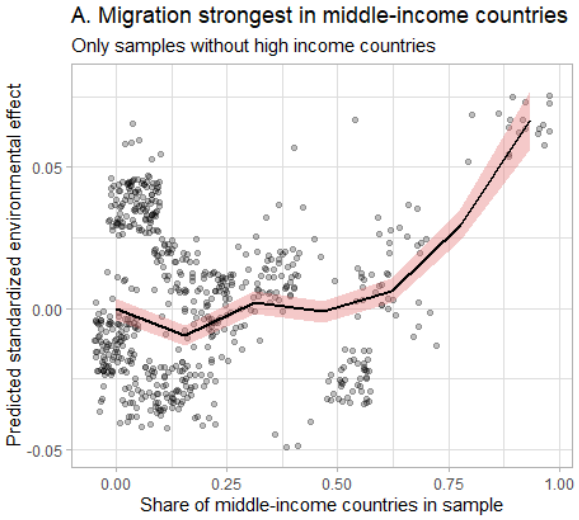
Analyzing the role of study sample composition in influencing the environment-migration relation



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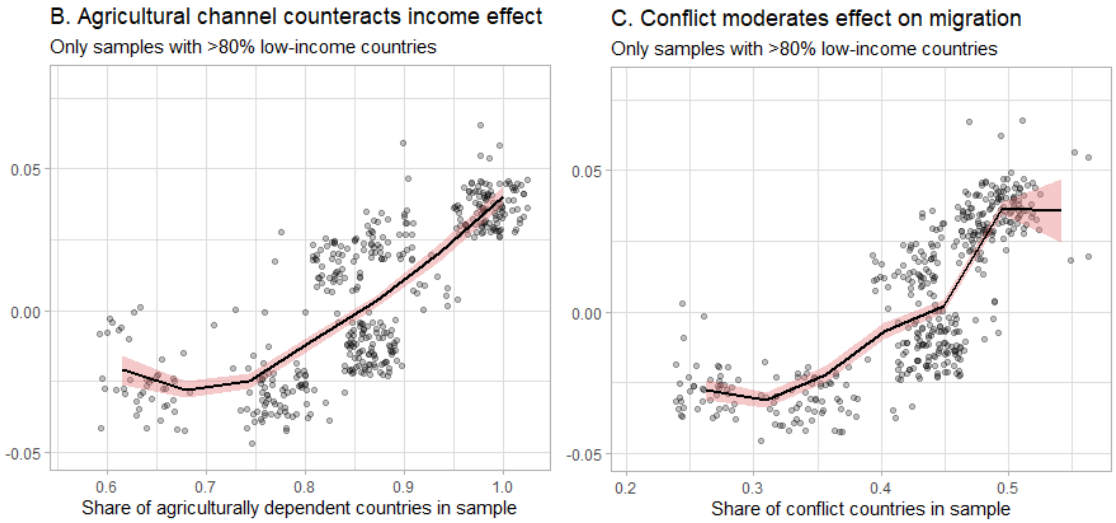

# Predictions Based on Meta Regressions

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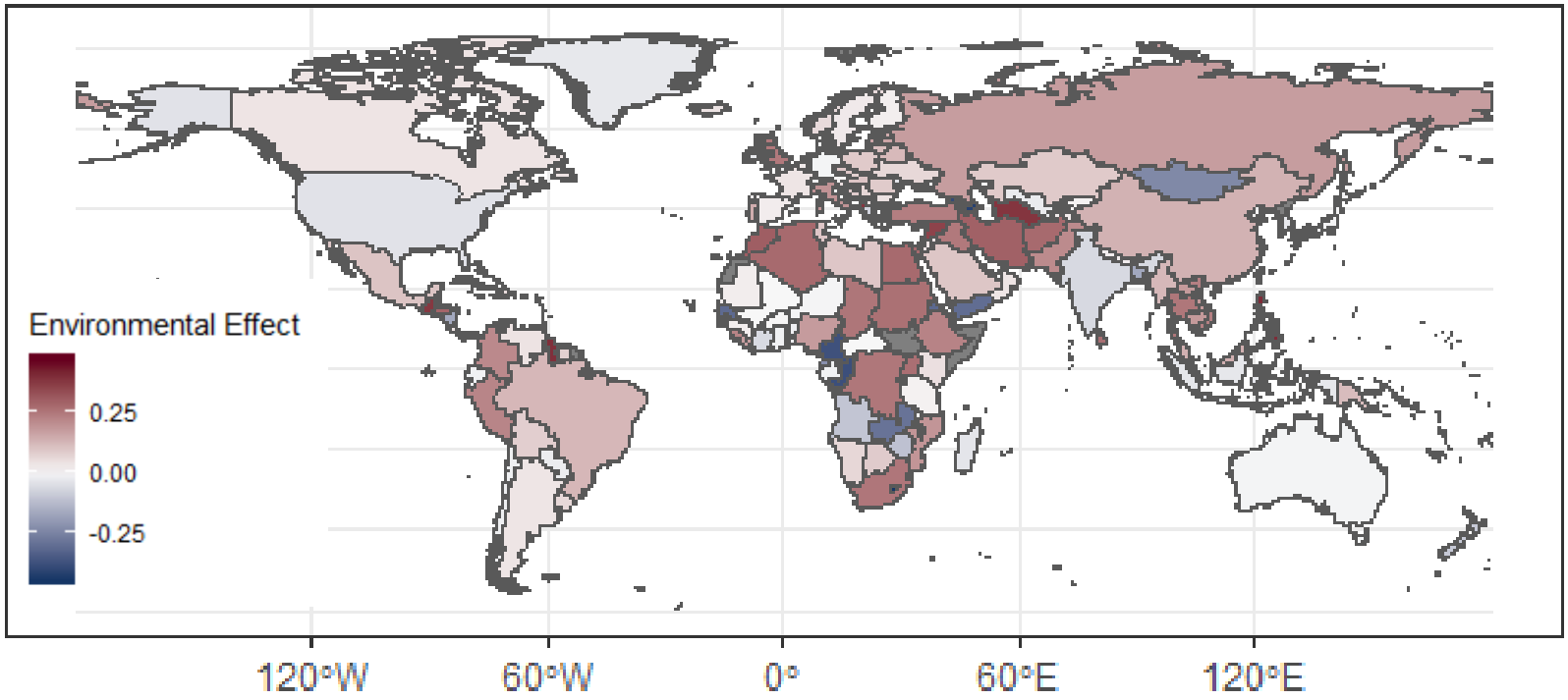
## A. Predicted environmental migration worldwide

Maps shows predicted standardized environmental effects based on meta-regressions



# Discussion and Conclusion

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- **Limitations:**
  - Necessary loss in precision and contextualization
  - Threat of ecological fallacy
  - Assumptions required for harmonization/predictions
- **Complements** and adds to findings in the previous literature
- **No deterministic relationship between environment and migration**. Effects depend strongly on type of hazard
- **Important role of context.** Conflict matters potentially both as mechanism and moderator of environmental migration

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# Thank you for your attention!

**Contact**

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# Appendix

# Introduction

- Increasing **number of quantitative studies** in the past years
- Ranging from case-studies in highly localized settings to macro studies analyzing global migration flows
- Majority agrees that **environmental conditions are important** for human mobility
- Very different conclusions in what way and how strongly migration depends on environmental factors

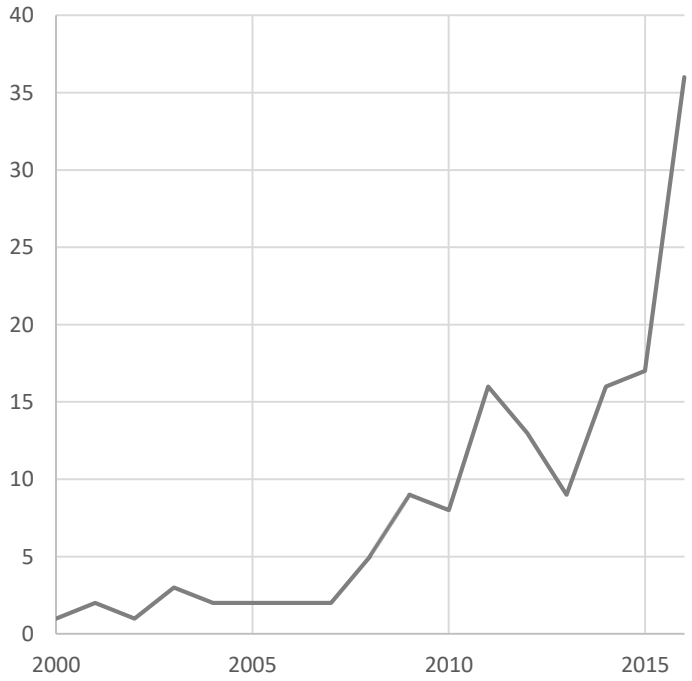


Fig - Number of quantititative studies on environmental migration since 2000

# Diversity in Findings

- **Substantial differences** in findings both between and within studies. Size of relationship depends on:
  - Population characteristics
  - Social, economic and political context
  - Considered climate measures
  - Form of migration
- **Many open questions remain**: How and under which condition do environmental shocks/changes influence migration and to what extent? (McLeman & Gemenne 2018, Black et al. 2011)

# Steps in Meta-Analysis

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Literature search

Broad search using scientific search engines identifying **more than 150 relevant studies**. Step-by-step selection. Reference screening

Selecting relevant literature

For comparability, focus on **macro studies** using country-level data (k~30, m=~1300). Focus on studies analyzing variations over time

Retrieving information of interest

**Study lines**: Focus on coefficients from linear estimation

$$M_{jt} = \alpha + Climate_{jt}\beta + X_{jt}\gamma + \theta_j + \delta_t + \varepsilon_{jt}$$

Calculating average effect sizes

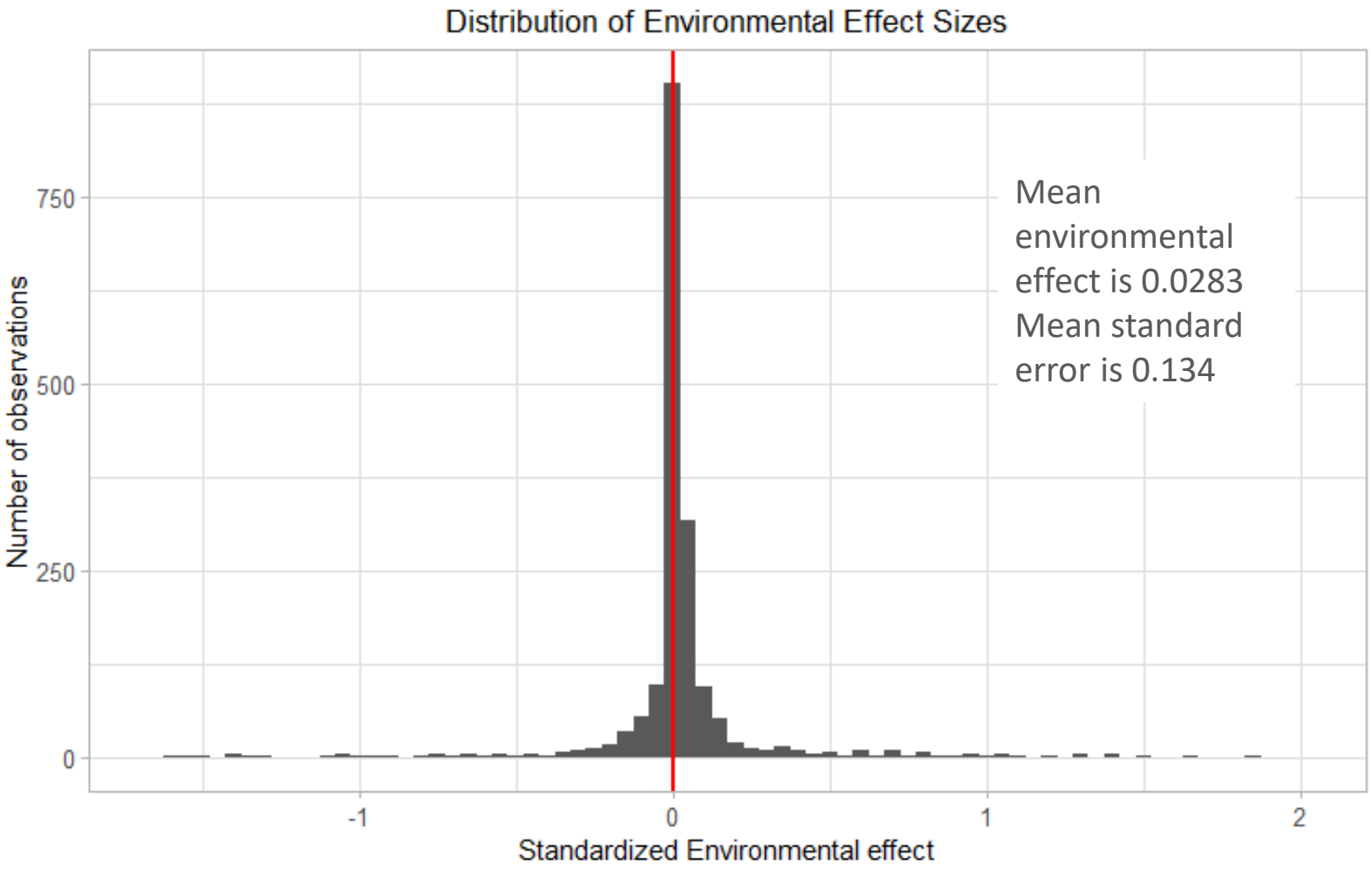
**Main challenge**: Making coefficients comparable → standardization

$$\beta_{stan,im} = \beta_{im} \cdot \frac{\sigma_M}{\sigma_{clim}}$$

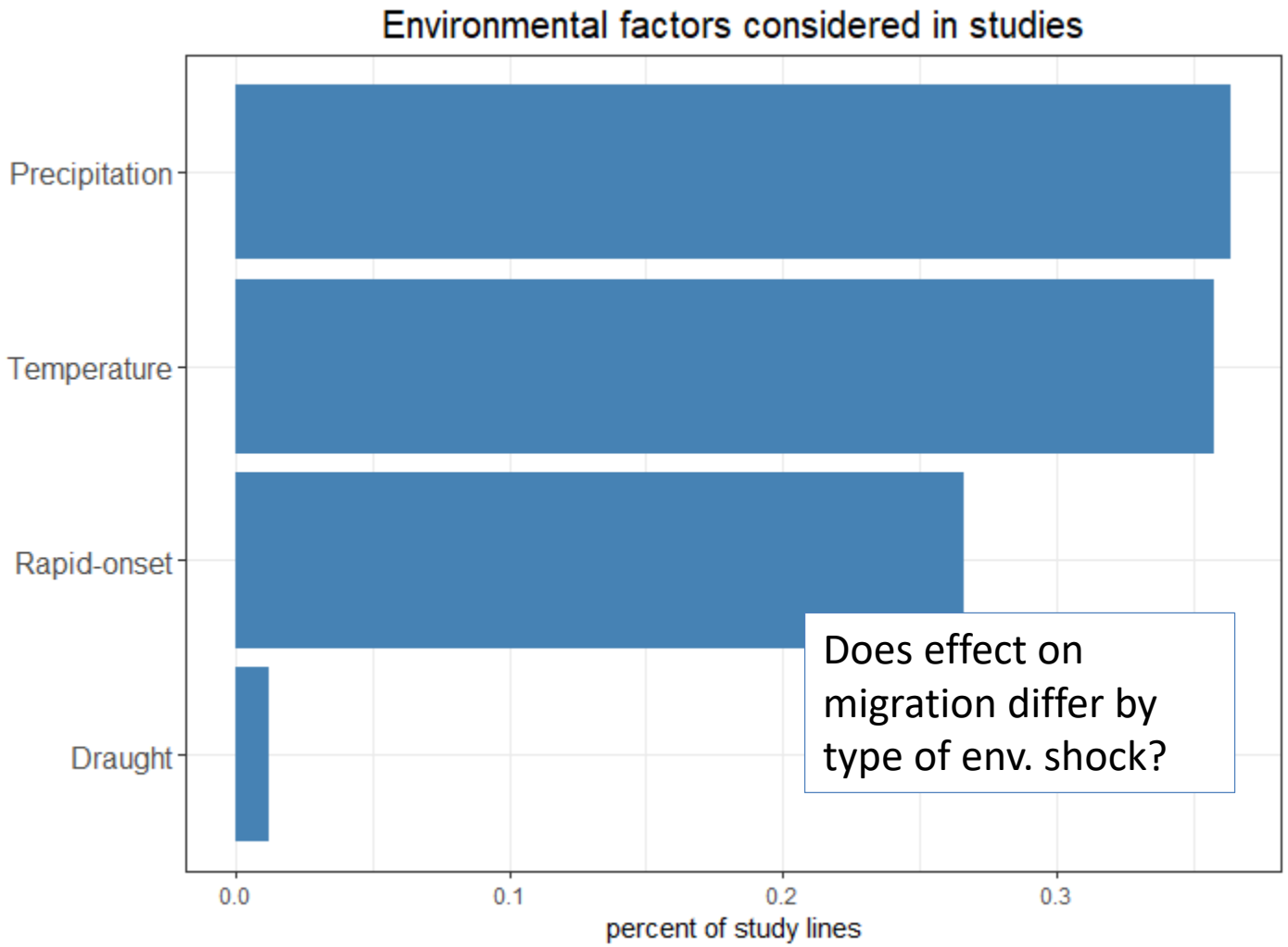
Performing meta-regression

**Meta-regression**: $\beta_{stan,im} = \mu + D_{im}\delta + u_{im}$

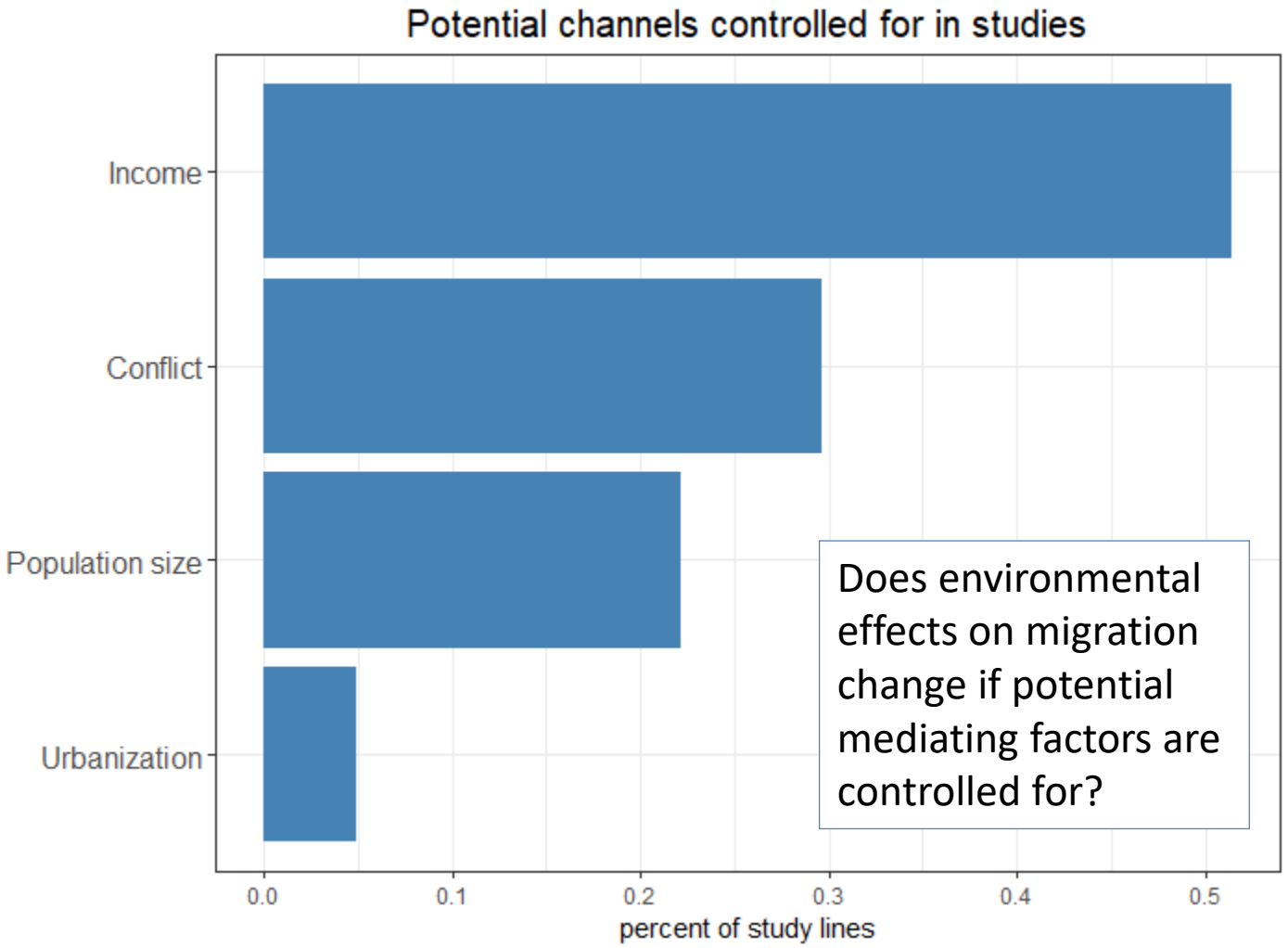
# Average Environmental Effects



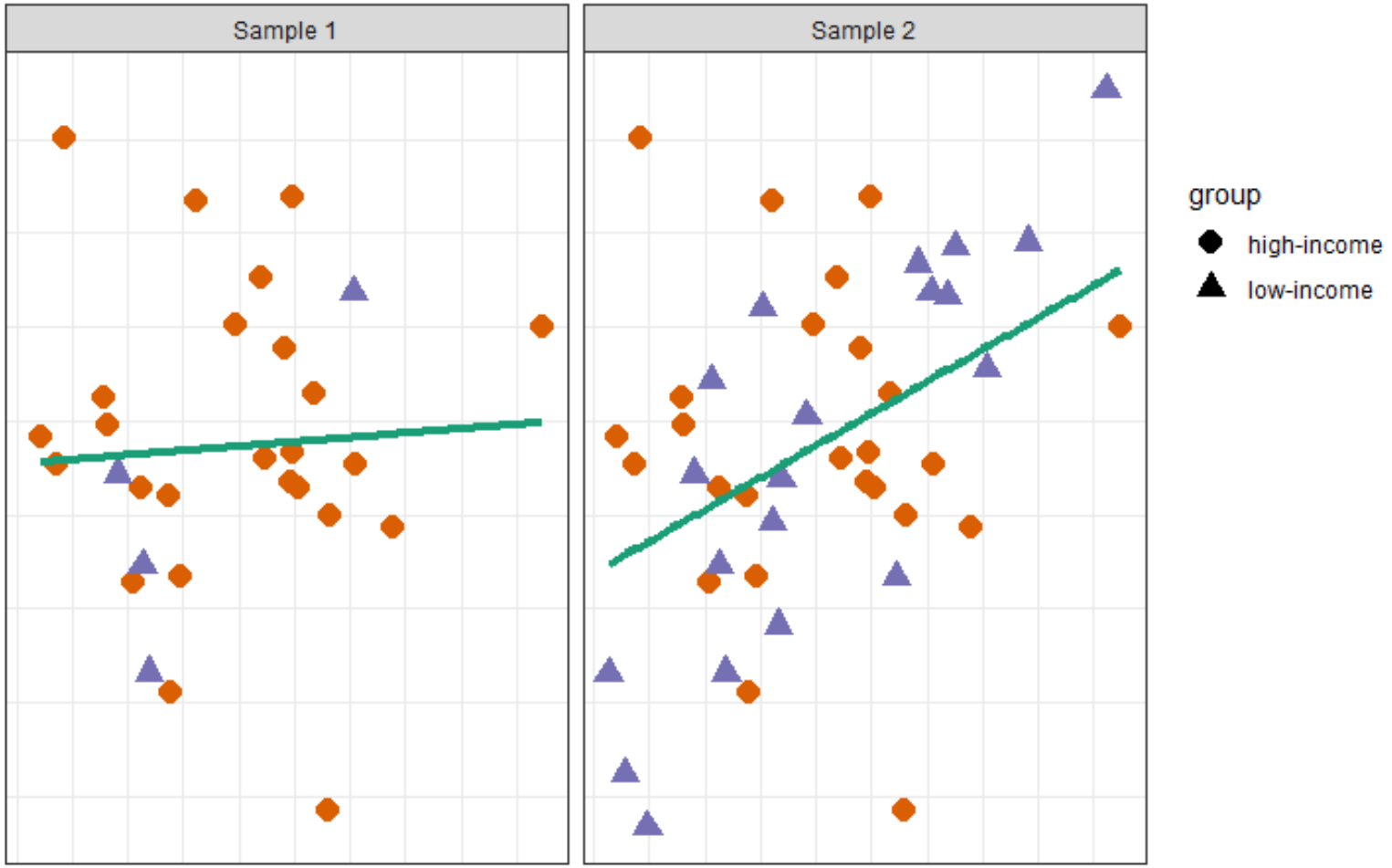
# Types of Environmental Factors



# Theoretical Mechanisms



# Importance of Sample Composition



# Contextual Characteristics

- Several studies emphasize role of context in influencing migration
- Most commonly: Studies calculate **separate effects** for countries with different levels of wealth and agricultural dependence
- **Problem**: Studies use very different ways to classify countries. Often procedures are not clear, making it hard to compare estimates
- **Our approach**: Derive information about the composition of the sample and obtain our own classification, e.g. share of low-income

# Funnel Plots