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The El Niño Southern Oscillation cycle and growth in the developing world

Sarah Smith

Contributed presentation at the 60th AARES Annual Conference,
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The El Niño Southern Oscillation cycle and growth in the developing world

AARES Conference 2016

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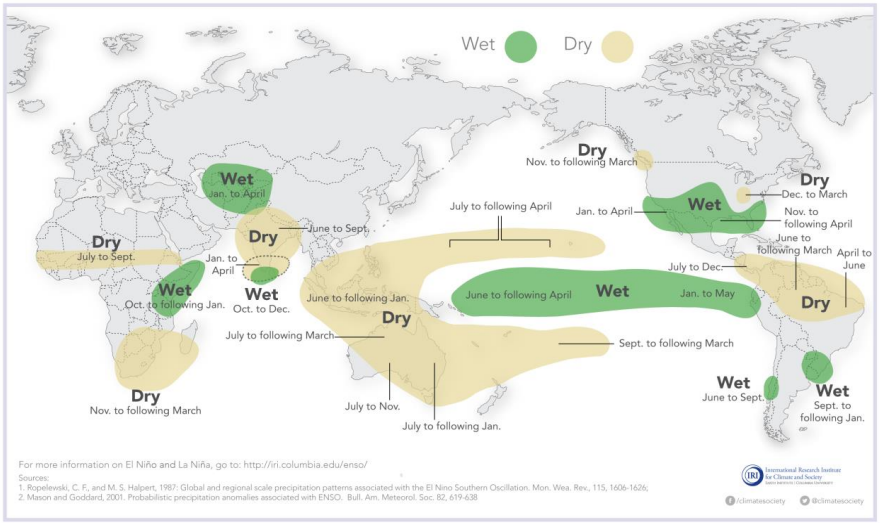
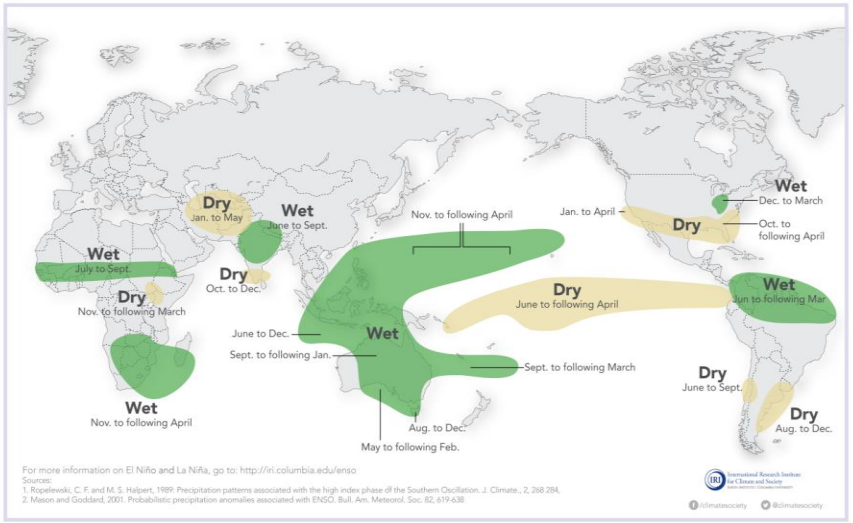
THE UNIVERSITY OF SYDNEY

El Niño Southern Oscillation (ENSO) cycles

El Niño



La Niña



- Biggest source of year-on-year climate variability
- Together, define the large scale, medium frequency climate phenomena known as ENSO Cycle

ENSO in the literature

- Unsurprisingly, ENSO induced climate variability impacts **agricultural production** (Funk et al. 2008; Battisti and Naylor 2009; Naylor et al. 2001)
- These climate-driven supply shocks have consequences for **world commodity and food prices** (Brunner 2002; Ubilava and Holt 2013; Chen et al. 2008)

Consequences for the macroeconomy?

ENSO & the macroeconomy

- Brunner (2002) found economic growth in the G7 economies to rise by up to half a percentage point in reaction to an El Niño event, but only significant at 10%
- Berry and Okulicz-Kozaryn (2008) found no evidence of ENSO in inflation and growth in the United States of America
- Focus on developed economies

Method

- Equation 1:

$$Y_t = \alpha + \beta Y_{t-1} + \delta_0 ENSO_t + \delta_1 ENSO_{t-1} + \mu_t$$

- Y is GDP per capita growth, ENSO is SOI or SST, repeated for 78 developing countries

Method

- Equation 1:

$$Y_t = \alpha + \beta Y_{t-1} + \delta_0 ENSO_t + \delta_1 ENSO_{t-1} + \mu_t$$

- Y is GDP per capita growth, ENSO is SOI or SST, repeated for 78 developing countries
- Finds the combined rather than net effect of ENSO

Method

- Equation 2: Structural change

$$Y_t = \alpha + \beta Y_{t-1} + \delta_0 ENSO_t + \delta_1 ENSO_{t-1} + \left(\tilde{\beta} Y_{t-1} + \tilde{\delta}_0 ENSO_t + \tilde{\delta}_1 ENSO_{t-1}\right).D + \mu_t$$

- D dummy variable equal to zero until reach optimal year for structural break after which D is one

Method

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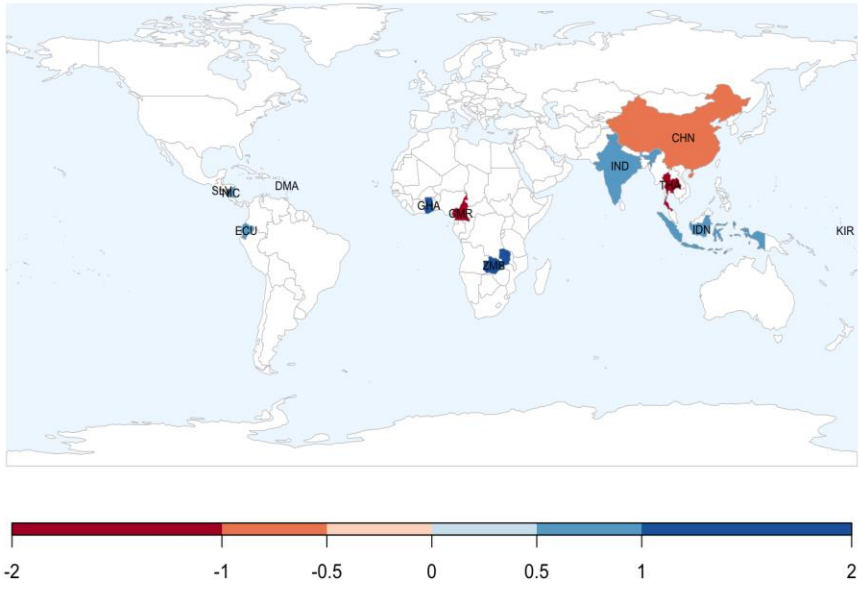
$$Y_t = \alpha + \beta Y_{t-1} + \delta_0 ENSO_t + \delta_1 ENSO_{t-1} + \left(\tilde{\beta} Y_{t-1} + \tilde{\delta}_0 ENSO_t + \tilde{\delta}_1 ENSO_{t-1}\right).D + \mu_t$$

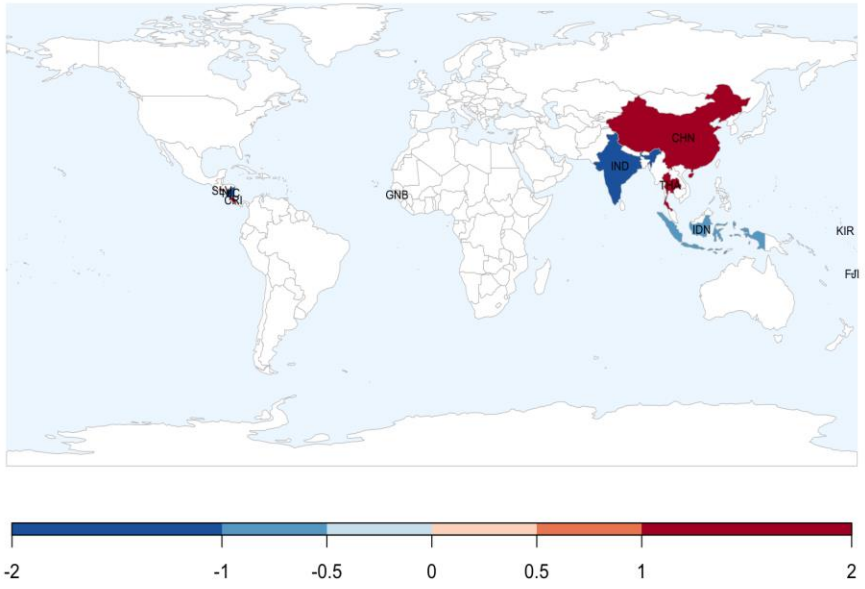
- D dummy variable equal to zero until reach optimal year for structural break after which D is one
- Motivation:
  - Industrialisation and diversification
  - Technology advancements in the mechanisation of agriculture and improved agricultural productivity
  - Integration of food and commodity markets
  - ENSO better understood and forecasted

Results 1

SOI Impact on GDP Per Capita Growth

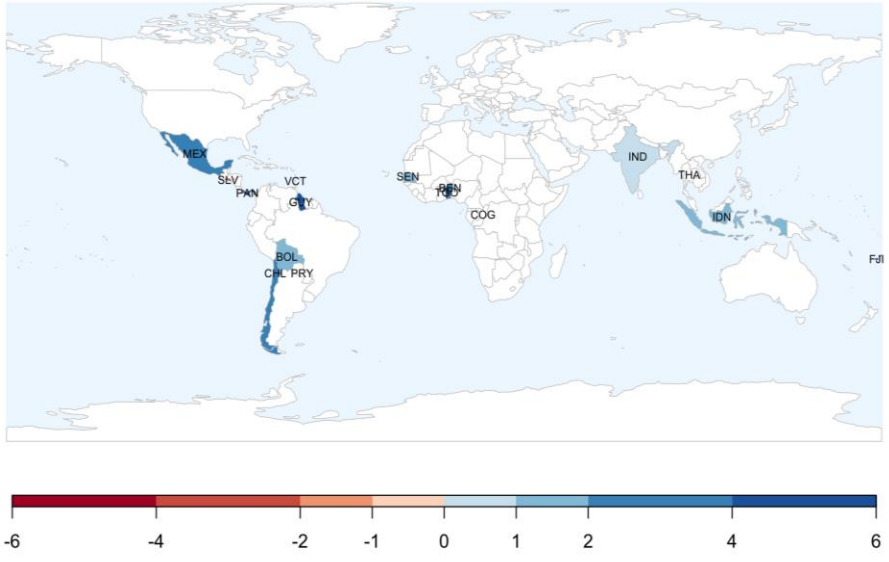


SST Impact on GDP Per Capita Growth



Results 2

SOI Impact on GDP Per Capita Growth Before Structual Change Split



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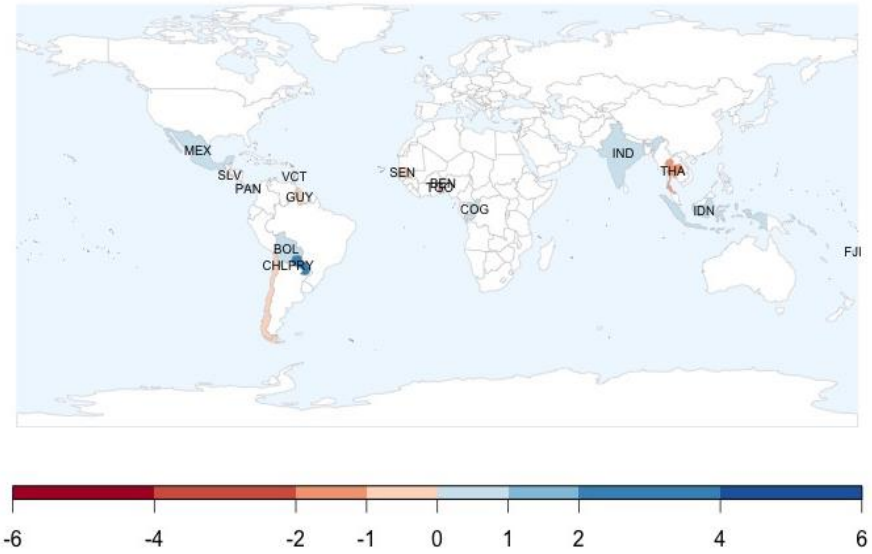

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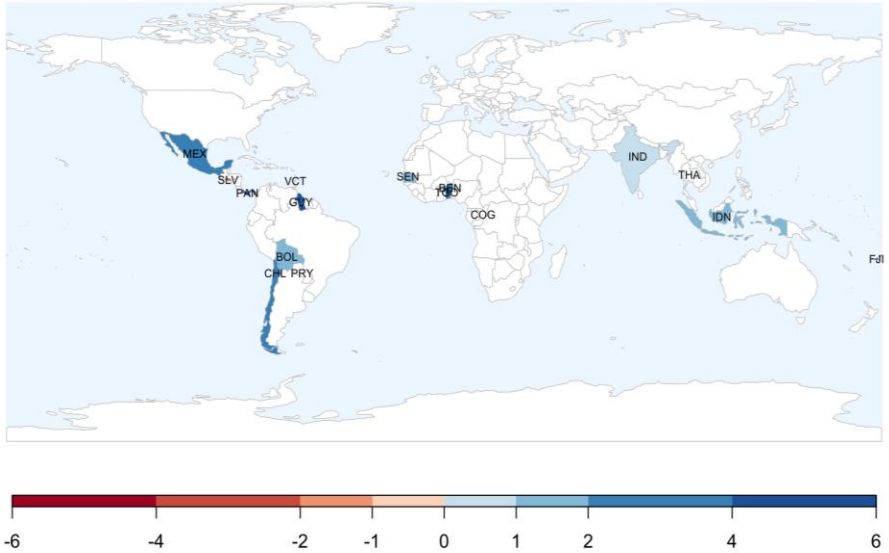

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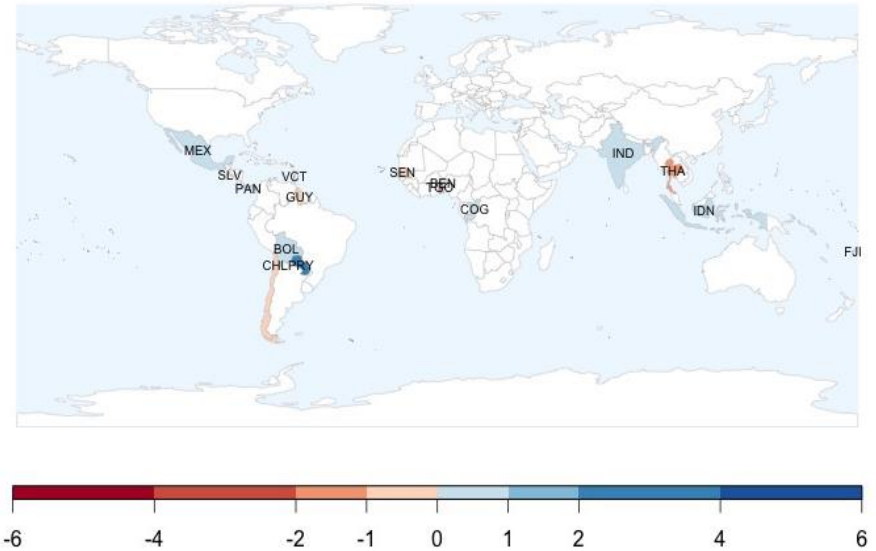
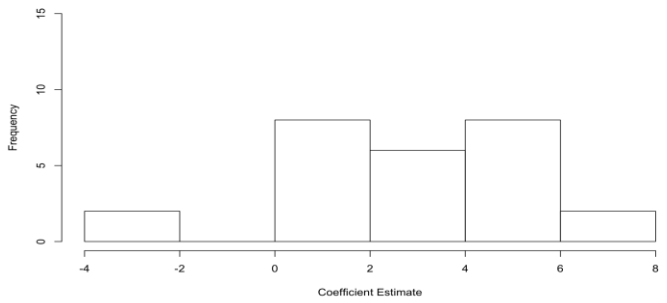


Histogram of Estimated Coefficients Before Structural Change



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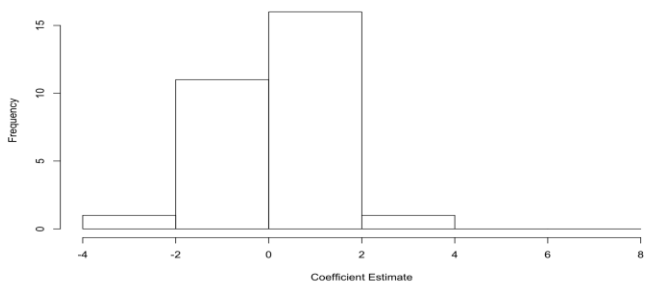

Policy Implications

- Explicitly consider ENSO in macroeconomic decisions

Policy Implications

- Explicitly consider ENSO in macroeconomic decisions
- Reduce climate vulnerability by communicating ENSO forecasts
  - Decreases uncertainty
  - Affected parties can take beneficial and timely action

Findings summarised

- Not all low-income countries are affected by ENSO on the macroeconomic scale
- Those that are directly impacted by ENSO tend to react negatively to dry events and positively to wet events
- Allowing the reaction of growth to ENSO to change through time uncovered 18 new countries
- A majority of these have experienced a decreased sensitivity to ENSO in line with economy diversification, industrialisation and international market integration
- Possible gains from forecast communication

Results case study: Indonesia

	Coefficient estimate	P-value	Percentage point change for El Niño[1]	US$ per person foregone
Equation 1	0.6	0.017	1.48	$17 (1997)
Equation 2 before split	1.41	0.005	3.47	$20 (1982)
Equation 2 after split	0.32	0.048	0.79	$10 (2009)

[1] El Niño event defined as 2 standard deviation shock in SOI