Climate Economics

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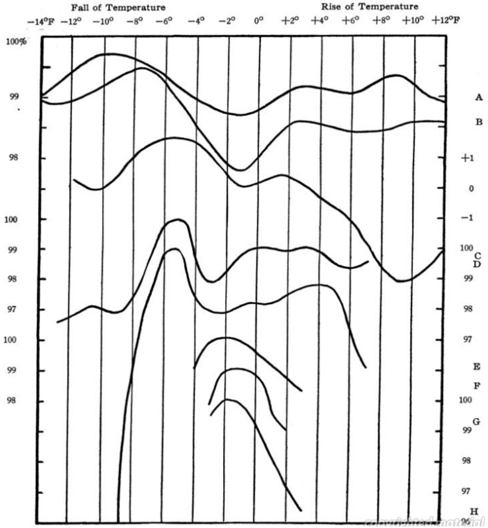
Introduction

- The **climate-economy relationship** has been discussed for many centuries and goes back to at least Ibn Khaldun's 14th Century *Muqaddimah*, in which he attributed **poverty** to the **climate**.

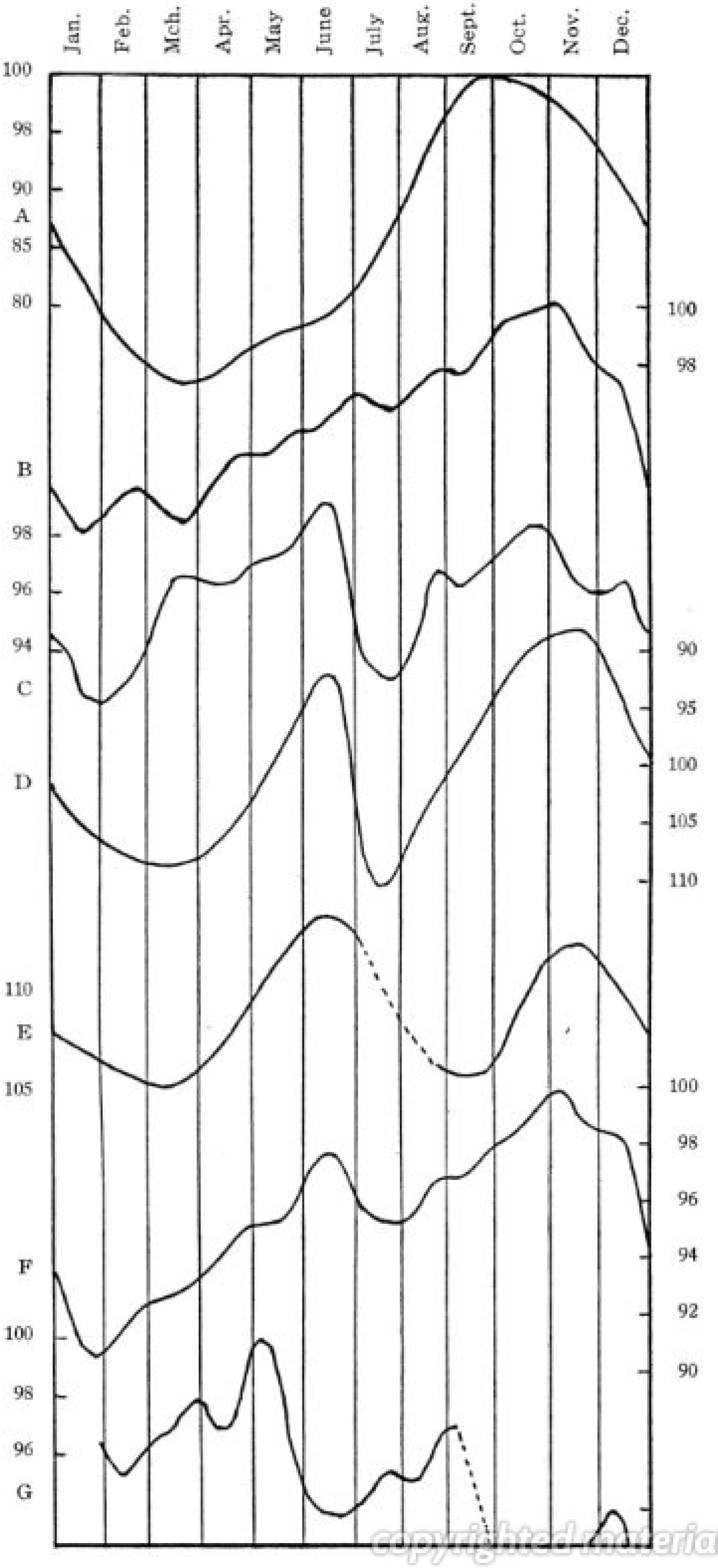
- In fact Montesquieu came to the same conclusion in the *Spirit of Laws* (1750):
  - "There are countries where the excess of heat enervates the body, and renders men so slothful and dispirited that nothing but the fear of chastisement can oblige them to perform any laborious duty..."

- A few centuries later Ellsworth Huntington's (1995) *Civilization and Climate* aims to quantify the effects of climate on economic activity using data.

Human Activity and Changes of Mean Temperature from Day to Day



Notes: A. 300 Men in Two Connecticut Factories, 1910-13. B. 256 Girls in Two Connecticut Factories, 1911-13. C. 460 Students in Mathematics and English at West Point and Annapolis, 1909-1913. D. 760 Cigar-makers at Tampa, Fla., in Winter (October-March), 1912 and 1913. Factory A. E. 400 Cigar-makers at Tampa in Winter, 1913. Factory B. F. 400 Cigar-makers at Tampa in Summer (April-September), 1913. Factory B. G. 380 Cigar-makers at Tampa in Summer, 1912. Factory A. H. 380 Cigar-makers at Tampa in Summer, 1913. Factory A.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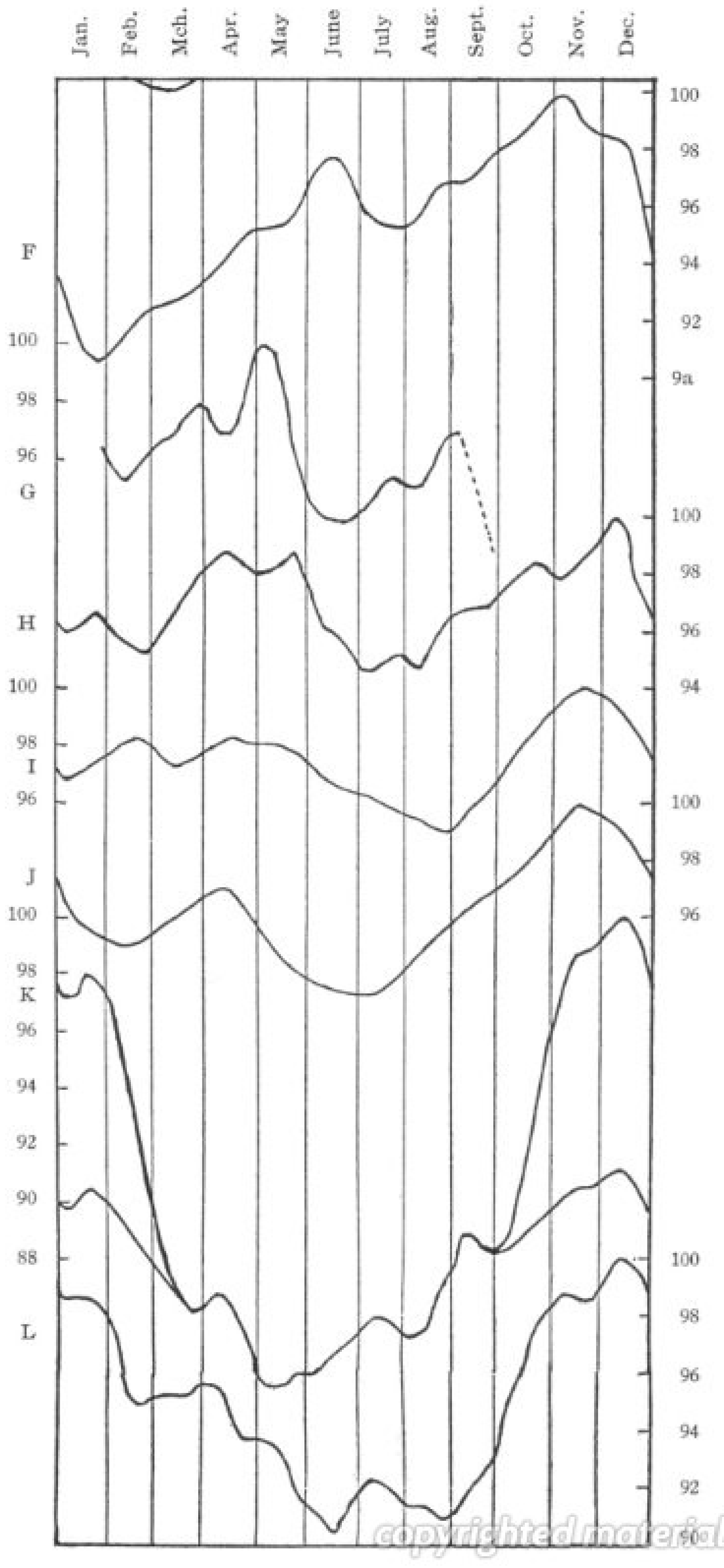
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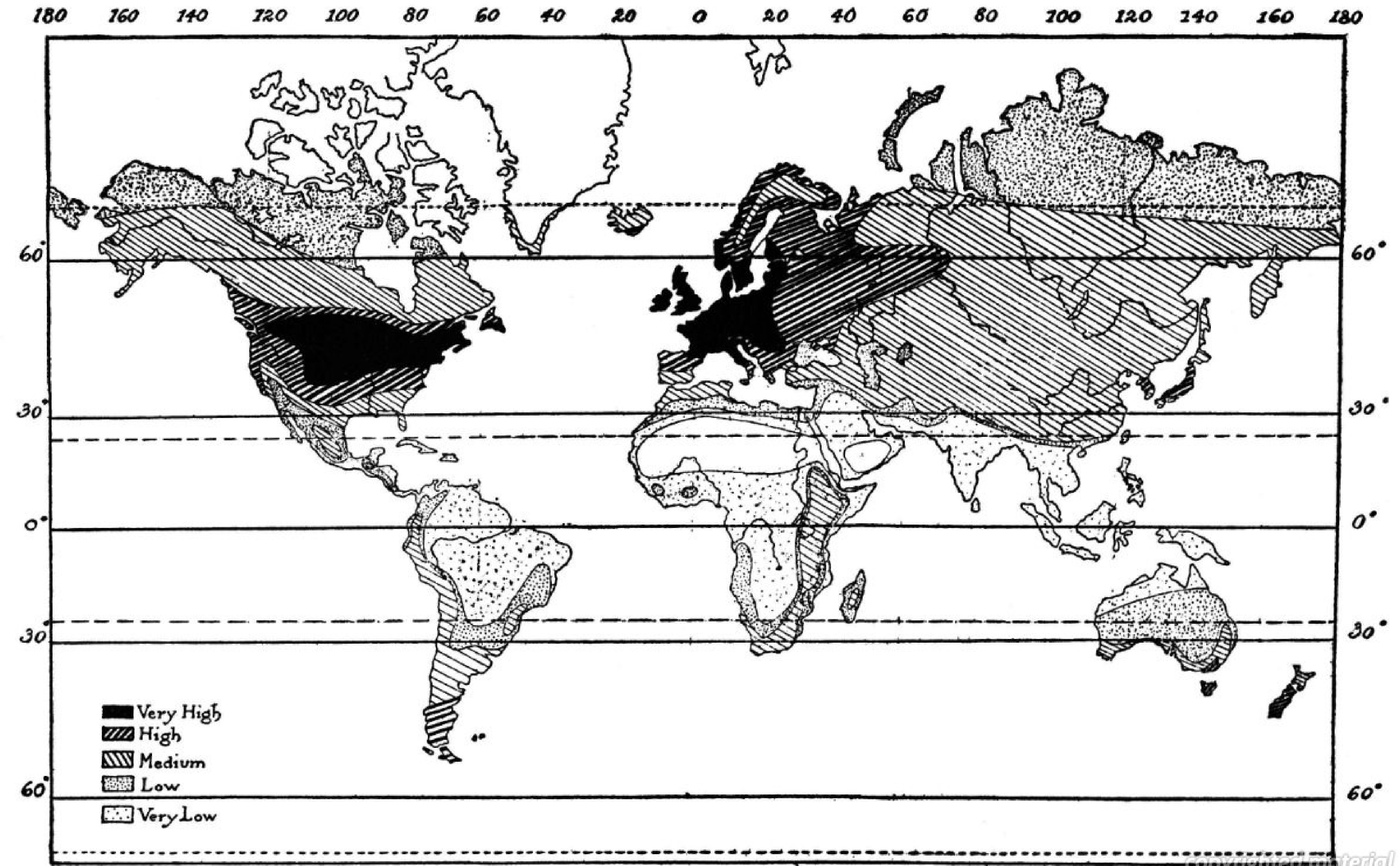
Introduction II

- Economists used to (and some still do) ask the question: Can **climate and/or the weather** explain why some countries are poor and others rich?

- The question that more and more economists are now attempting to answer is: do **weather events and climate change** have consequences for **economic growth**?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Introduction III

- However, the literature which attempts to quantify the effects of changes in climate (temperature, precipitation, storms, and other aspects of the weather) and economic performance (agricultural production, labor productivity, commodity prices, health, conflict, and economic growth) is very young and mainly concerned with **short-run growth effects of climate change**.

- This is important as a careful understanding of the climate-economy relationship is essential to the effective design of **appropriate institutions and macroeconomic policies**, as well as enabling forecasts of how future changes in climate will affect economic activity.

- However, a key challenge in studying such a relationship is "identification", i.e. distinguishing the effects of climate on economic activity from many other characteristics potentially covarying with it.

Outline

- Part I: Do **weather events** have short-run growth effects?
- Part II: Does **climate change** have short-run or long-run growth effects?
- Is President Obama right?
  - Remarks by President Obama at the First Session of COP21 on November 30, 2015: "No nation –large or small, **wealthy or poor** –is immune to what this means."

Fair Weather or Foul?
The Macroeconomic Effects of El Niño

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Motivation

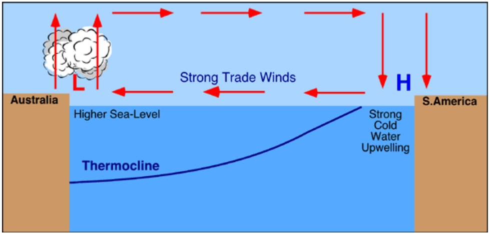
- Our focus on El Niño weather events is motivated by growing concerns about their effects not only on the global climate system, but also on commodity prices and the macroeconomy of different countries.
- These extreme weather conditions can constrain the supply of rain-driven agricultural commodities, create food-price and generalized inflation, and may trigger social unrest in commodity-dependent countries that primarily rely on imported food.
- It has been suggested, by both historians and economists, that El Niño shocks may even have played a role in a substantial number of civil conflicts, see Hsiang et al. (2011).

What is El Niño

- El Niño refers to the large-scale ocean-atmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific.
- El Niño (The Little Boy or Christ Child) was originally recognized by fishermen off the coast of South America in the 1600s, with the appearance of unusually warm water in the Pacific Ocean. They observed that periodically around Christmas time, Pacific waters grew warmer and fish vanished, migrating to cooler waters.
- The most extreme El Niño events, in terms of the surface warming in the eastern and central Pacific, occurred during 1982-1983 and 1997-1998.
- During these two events, Piura, a city in the coastal desert in northern Peru, experienced annual rainfall amounts equivalent to the other 40 rainiest years combined!

The Southern Oscillation: Normal Years

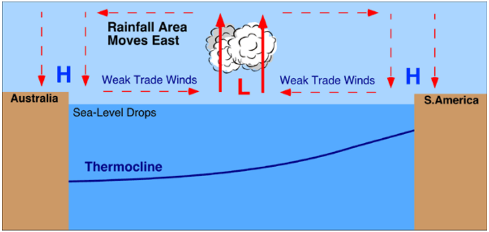
During "normal" years, a surface high pressure system develops over the coast of Peru and a low pressure system builds up in northern Australia and Indonesia.



- As a result, trade winds move strongly from east to west over the Pacific Ocean, and carry warm surface waters westward and bring precipitation to Indonesia and Australia.
- Along the coast of Peru, cold nutrient-rich water wells up to the surface, and thereby boosts the fishing industry in South America.

The Southern Oscillation: El Niño Conditions

Air pressure drops along the coast of South America and over large areas of the central Pacific and the "normal" low pressure system in the western Pacific also becomes a weak high pressure system (causing the trade winds to be reduced).



- This phenomenon causes the thermocline (the separation zone between the mixed-layer above and the deep ocean) to drop in the eastern part of Pacific Ocean, cutting off the upwelling of cold deep ocean water along the coast of Peru.
- Overall, this brings drought to the western Pacific (including Australia), rains to the equatorial coast of South America, and convective storms and hurricanes to the central Pacific.

Global Climatological Effects of El Niño

These changes in weather patterns have significant effects on agriculture, fishing, and construction industries, as well as on national and global commodity prices.

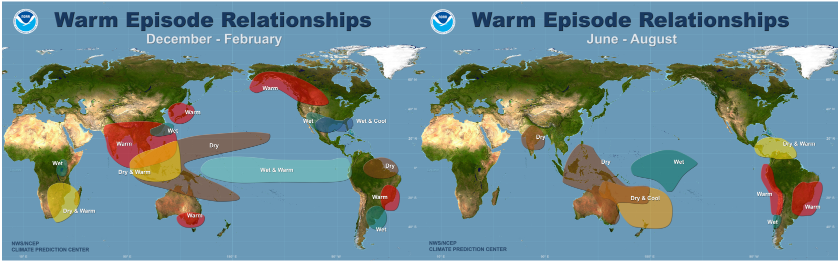
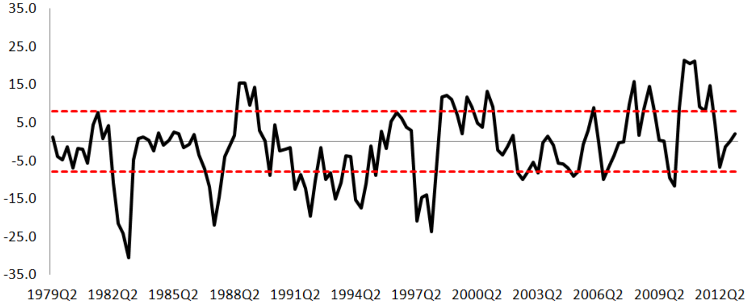


Table 1: El Niño's Impact Across the Globe

Asia and Pacific		
Australia	(−)	Drought in Southeast, bush fires, lower wheat exports
China	(?)	Dry (wet) weather in North (South)
India	(−?)	Weak monsoon rains
Indonesia	(−)	Drought, wildfire and lower hydropower output
Japan	(−?)	More frequent typhoon strikes
Korea	(?)	Drought
Malaysia	(?)	
New Zealand	(−)	More rain in wet areas and less precipitation in dry parts
Philippines	(−?)	Below normal rainfall and cyclone
Singapore	(?)	Shipping industry maybe affected
Thailand	(−?)	Drier weather
North America		
Canada	(+)	Warmer weather
Mexico	(+?)	Dry summers, fewer (more) hurricanes in East (West) coast
United States	(+)	More rain in South and California, warmer winter in Northeast, diminished tornadic activity in Midwest, fewer hurricanes in East coast
South America		
Argentina	(+?)	Plentiful rains
Brazil	(?)	Drought (plentiful rain) in North (South)
Chile	(−?)	Stormy winters and lower mining activity
Peru	(−?)	Fisheries industry suffers, cold wave and floods
Europe*	(?)	
Middle East and Africa		
Saudi Arabia	(?)	
South Africa	(−)	Drought

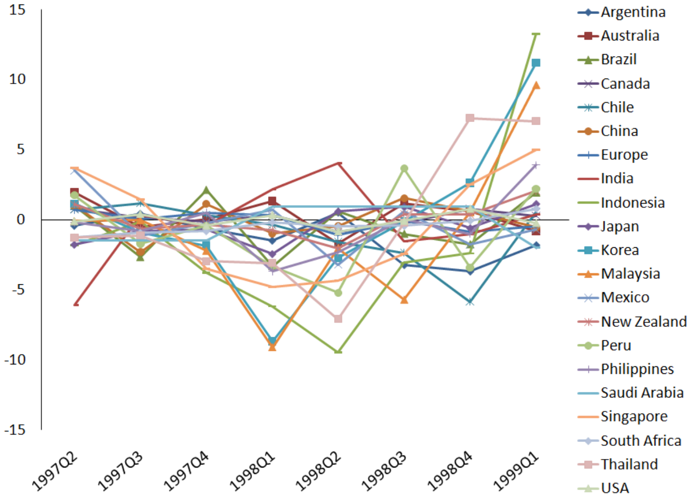
Notes: * Europe includes the following 13 countries: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, Turkey and the United Kingdom. (+), (-), and (?) indicate a positive, negative and ambiguous effects of El Niño on real growth respectively.

The Southern Oscillation Index (SOI), 1979Q2–2013Q1

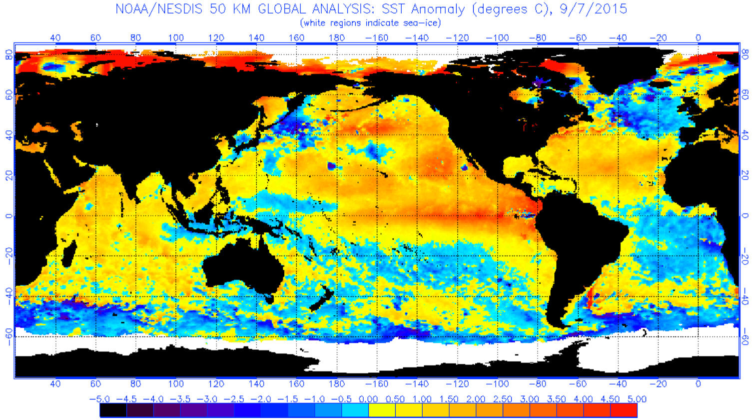


- SOI measures air-pressure differentials in the South Pacific (between Tahiti and Darwin). Deviations of the SOI from their historical averages, SOI anomalies, indicate the presence of El Niño (warm phase of the Southern Oscillation cycle) or La Niña (cold phase of the Southern Oscillation cycle).

The 1997/98 El Niño



El Niño Forecasts: Godzilla El Niño 2015-16



Contributions

- We contribute to the climate-economy literature in several dimensions, including a novel multi-country methodology.
- By exploiting the exogenous variation in weather-related events over time, and their impact on different regions cross-sectionally, we identify the effects of El Niño weather shocks on growth, inflation, energy and non-fuel commodity prices within a compact model of the global economy.
- Our modelling framework accounts for the effects of common factors (whether observed or unobserved), and ensures that the El Niño-economy relationship is identified from idiosyncratic local characteristics (using both time-series and cross-section dimensions of the data).

Contributions II

- We study the effects of El Niño shocks on 21 individual countries/regions (some of which are directly affected by El Niño) in an interlinked and compact model of the world economy, rather than focusing on an *aggregate* measure of global growth and inflation.

- We explicitly take into account the economic interlinkages and spillovers that exist between different regions in our interconnected framework (which may also shape the responses of different macroeconomic variables to El Niño shocks), rather than undertaking a country-by-country analysis.

- We contribute to the Global VAR (GVAR) literature that mostly relies on reduced-form impulse-response analysis by introducing El Niño as a dominant and causal variable in our framework.

Literature

- Despite their importance, the macroeconomic effects of the most recent strong El Niño events of 1982/83 and 1997/98, along with the more frequent occurrences of weak El Niños, are under-studied.

- There are a number of papers looking at the effects of El Niño on:
  - particular **countries**, for example, Australia and the United States (Changnon 1999 and Debelle and Stevens 1995);
  - a particular **sector**, for instance, agriculture and mining (Adams et al. 1995 and Solow et al. 1998);
  - or particular **commodity markets**, including coffee, corn, and soybean (Handler and Handler 1983, Iizumi et al. 2014, and Ubilava 2012).

Literature II

- Brunner (2002) argues that the ENSO cycle can explain about 10–20% of the variation in the GDP growth and inflation of G-7 economies, and about 20% of real commodity price movements over the period 1963–1997.

- He shows that an ENSO shock raises real commodity price inflation by about 3.5–4% (only significant in the 2nd quarter), and although the median responses of G-7 economies' *aggregate* CPI inflation and GDP growth are positive in the first year, they are both in fact statistically insignificant.

- While Brunner (2002) focuses on the economic effects El Niño shocks over time (only taking advantage of the temporal dimension of the data), his sample is mostly restricted to regions which are not directly affected by El Niño.

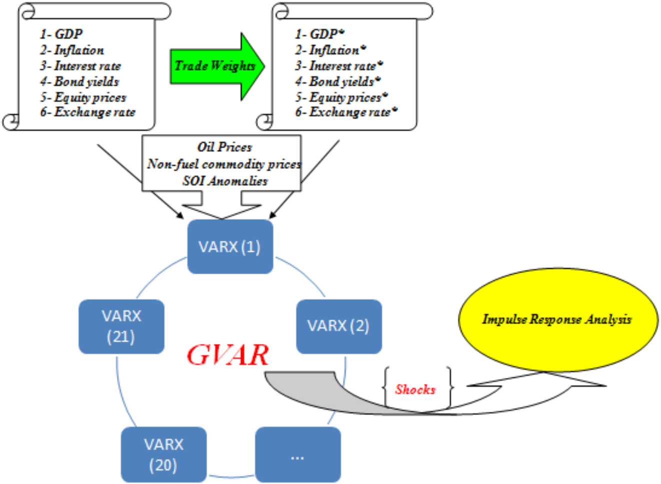
Modelling the Climate-Macroeconomy Relationship in a Global Context

- To analyze the macroeconomic transmission of El Niño shocks, both nationally and internationally, we employ a dynamic multi-country framework.

- This framework takes into account both the temporal and cross-sectional dimensions of the data; real and financial drivers of economic activity; interlinkages and spillovers that exist between different regions; and the effects of unobserved or observed common factors (e.g. energy and non-fuel commodity prices).

- This is crucial as the impact of El Niño shocks cannot be reduced to one country but rather involve multiple regions, and may be amplified or dampened depending on the degree of openness of the countries and their trade structure.

The GVAR Methodology



The GVAR Methodology II

- Chudik and Pesaran (2013) extend the GVAR methodology to a case in which common variables are added to the conditional country models (either as observed *global* factors or as *dominant* variables).

- In such circumstances, a VARX* (s_i, s_i^*) model for the ith country relates a $k_i \times 1$ vector of domestic macroeconomic variables (treated as endogenous), $\mathbf{x}_{it}$, to a $k_i^* \times 1$ vector of country-specific foreign variables (taken to be weakly exogenous), $\mathbf{x}_{it}^*$, and vector of global/dominant variables, $\boldsymbol{\omega}_t$:

$$\Phi_i (L, s_i) \mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1} t + \Lambda_i (L, s_i^*) \mathbf{x}_{it}^* + \Upsilon_i (L, s_i^{\omega}) \boldsymbol{\omega}_t + \mathbf{u}_{it}, \qquad (1)$$

  for $t = 1, 2, ..., T$, where $\mathbf{a}_{i0}$ and $\mathbf{a}_{i1}$ are $k_i \times 1$ vectors of fixed intercepts and coefficients on the deterministic time trends, respectively, and $\mathbf{u}_{it}$ is a $k_i \times 1$ vector of country-specific shocks, which we assume are serially uncorrelated with zero mean and a non-singular covariance matrix, Σ_{ii}, namely $\mathbf{u}_{it} \sim i.i.d. (0, \Sigma_{ii})$.

The GVAR Methodology III

- Furthermore, $\Phi_i\left(L, s_i\right) = I - \sum_{i=1}^{s_i} \Phi_i L^i$, $\Lambda_i\left(L, s_i^*\right) = \sum_{i=0}^{s_i^*} \Lambda_i L^i$, and $\Upsilon_i\left(L, s_i^\omega\right) = \sum_{i=0}^{s_i^\omega} \Upsilon_i L^i$ are the matrix lag polynomial of the coefficients associated with the domestic, foreign, and common variables, respectively, and allowed to differ across countries.

- The country-specific foreign variables are constructed as cross-sectional averages of the domestic variables using data on bilateral trade as the weights, w_{ij}:

$$\mathbf{x}_{it}^* = \sum_{j=1}^{N} w_{ij} \mathbf{x}_{jt}, \tag{2}$$

  where $j = 1, 2, ...N$, $w_{ii} = 0$, and $\sum_{j=1}^{N} w_{ij} = 1$. For empirical application, the trade weights are computed based on the average trade flows measured over the period 2009 to 2011.

The GVAR Methodology IV

- To allow for feedback effects from the variables in the GVAR model to the common variables via cross-section averages, we define the following model for $\boldsymbol{\omega}_t$:

$$\boldsymbol{\omega}_t = \sum_{l=1}^{p_\omega} \Phi_{\omega l} \boldsymbol{\omega}_{i,t-l} + \sum_{l=1}^{q_\omega} \Lambda_{\omega l} \mathbf{x}^*_{i,t-l} + \boldsymbol{\eta}_{\omega t}. \tag{3}$$

- We allow for different lag orders for the dominant (p_ω) and foreign variables (q_ω).

- Conditional (1) and marginal models (3) can be combined and solved as a complete GVAR model, see Chudik and Pesaran (2014) for the derivations.

Country Coverage

- Our model includes 33 countries covering over 90 percent of world GDP.
- Key countries in our sample include those likely to be directly affected by El Niño—mainly countries in the Asia and Pacific region as well as those in the Americas.
- To investigate the possible indirect effects of El Niño (through trade, commodity price and financial channels), we also include other major economies, such as European countries, in the model.

Country Coverage II

Asia and Pacific	North America	Europe
Australia	Canada	Austria
China	Mexico	Belgium
India	United States	Finland
Indonesia		France
Japan	**South America**	Germany
Korea	Argentina	Italy
Malaysia	Brazil	Netherlands
New Zealand	Chile	Norway
Philippines	Peru	Spain
Singapore		Sweden
Thailand	**Middle East and Africa**	Switzerland
	Saudi Arabia	Turkey
	South Africa	United Kingdom

Country-Specific Models

- Both real and financial variables: real GDP, inflation, real exchange rate, short-term and long-term interest rates, and real equity prices.

- Domestic variables:

$$
\begin{aligned}
y_{it} &= \ln(GDP_{it}), \quad \pi_{it} = p_{it} - p_{it-1}, \quad p_{it} = \ln(CPI_{it}), \\
eq_{it} &= \ln\left(EQ_{it} / CPI_{it}\right), \qquad ep_{it} = \ln\left(E_{it} / CPI_{it}\right) \\
r_{it}^{S} &= 0.25 \ln(1 + R_{it}^{S}/100), \quad r_{it}^{L} = 0.25 \ln(1 + R_{it}^{L}/100). \qquad (4)
\end{aligned}
$$

Country-Specific Models II

We include five foreign variables in our model:

$$
\begin{aligned}
y_{it}^{*} &= \sum_{j=0}^{N} w_{ij} y_{jt}, \quad eq_{it}^{*} = \sum_{j=0}^{N} w_{ij} eq_{jt}, \quad p_{it}^{*} = \sum_{j=0}^{N} w_{ij} p_{jt}, \\
\pi_{it}^{*} &= p_{it}^{*} - p_{it-1}^{*}, \quad r_{it}^{S*} = \sum_{j=0}^{N} w_{ij} r_{jt}^{S}, \quad r_{it}^{L*} = \sum_{j=0}^{N} w_{ij} r_{jt}^{L}.
\end{aligned} \tag{5}
$$

where $j = 1, 2, ...N$, w_{ij} is the trade share of country j for country i, $w_{ii} = 0$, $\sum_{j=1}^{N} w_{ij} = 1$, and:

$$
w_{ij} = \frac{T_{ij,2009} + T_{ij,2010} + T_{ij,2011}}{T_{i,2009} + T_{i,2010} + T_{i,2011}}, \tag{6}
$$

where T_{ijt} is the bilateral trade of country i with country j during a given year t and is calculated as the average of exports and imports of country i with j, and $T_{it} = \sum_{j=1}^{N} T_{ijt}$ (the total trade of country i).

El Niño

- Given our interest in analyzing the macroeconomic effects of El Niño shocks, we need to include the Southern Oscillation index anomalies (SOI_t) in our framework.
- We model SOI_t as a dominant variable because there is no reason to believe that any of the macroeconomic variables described above influences it.
- In other words, SOI_t is included as a weakly exogenous variable in each of the 21 country/region-specific VARX* models, with no feedback effects from any of the macro variables to SOI_t (hence a unidirectional causality).

Commodity Markets

- There is some anecdotal evidence that SOI_t influences global commodity markets—for example, hot and dry summers in southeast Australia increases the frequency and severity of bush fires, which reduces Australia's wheat exports and thereby drives up global wheat prices.
- A key question is how should these commodity prices be included in the GVAR model?
- The standard approach to modelling commodity markets in the GVAR literature is to include oil prices as a "global variable" in the U.S. VARX* model.

Commodity Markets II

- We also need to include the prices of non-fuel commodities in our model, given that El Niño events potentially affect the global prices of food, beverages, metals and agricultural raw materials,

- However, rather than including the individual prices of non-fuel commodities (such as wheat, coffee, timber, and nickel) we use a measure of real non-fuel commodity prices in logs, p_t^{nf}, with the weight of each of the 38 non-fuel commodities included in the index being equal to average world export earnings.

- Therefore, our commodity market model includes both p_t^{oil} and p_t^{nf} as endogenous variables, where the former can be seen as a good proxy for fuel prices in general.

Global Output

To capture the effects of global economic conditions on world commodity markets, we include seven weakly exogenous variables in this model, for instance global output, y_t^w: calculated as :

$$y_t^w = \sum_{j=1}^{N} w_j^{PPP} y_{jt}, \tag{7}$$

where y_{jt} is the log of real GDP of country j at time t, $j = 1, 2, ...N$, w_j^{PPP} is the PPP GDP weights of country j, and $\sum_{j=0}^{N} w_j^{PPP} = 1$.

We compute w_j^{PPP} as a three-year average to reduce the impact of individual yearly movements on the weights:

$$w_j^{PPP} = \frac{GDP_{j,2007}^{PPP} + GDP_{j,2008}^{PPP} + GDP_{j,2009}^{PPP}}{GDP_{2007}^{PPP} + GDP_{2008}^{PPP} + GDP_{2009}^{PPP}}. \tag{8}$$

PPP GDP Weights (2009-2011)

Country	PPP GDP Weights	Country	PPP GDP Weights	Country	PPP GDP Weights
Argentina	1.07	India	6.66	Peru	0.46
Australia	1.56	Indonesia	1.73	Philippines	0.58
Brazil	3.59	Japan	6.91	South Africa	0.87
Canada	2.24	Korea	2.33	Saudi Arabia	1.27
China	16.87	Malaysia	0.69	Singapore	0.46
Chile	0.51	Mexico	2.91	Thailand	0.96
Europe	24.52	New Zealand	0.22	USA	23.61

Country-Specific Models III

The U.S. Model		Remaining 20 Countries		Commodity Market		El Niño
$\mathbf{x}_{it}$	$\mathbf{x}_{it}^*$	$\mathbf{x}_{it}$	$\mathbf{x}_{it}^*$	$\boldsymbol{\omega}_{t,c}$	$\mathbf{x}_t^w$	$\boldsymbol{\omega}_{t,SOI}$
y_{it}	y_{it}^*	y_{it}	y_{it}^*	—	y_t^w	—
π_{it}	—	π_{it}	π_{it}^*	—	π_t^w	—
—	ep_{it}^*	ep_{it}	—	—	ep_t^w	—
r_{it}^S	—	r_{it}^S	r_{it}^{*S}	—	r_t^{wS}	—
r_{it}^L	—	r_{it}^L	r_{it}^{*L}	—	r_t^{wL}	—
eq_{it}	—	eq_{it}	eq_{it}^*	—	eq_t^w	—
—	p_t^{oil}	—	p_t^{oil}	p_t^{oil}	—	—
	p_t^{nf}		p_t^{nf}	p_t^{nf}	—	—
	SOI_t		SOI_t	—	SOI_t	SOI_t

Data

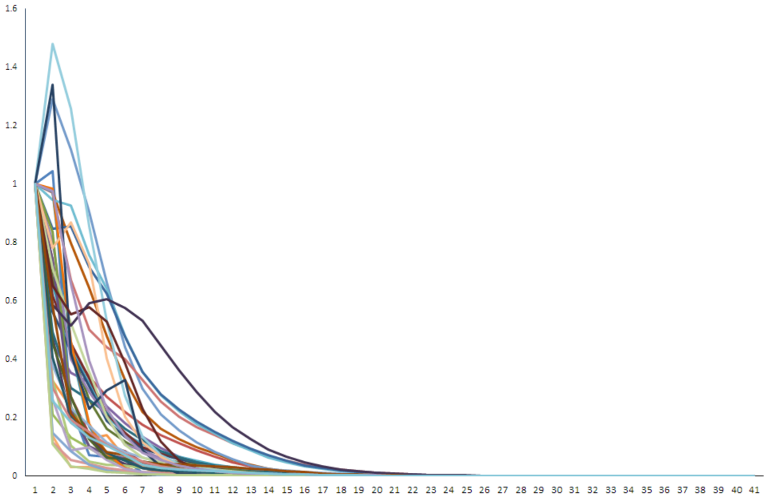
- We use quarterly observations over the period 1979Q2–2013Q1 to estimate the 21 country-specific VARX*(p_i, q_i) models.
- Data on $\mathbf{x}_{it}$ for the 33 countries our sample from the GVAR website.
- To construct $\mathbf{x}^*_{it}$ we use trade weights from IMF's Direction of Trade Statistics.
- To construct $\mathbf{x}^w_t$ (and the European region) we use PPP GDP Weights from WB's WDI.
- Oil price data is also from the GVAR website, while data on non-fuel commodity prices are from the IMF's *International Financial Statistics.*
- The SOI data is from National Oceanic and Atmospheric Administration's *National Climatic Data Centre*.

Country-Specific Estimates (1979Q2-2013Q1)

Country	VARX* Order		#CVs	Country	VARX* Order		#CVs
	p_i	q_i	(r_i)		p_i	q_i	(r_i)
Argentina	2	2	1	Malaysia	1	1	2
Australia	1	1	4	Mexico	1	2	2
Brazil	2	2	1	New Zealand	2	2	2
Canada	1	2	2	Peru	2	2	1
China	2	1	1	Philippines	2	1	2
Chile	2	2	1	South Africa	2	2	3
Europe	2	2	3	Saudi Arabia	2	1	1
India	2	2	3	Singapore	2	1	1
Indonesia	2	1	3	Thailand	1	1	1
Japan	2	2	3	USA	2	2	2
Korea	2	1	2				

Notes: p_i and q_i denote the lag order for the domestic and foreign variables respectively and are selected by the Akaike Information Criterion (AIC). The number of cointegrating relations (r_i) are selected using the maximal eigenvalue test statistics based on the 95% simulated critical values computed by stochastic simulations and 1000 replications for all countries except for Korea and Saudi Arabia, for which we reduced r_i below those suggested by the maximal eigenvalue statistic to ensure that the persistence profiles were well behaved.

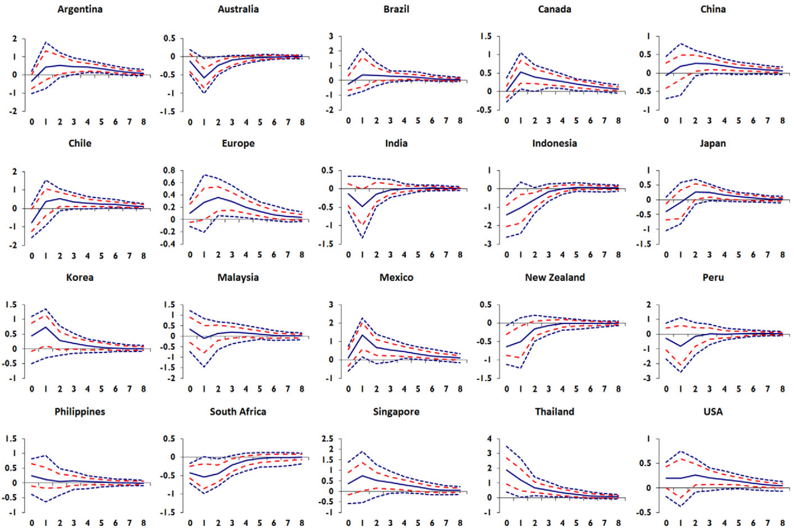
Persistence Profiles of the Effect of a System-wide Shock to the Cointegrating Relations



The Effects of El Niño on Real Output Growth

- Contrary to the findings of earlier studies, the results of our dynamic multi-country model of the world economy indicate that the economic consequences of El Niño shocks are large, statistically significant, and highly heterogeneous across different regions.
- Australia, Chile, Indonesia, India, Japan, New Zealand and South Africa face a short-lived fall in economic activity in response to an El Niño shock.
- For other countries, an El Niño event has a growth-enhancing effect; some (for instance the United States) due to direct effects while others (for instance the European region) through positive spillovers from major trading partners.

The Effects of El Niño on Real Output Growth II



Share of Primary Sector in GDP (in percent)

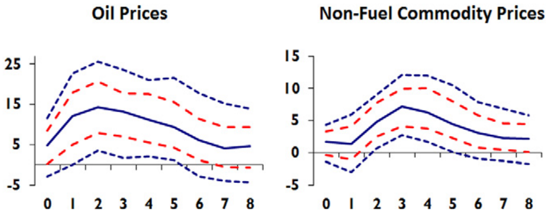
Averages over 2004-2013

Asia and Pacific		**North America**	
Australia	11	Canada	10
China	11	Mexico	12
India	21	United States	3
Indonesia	25		
Japan	1	**South America**	
Korea	3	Argentina	11
Malaysia	22	Brazil	7
New Zealand	6	Chile	18
Philippines	14	Peru	20
Singapore	0		
Thailand	15	**Africa**	
		South Africa	10

Overall, the larger the geographical area of a country, the smaller the primary sector's share in national GDP, and the more diversified the economy is, the smaller is the impact of El Niño shocks on GDP growth.

The Effects of El Niño on Real Commodity Prices

- The higher temperatures and droughts following an El Niño event, particularly in Asia-Pacific countries, not only increases the prices of non-fuel commodities, but also leads to higher demand for coal and crude oil as lower electricity output is generated from both thermal power plants and hydroelectric dams.
- In addition, farmers increase their water demand for irrigation purposes, which further increases the fuel demand for power generation and drives up energy prices.



The Effects of El Niño on Real Commodity Prices II

- Although the initial increase in oil prices (as a proxy for fuel prices) arises from higher demand for power, oil prices remain high even four quarters after the initial shock.

- This is because an El Niño event has positive growth effects on major economies which demand more oil to be able to sustain higher production.

- Therefore, what was initially an increase in oil prices due to higher demand from Asia translates into a global oil demand shock a couple of quarters later.

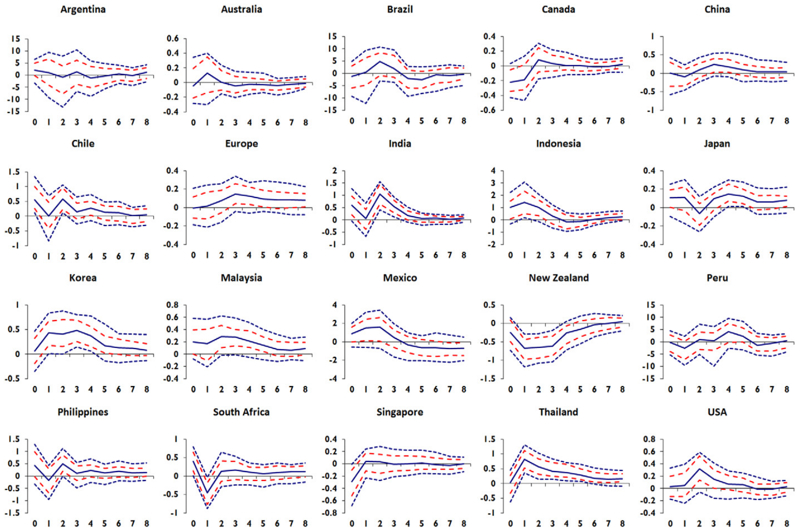
- Excess demand also arises for non-fuel commodity prices (food, beverages, metals, and agricultural raw materials) mainly due to lower supply from the Asia-Pacific region, but also due to higher global demand for non-fuel commodities.

The Effects of El Niño on Inflation

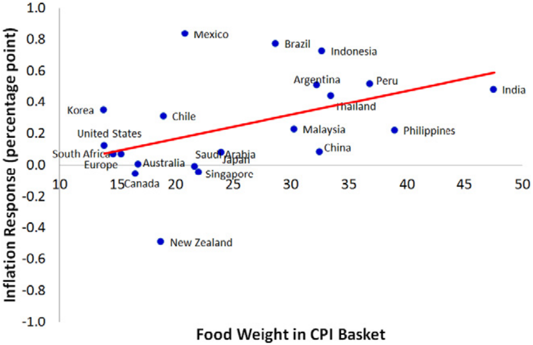
- Most countries in our sample experience short-run inflationary pressures following an El Niño shock (depending mainly on the share of food in their CPI baskets).

- This is mainly due to higher fuel as well as non-fuel commodity prices, but is also the result of inflation expectations, as well as aggregate demand-side pressures for those countries which experience a growth pick-up following an El Niño episode.

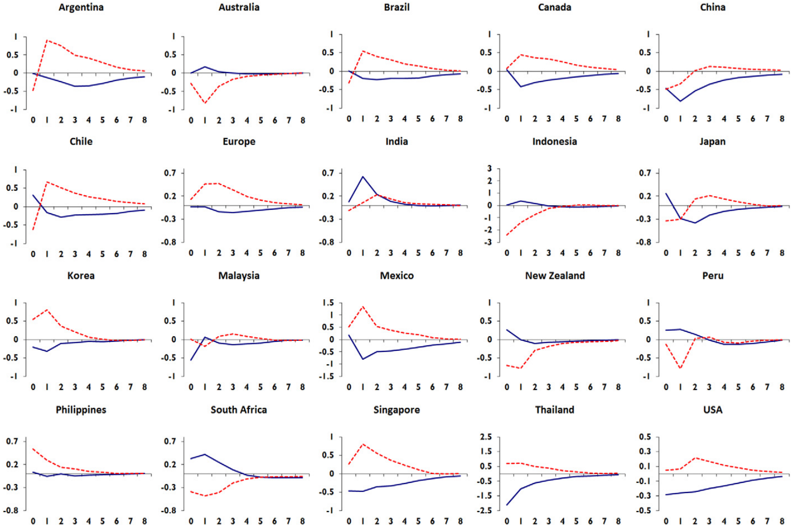
The Effects of El Niño on Inflation II



Food Weight in CPI Basket and Inflation Responses



Asymmetric Effects of El Niño and La Niña on Growth



Summary of Results

- To analyze the international macroeconomic transmission of El Niño shocks we estimated a Global VAR (GVAR) model for 21 countries/regions over the period 1979Q2–2013Q1.
- Our modelling framework took into account real and financial drivers of economic activity; interlinkages and spillovers that exist between different regions; and the effects of unobserved or observed common factors (e.g. energy and non-fuel commodity prices).
- We showed that there are considerable heterogeneities in the responses of different countries to El Niño shocks. While Australia, Chile, Indonesia, India, Japan, New Zealand and South Africa face a short-lived fall in economic activity following an El Niño weather shock, the United States, Europe and China actually benefit (possibly indirectly through third-market effects) from such a climatological change.
- Most countries in our sample experience short-run inflationary pressures following an El Niño shock (depending mainly on the share of food in their CPI baskets), while global energy and non-fuel commodity prices increase

Policy Implications

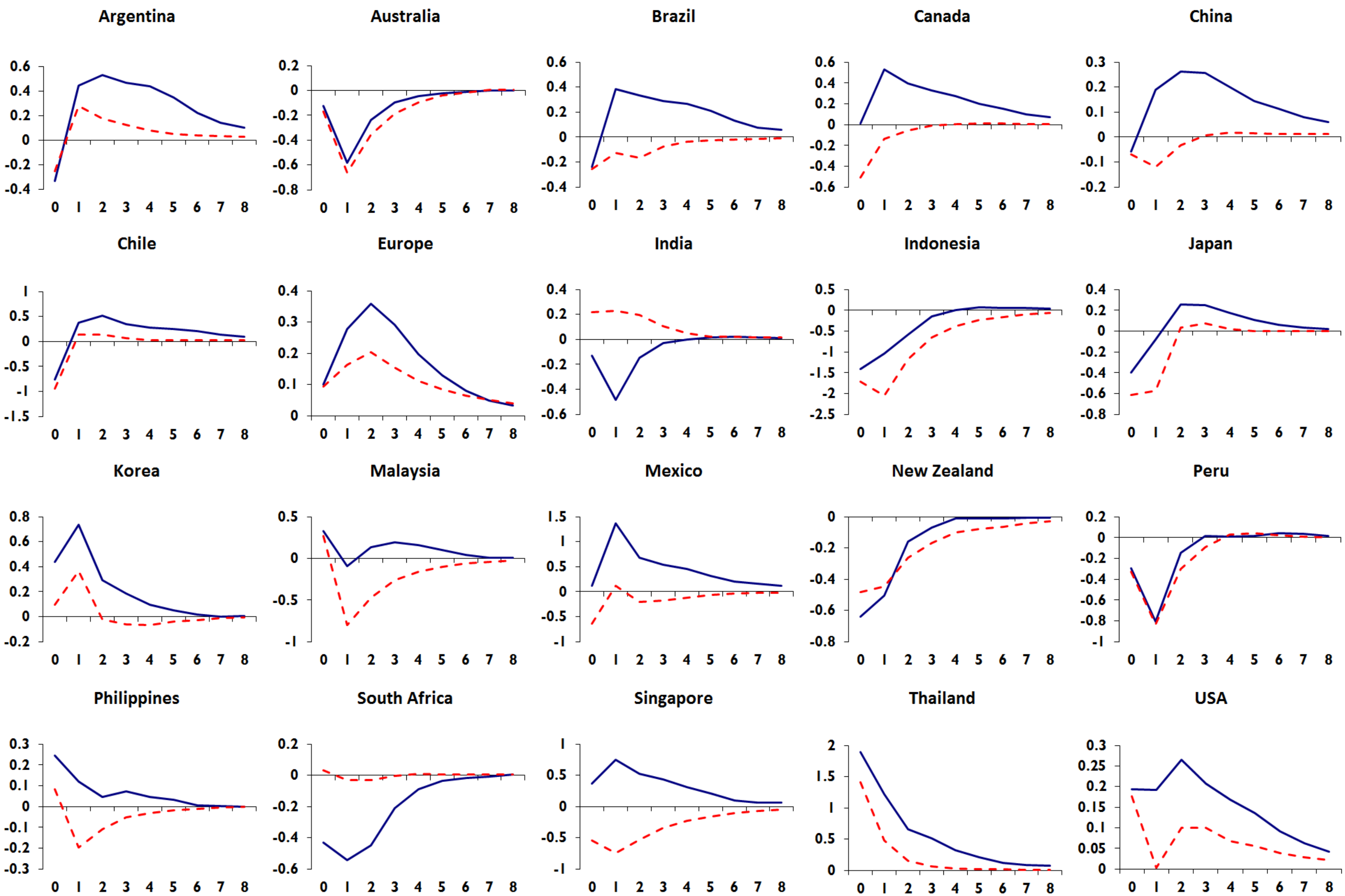
- The sensitivity of growth and inflation in different countries, as well as global commodity prices, to El Niño developments raises the question of which policies and institutions are needed to counter the adverse effects of such shocks.

- Measures to bolster agricultural production in low-rainfall El Niño years include changes in the cropping pattern and input use (e.g. seeds of quicker-maturing crop varieties), rainwater conservation, judicious release of food grain stocks, and changes in imports policies/quantities.

- On the macroeconomic policy side, any uptick in inflation arising from El Niño shocks could be accompanied by a tightening of the monetary stance (if second-round effects emerge), to help anchor inflation expectations.

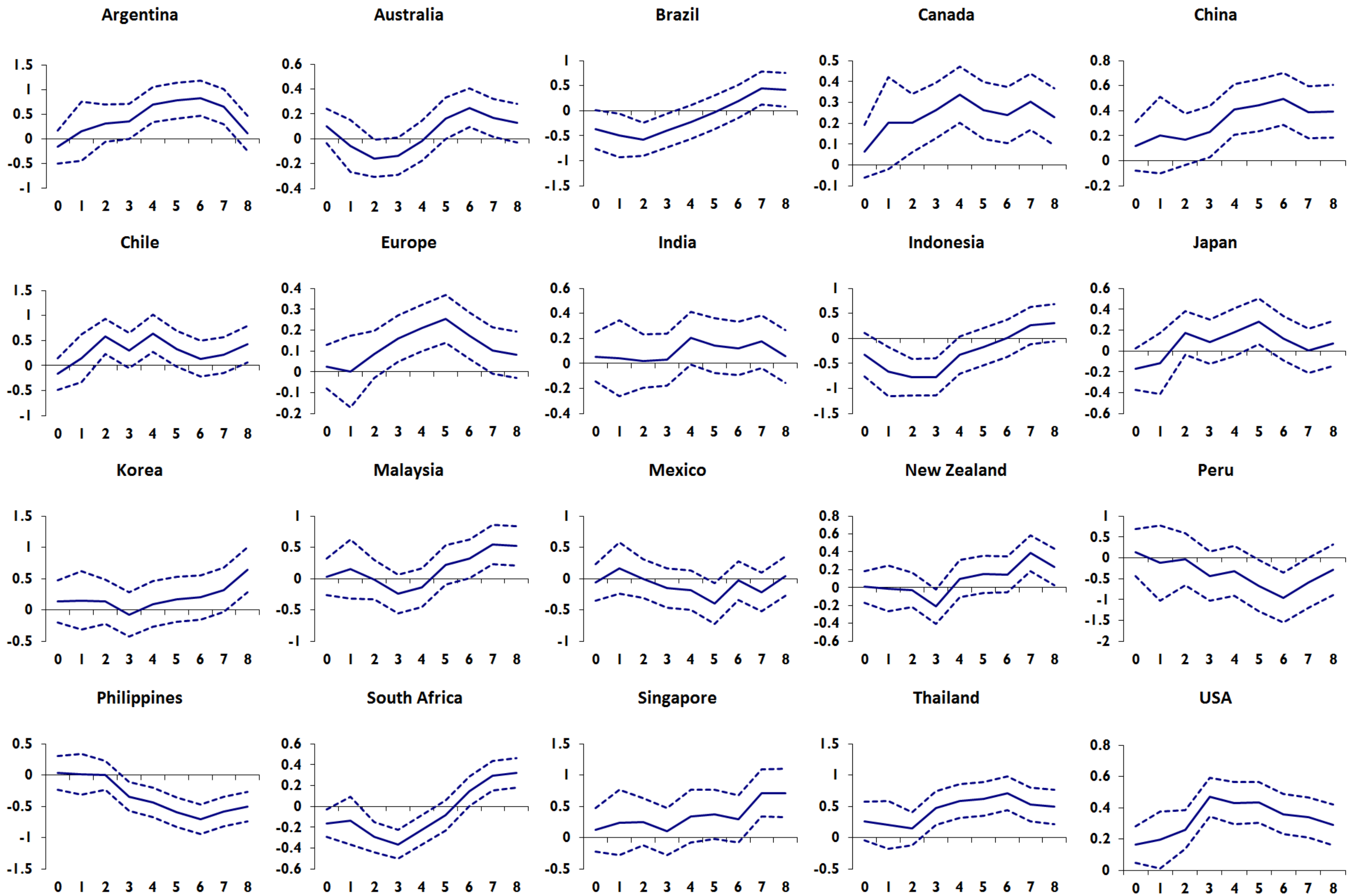
- Investment in agriculture sector, mainly in irrigation, as well as building more efficient food value chains should also be considered in the longer-term.

Figure 9: Direct and Total Effects of an El Niño Shock on Real GDP Growth (in percentage points)



Notes: Figures are median impulse responses to a one standard deviation reduction in SOI anomalies from our baseline GVAR model in Section 5.1 (blue solid) as compared with those in which counterfactual trade weights replace the actual ones (red dashed). The impact is in percentage points and the horizon is quarterly.

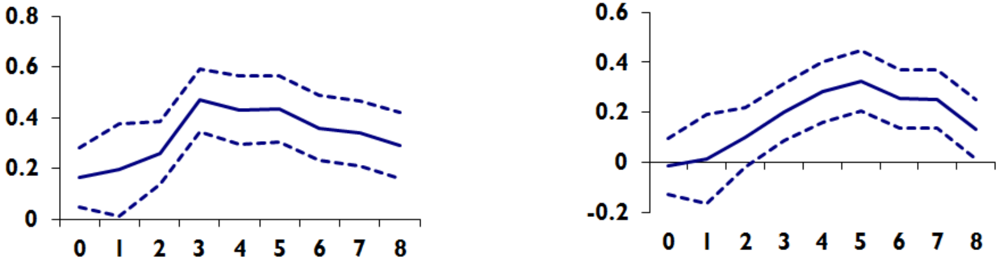
Figure 3: The Effects of an El Niño Shock on Real GDP Growth (in percentage points), using the Local Projections Method



Notes: Figures are median impulse responses to a one standard deviation reduction in SOI anomalies, together with the 5th and 95th percentile conditional error bands. The impact is in percentage points and the horizon is quarterly.

Figure 4: The Effects of an El Niño Shock on United States Real GDP Growth (in percentage points), using the Local Projections Method

(a) Based on data from 1979Q2 to 2013Q1 (b) Based on data from 1951Q1 to 2016Q2



Notes: Figures are median impulse responses to a one standard deviation reduction in SOI anomalies, together with the 5th and 95th percentile conditional error bands. The impact is in percentage points and the horizon is quarterly.