China's Emergence in the World Economy and Business Cycles in Latin America

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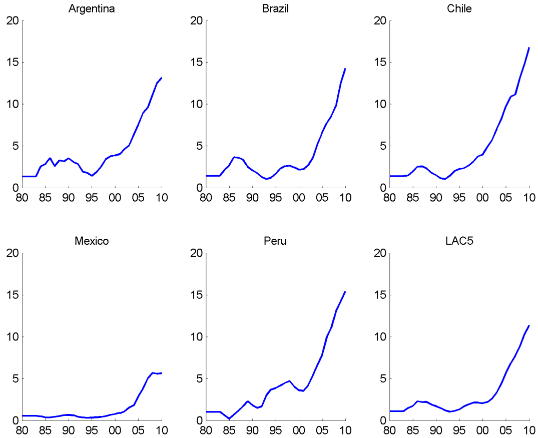
Motivation

- International business cycle is very important for Latin America's economic performance
  - Little et al (1993), Hoffmaister and Roldos (1998), Canova (2005), Osterholm and Zettelmeyer (2007), Izquierdo, Romero, and Talvi (2008), and Rebucci (2008)
- World economy has undergone profound changes with the emergence of China and other large developing countries
- The transmission mechanisms of the international business cycle to Latin American may have changed
  - China has emerged in the world economy with important implications for LAC (Calderon, 2008)

The importance of China has skyrocketed in LAC

Figure: China's Trade Share in LAC5's Total Trade (Annual; in percent)



China has affected also patterns of world trade

Table: Trade shares for major trading blocks in 2009 and 1995

(a) 2009

	US	Euro area	Japan	China	LAC5
US	-	0.17	0.18	0.22	**0.51**
Euro area	0.15	-	0.11	0.18	**0.15**
Japan	0.07	0.05	-	0.15	0.04
China	**0.18**	**0.15**	0.26	-	**0.12**
LAC5	0.18	0.06	0.03	0.05	-
Others	0.42	0.58	0.42	0.39	0.18
Sum	1.00	1.00	1.00	1.00	1.00

(b) 1995

	US	Euro area	Japan	China	LAC5
US	-	0.19	0.31	0.21	**0.60**
Euro area	0.16	-	0.13	0.17	**0.18**
Japan	0.17	0.09	-	0.30	0.07
China	**0.05**	**0.04**	0.09	-	**0.02**
LAC5	0.13	0.05	0.03	0.02	-
Others	0.50	0.63	0.43	0.29	0.13
Sum	1.00	1.00	1.00	1.00	1.00

Contribution

- Investigate how changes in trade linkages between China, US, Latin America, and the rest of the world have altered the transmission of international business cycle to Latin America
  - The impact and the transmission of GDP shocks originating in US, China, Latin America and Rest of Emerging Asia

Contribution (cont'd)

- Methodological contribution:
  - Set up and estimate a GVAR model in which the country specific foreign variables are constructed with time-varying trade weights
    –>time varying weights enhance parameter stability
    –>permit more reliable counterfactual simulation exercises
  - Solve the GVAR with time-specific counterfactual trade weights
    –>allow us to study and compare the impact of GDP shocks using trade weights at different points in time
    –>capture the fundamental aspect of China's rapidly changing role in the world economy

Preview of the results

- Long run impact of China GDP shock on LAC5 has increased dramatically (3 times) since mid-1990s
- Long run effects of a US GDP shock on LAC5 have halved over the same period
- The transmission of LAC5 GDP shock and Rest of Emerging Asia GDP shock has not changed
- Increased impact of China GDP shock owes to both direct and indirect effects, from stronger linkages between China and US and the euro area.

Outline

1. **The GVAR Methodology**
2. Model Specification and Data
3. Results: Transmission of Shocks before and After China's rise in the World Economy
4. Conclusions

GVAR–two steps

- Step 1: Estimation of the country specific model
  - Estimate the number of cointegration relations in the VARX*
  - Domestic variables are related to country specific foreign variables

- Step 2: Solution to the global model
  - Collect all the endogenous variables in a global vector
  - Solve simultaneously using the link matrix of country specific weights

Step 1: Country specific VARX* model

- Country specific VARX*(p_i, q_i) model for the ith economy

$$\Phi_i(L, p_i)\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \Upsilon_i(L, q_i)\mathbf{d}_t + \Lambda_i(L, q_i)\mathbf{x}^*_{it} + \mathbf{u}_{it} \quad (1)$$

  - $\mathbf{x}_{it}$ is the $k_i \times 1$ vector of domestic variables
  - $\mathbf{x}^*_{it}$ is the $k^*_i \times 1$ vector of country-specific foreign variables
  - $\mathbf{d}_t$ denotes the $m_d \times 1$ matrix of observed global factors
  - $\mathbf{u}_{it}$ is the idiosyncratic country specific shock
  - p_i and q_i: lag order of the domestic and foreign variables

- Country specific foreign variables $\mathbf{x}^*_{it}$

$$\mathbf{x}^*_{it}\left(\mathbf{W}_{i,\tau(t)}\right) = \sum_{j=0}^{N} \mathbf{W}_{ij,\tau(t)}\mathbf{x}_{jt} = \mathbf{W}_{i,\tau(t)}\mathbf{x}_t, \quad (2)$$

  - $\mathbf{x}_t = (\mathbf{x}'_{0t}, \mathbf{x}'_{1t}, ..., \mathbf{x}'_{Nt})'$ is the vector of all endogenous variables
  - $\mathbf{W}_{i,\tau(t)} = (\mathbf{W}_{i0,t}, \mathbf{W}_{i1,t}, ..., \mathbf{W}_{iN,t})$ is the $k^*_i \times k$ time-varying matrix of weights

Weak exogeneity

- Weak exogeneity of $\mathbf{x}^*_{it}$
  - no long run feedback from domestic to foreign variables, without ruling out lagged short run interactions
  - important: allows for estimation conditional on country specific foreign variables
- Testing Weak exogeneity
  - Johansen (1992) and Harbo (1998)
  - Joint significance of the estimated error correction terms of VARX models in the marginal model of $\mathbf{x}^*_{it}$

$$\begin{aligned} \Delta \mathbf{x}^*_{it,l} &= \mu_{il} + \sum_{j=1}^{r_i} \gamma_{ij,l} ECM^j_{i,t-1} + \sum_{k=1}^{s_i} \varphi_{ik,l} \Delta \mathbf{x}_{i,t-k} \\ &+ \sum_{m=1}^{n_i} \vartheta_{im,l} \Delta \tilde{\mathbf{x}}^*_{i,t-m} + \varepsilon_{it,l} \qquad (3) \end{aligned}$$

  - F-test of joint hypothesis: $\gamma_{ij,l} = 0, j = 1, 2, ...r_i$

Step 2: The Global VAR model–Combining the VARX*

- Collect all the $k = \sum_{i=0}^{N} k_i$ endogenous variables in the $k \times 1$ global vector $\mathbf{x}_t$, define the $k_i \times k$ selection matrix $\mathbf{S}_i$

$$\mathbf{x}_{it} = \mathbf{S}_i \mathbf{x}_t. \tag{4}$$

- Solve simultaneously using the link matrix of country specific weights $\mathbf{W}_i^0$

$$\mathbf{S}_i \mathbf{x}_t = \hat{\Phi}_i \mathbf{S}_i \mathbf{x}_{t-1} + \hat{\Lambda}_{i0} \mathbf{W}_i^0 \mathbf{x}_t + \hat{\Lambda}_{i1} \mathbf{W}_i^0 \mathbf{x}_{t-1} + \tilde{\mathbf{u}}_{it}. \tag{5}$$

and stack each country-specific model for $i = 0, 1, ..., N$

$$\mathbf{G}\mathbf{x}_t = \mathbf{H}\mathbf{x}_{t-1} + \tilde{\mathbf{u}}_t, \tag{6}$$

where $\mathbf{G} = (\mathbf{G}_0', \mathbf{G}_1', ..., \mathbf{G}_N')'$, and $\mathbf{H} = (\mathbf{H}_0', \mathbf{H}_1', ..., \mathbf{H}_N')'$, and $\mathbf{G}_i = \mathbf{S}_i - \hat{\Lambda}_{i0} \mathbf{W}_i^0$, and $\mathbf{H}_i = \hat{\Phi}_i \mathbf{S}_i + \hat{\Lambda}_{i1} \mathbf{W}_i^0$

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Model Setup

- Estimation period: 1979Q2 to 2009Q4
- 26 country/area specific VARX models
- Euro Area considered as one single economy

United States	**Euro Area**	**Latin America**
China	Germany	Brazil
Japan	France	Mexico
United Kingdom	Italy	Argentina
	Spain	Chile
Canada	Netherlands	Peru
Australia	Belgium	
New Zealand	Austria	
	Finland	
Rest of Asia	**Rest of W. Europe**	**Rest of the World**
Korea	Sweden	India
Indonesia	Switzerland	South Africa
Thailand	Norway	Turkey
Philippines		Saudi Arabia
Malaysia		
Singapore		

Inclusion of variables

- Variables included in the GVAR (in logarithms)

real output (y_{it})	the rate of inflation (π_{it})
short term interest rate (ρ^S_{it})	long rate of interest (ρ^L_{it})
real equity prices (q_{it})	oil prices (p^o_t)
real exchange rate ($e_{it} - p_{it}$)	

- Variables Specification of the Country-specific VARX* Models

Non-US models		**US model**	
Domestic	Foreign	Domestic	Foreign
y_{it}	y^*_{it}	y_{US}	y^*_{US}
π_{it}	π^*_{it}	π_{US}	π^*_{US}
q_{it}	q^*_{it}	q_{US}	
ρ^S_{it}	ρ^{S*}_{it}	ρ^S_{US}	ρ^{S*}_{US}
ρ^L_{it}	ρ^{L*}_{it}	ρ^L_{US}	-
$e_{it} - p_{it}$	-	-	$e^*_{US} - p^*_{US}$
-	p^o_t	p^o_t	-

Note: In the non-US models the inclusion of the listed variables depends on data availability.

Country-specific estimates and tests

- Model specifications are determined in the estimation stage (step 1) and kept constant in the counterfactual exercises (step 2)
  - The lag order (p, q) of country-specific $VARX(p, q)$ models
  - The number of cointegrating relations in each country-specific model

- Test results suggest the following conditions are broadly satisfied
  - Weak exogeneity of the country-specific foreign variables
  - Weak cross-sectional correlation among shocks in country-specific conditional models
  - Unit roots in the data series included in VARX* models
  - Parameter constancy supported by structural break tests

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Relevant shocks

- Consider two country specific shocks and two regional shocks
  - China GDP shock (main focus of our application)
  - US GDP shock (major trading partner of LAC)
  - LAC5 GDP shock and Rest of Emerging Asia GDP shock
    - Shed light on the ongoing debate on the "decoupling" of emerging market business cycles

Counterfactual exercises

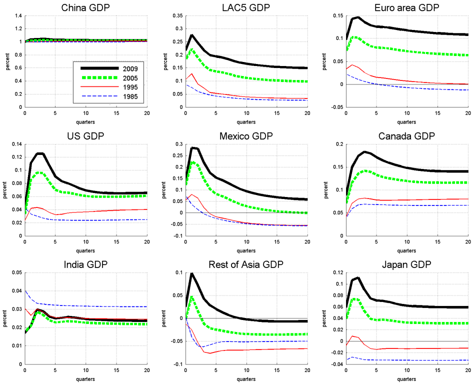
- Examine four sets of weights ($\mathbf{W}_i^0$), 1980, 1995, 2005 and 2009.
- Quantify changed transmission of shocks to LAC5 and the world economy, abstracting from any implied changes to parameter estimates that might have taken place as a result of changing trade weights

Generalized impulse response functions

- Simulate generalized impulse responses (GIRFs) for each set of weights
- Not attempt to identify demand or supply sources of GDP shocks
- Once $\mathbf{x}_t$ is conditioned on $\mathbf{x}_t^*$, the estimated country specific shocks have little or no correlation *across* countries
  - Possible to consider GDP shocks to different countries with no concerns of reverse spillovers

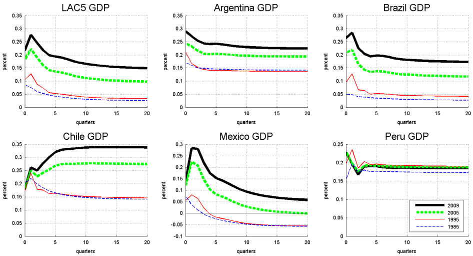
China GDP shock matters much more in AEs...

Figure: GIRFs for One Percent Increase in China GDP (World economy; point estimates; 1985, 1995, 2005, and 2009)



...and is almost three times as large in LAC5

Figure: GIRFs for One Percent Increase in China GDP (LAC5; point estimates; 1985, 1995, 2005, and 2009)

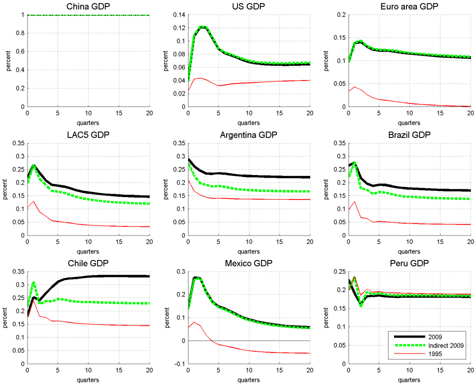


Some back of the envelope calculations

- Assume that, absent the fiscal stimulus during the crisis, China's growth rate falls by 3 percentage points to 7 percent per year (Cova et al, 2010)
- This implies a fall in LAC5 GDP growth of around 0.4-0.5 percentage points in the long run
- The observed changes in the transmission of the China GDP shock are likely to have played an important role in the unfolding of the recent global crisis

Indirect channel is at least as important as the direct

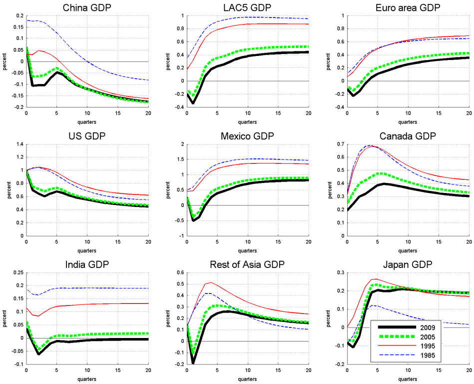
Figure: GIRFs for 1% Increase in China GDP: Total and Indirect Effect (World economy and LAC5; point estimates; 2009, Indirect 2009, and 1995)



Note: The indirect effect (labeled "Indirect 2009") is computed by lowering the trade shares of China in the LAC5 countries (except Mexico) to their 1995 levels.

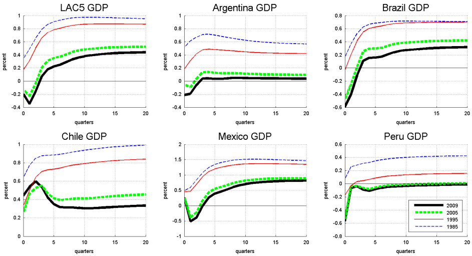
US shock has lower impact with recent weights...

Figure: GIRFs for One Percent Increase in US GDP
(World economy; point estimates; 1985, 1995, 2005, and 2009)



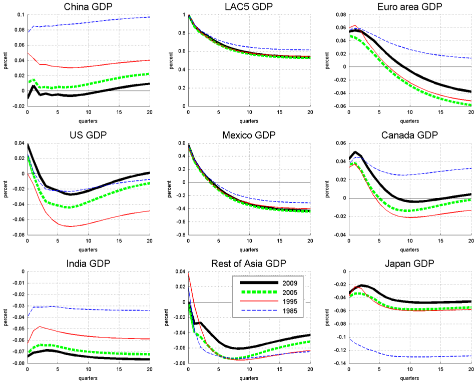
... also on LAC5

Figure: GIRFs for One Percent Increase in US GDP (LAC5; point estimates; 1985, 1995, 2005, and 2009)



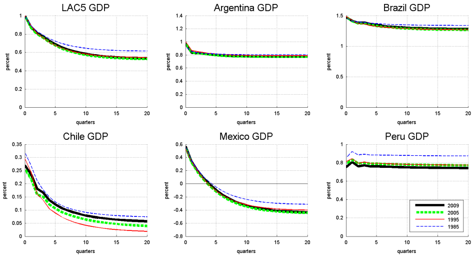
LAC5 has negligible effects on the rest of the world...

Figure: GIRFs for One Percent Increase in LAC5 GDP
(World economy; point estimates; 1985, 1995, 2005, and 2009)



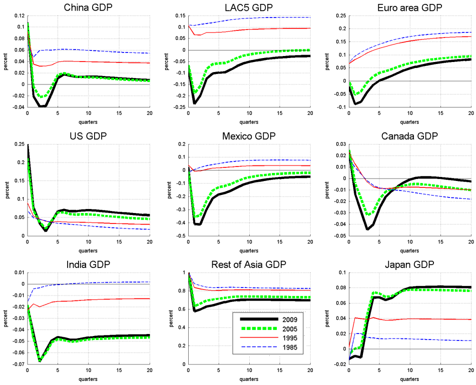
... and no change is observed on LAC5

Figure: GIRFs for One Percent Increase in LAC5 GDP (LAC5; point estimates; 1985, 1995, 2005, and 2009)



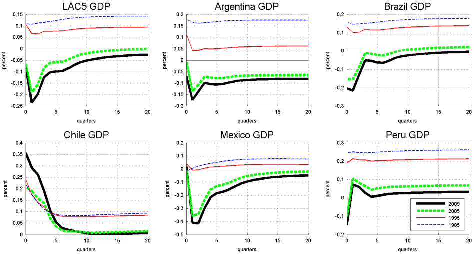
Rest of Asia has little effect on rest on the world...

Figure: GIRFs for One Percent Increase in Rest of Emerging Asia GDP (World economy; point estimates; 1985, 1995, 2005, and 2009)



... as well as on LAC5

Figure: GIRFs for One Percent Increase in Rest of Emerging Asia GDP (LAC5; point estimates; 1985, 1995, 2005, and 2009)



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Conclusions

- In this paper we investigate how China's emergence in the world economy may have changed the transmission of global output shocks to the Latin America region and the rest of the world
- Main findings
  - Long run impact of China GDP shock on LAC5 has increased dramatically (3 times) since mid-1990s
  - Long run effects of a US GDP shock on LAC5 have halved over the same period
  - The transmission of LAC5 GDP shock and Rest of Emerging Asia GDP shock has not changed
  - Increased impact of China GDP shock owes to both direct and indirect effects, from stronger linkages between China and US and the euro area

Policy Implications

- Latin America has recovered much faster than initially anticipated, as it now owes more to a fast growing economy (China) and less to the epicenter of the crisis
- "Decoupling" might be related to the emergence of China as an important source of world growth, as opposed to a more general tendency of emerging markets' business cycles from advanced economies
- New vulnerabilities for Latin America and the rest of the world if China's growth begins to slow, especially before the US and the euro area have fully recovered

Thank you!