From open economies to attitudes toward change

Growth and institutions in Latin America and Asia

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Motivation

- What explains differences in growth rates between countries over time continues to be a question of central importance in economics;
- Growth is the result and a source of structural change:
  - Andreoni and Scazzieri (2014, CJE), Herrendorf et al. (2014);
- The existence of complementarities between different pieces of the system tends to trigger circular and cumulative processes of development and underdevelopment
  - Structural change requires institutional and ideological adjustments (Pagano, 2011, JIE; Chang and Andreoni, 2019);

Motivation

- Institutions matter for economic growth:
  - "Rules of the game", a combination of formal rules, written laws, informal norms of behaviour, and shared beliefs about the world (e.g. North, 2005);
- Thirlwall's law (1979): in the long-run, growth is subject to the Balance-of-Payments Constraint (BoPC) $\Rightarrow$ $X(Z) = M(Y)$
  - Powerful explanation of international growth rate differences;
  - Institutional asymmetries viewed as different functional forms or parameter values in the behavioural equations (Cimoli, 1988, Meca; Cimoli et al. 2019, RP);

Motivation

- Societies that regard innovative change with antipathy are in sharp contrast with those with a favorable attitude towards change (North, 2005);
- Our main point is that if you are more open to change, you will find better ways to adapt to change;

  Attitudes toward change $\Leftrightarrow$ Institutions $\Leftrightarrow$ Structural Change

- The sum of "individual sentiments" forms the "collective opinion", determining the explicit and implicit rules that influence our own beliefs.
  - The capacity of adaptation of the economy depends on the design of public policies and institutions which are ultimately the result of people's attitudes and sentiments towards change;

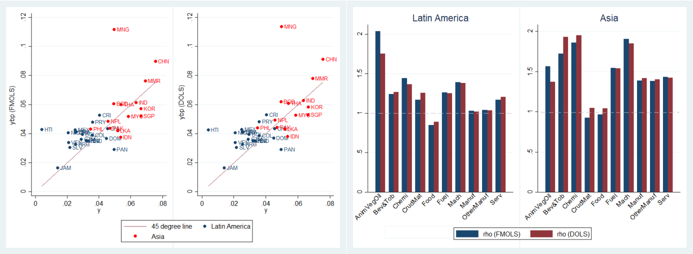
Our contribution

- Estimate the multisectoral version of Thirlwall's law using panel cointegration techniques;
- Investigate feedback channels from growth to non-price competitiveness using a panel Vector Autoregression (pVAR) model;
  - 20 Latin American and 14 Asian countries, 1980-2014, 11 sectors;
- Formalise a mechanism that explains how people with different attitudes toward change influence each other and contribute to the consolidation of certain types of institutions:
  - Two non-linear models of structural change;
  - Multiple equilibria and a formalisation of "structural cycles" through a Hopf bifurcation;

Our contribution

- 2D non-linear dynamic system:
  - BoPC rate of growth and sentiments toward change;
  - Multiple equilibria as a representation of “Asia” and “Latin America” experiences;
- 4D non-linear dynamic system:
  - BoPC rate of growth, employment rate, wage-share, and sentiments toward change;
  - Multiple equilibrium points including the possibility of “poverty traps”;

Some empirics on structural change and the external constraint

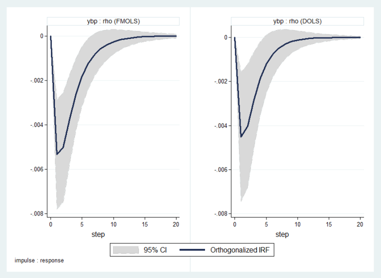


$$\ln M_{it} = \pi_{it} \ln Y_t + u_{it}$$
$$\ln X_{it} = \varphi_{it} \ln Z_t + v_{it}$$

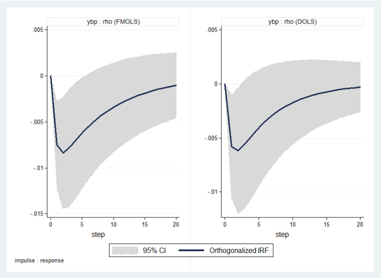
$$y_{bp} = \frac{\sum_{i=1}^{11} \Theta_i X_i}{\sum_{i=1}^{11} \Omega_i \pi_i} = \frac{\sum_{i=1}^{11} \Theta_i \varphi_i}{\sum_{i=1}^{11} \Omega_i \pi_i} z = \rho z$$

Notation: M, imports; X, exports; Y, domestic output; Z, rest of the world's output; π_i and φ_i, sectoral income elasticities of imports and exports, respectively; y_{bp}, BoPC rate of growth; ρ, non-price competitiveness; z, rate of growth of the rest of the world; Θ_i and Ω_i, share of exports and imports of sector i, respectively; u_i and v_i, error terms.

Some empirics on structural change and the external constraint



Latin America



Asia

Impulse (y_{bp}) response (ρ) functions based on pVAR estimates

A simple model of structural change

- **Sentiments:**

$$N = N^{+} + N^{-}$$

$$n = N^{+} - N^{-}$$

$$\Phi = \frac{n}{N} = \frac{N^{+} - N^{-}}{N^{+} + N^{-}}$$

- **Switching probabilities:**

$$p^{-+} = \zeta \exp\left(\mu\Phi\right)$$
$$p^{+-} = \zeta \exp\left(-\mu\Phi\right)$$

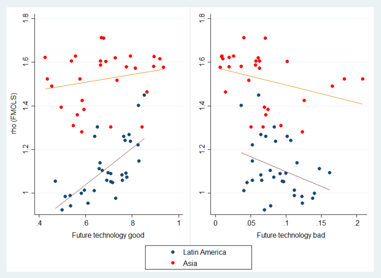
Notation: $\Phi \in [-1, 1]$ index of average sentiments toward change; p^{-+} probability of someone who is opposed to innovation changing her/his mind; p^{+-} stands for the probability of the opposite case; μ, herd behaviour parameter.

A simple model of structural change

- **Stratification mechanism (Dávila-Fernández et al. 2018):**

$$\frac{\dot{\rho}}{\rho} = \varepsilon \left(\alpha - y_{bp} \right)$$

$$\alpha = \alpha \left(\Phi \right), \ \alpha_{\Phi} > 0, \ \alpha \left(0 \right) > 0$$



Notation: $\mathcal{E}$, stratification coefficient; α, capacity of adaptation;

Dynamic system

2D non-linear system

$$\dot{y}_{bp} = \varepsilon \left[\alpha \left(\Phi \right) - y_{bp} \right] y_{bp}$$
$$\dot{\Phi} = \zeta \left[\left(1 - \Phi \right) \exp \left(\mu \Phi \right) - \left(1 + \Phi \right) \exp \left(-\mu \Phi \right) \right]$$

Equilibrium conditions

$$\varepsilon \left[\alpha \left(\Phi \right) - y_{bp} \right] y_{bp} = 0$$
$$\left(1 - \Phi \right) \exp \left(\mu \Phi \right) = \left(1 + \Phi \right) \exp \left(-\mu \Phi \right)$$

A simple model of structural change

Proposition 1 If the "herd behaviour" effect regarding sentiments toward change is weak enough, i.e. $\mu \leq 1$, the dynamic system has two equilibrium solutions, $\left(y_{bp}^{E_1}, \Phi^{E_1}\right)$ and $\left(y_{bp}^{E_2}, \Phi^{E_2}\right)$, such that:

$$y_{bp}^{E_1} = \alpha\left(0\right)$$
$$\Phi^{E_1} = 0$$

and

$$y_{bp}^{E_2} = \Phi^{E_2} = 0$$

A simple model of structural change

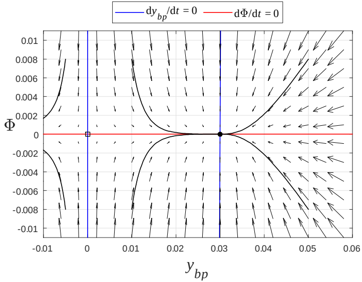
Proposition 2 If $\mu > 1$, the dynamic system has four additional equilibrium solutions:

$$y_{bp}^{E_i} = \alpha\left(\Phi^{E_i}\right)$$
$$\left(1 - \Phi^{E_i}\right)\exp\left(\mu\Phi^{E_i}\right) = \left(1 + \Phi^{E_i}\right)\exp\left(-\mu\Phi^{E_i}\right)$$
$$i = 3, 4$$

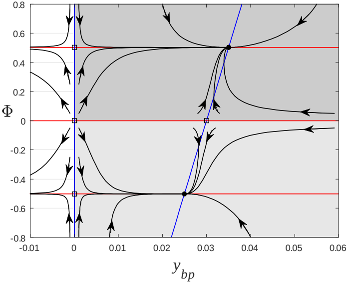
and

$$y_{bp}^{E_j} = 0$$
$$\left(1 - \Phi^{E_j}\right)\exp\left(\mu\Phi^{E_j}\right) = \left(1 + \Phi^{E_j}\right)\exp\left(-\mu\Phi^{E_j}\right)$$
$$j = 5, 6$$

A simple model of structural change



μ=0.75



μ=1.1

Functional form $\alpha(\Phi) = \alpha_0 + \alpha_1 \Phi$

Parameter values: $\alpha_0 = 0.03$, $\alpha_1 = 0.01$; $\varepsilon = 1.5$, $\zeta = 0.25$

A 4D extension of the model

- **Supply conditions:**

$$Y = \min\{K/\vartheta; qNe\}$$

$$\frac{\dot{K}}{K} = \frac{\dot{Y}}{Y} = y_{bp}$$

$$\frac{\dot{e}}{e} = \frac{\dot{Y}}{Y} - \frac{\dot{q}}{q} = y_{bp} - \frac{\dot{q}}{q}$$

- **Distributive conditions:**

$$Y = wL + rK$$

$$\frac{\dot{\varpi}}{\varpi} = \frac{\dot{w}}{w} - \frac{\dot{q}}{q}$$

Notation: K, capital; ϑ, capital-output ratio; L, employment; $e = L/N$, employment rate; $q = Y/L$, labour productivity; w, real wages; ϖ, wage-share; r, profit-rate;

Relative power theory

- Money is a political resource $\Rightarrow$ when the rich get richer relative to the poor, they will also be more powerful (Goodin and Dryzeck, 1980):
  - Reduction in protest participation (Solt, 2015, SSQ);
  - Reduction in political engagement and campaign participation (Solt 2008, JPS; Ritter and Solt, 2019, SSQ);
  - Increase and acceptance of authoritarianism (Solt, 2012, PRQ);
  - Increase in nationalism (Solt, 2011, JP);
  - Increase in religiosity (Solt et al. 2011, SSQ);

A 4D extension of the model

- **Behavioural relations:**

$$\frac{\dot{\Gamma}}{\Gamma} = \psi\frac{\dot{\sigma}}{\sigma},\ \psi > 0 \quad \frac{\dot{\sigma}}{\sigma} = -\gamma\frac{\dot{\varpi}}{\varpi},\ \gamma > 0$$

$$\frac{\dot{w}}{w} = F(e),\ F_e > 0$$

$$\frac{\dot{q}}{q} = G(y_{bp}, \varpi),\ G_{y_{bp}} > 0,\ G_{\varpi} > 0$$

- **Crucial modification:**

$$p^{-+} = \zeta \exp\left(\mu\Phi - \mu_1 \frac{\dot{\Gamma}}{\Gamma}\right) \quad (1)$$

$$p^{+-} = \zeta \exp\left(-\mu\Phi + \mu_1 \frac{\dot{\Gamma}}{\Gamma}\right) \quad (2)$$

Notation: Γ, power inequality; σ, income inequality; ψ and γ, power to income inequality elasticity and income inequality to wage-share elasticity, respectively; μ_1, sensitiviy of switching probabilities to power distribution;

Dynamic system

4D non-linear system

$$\begin{aligned}
\dot{y}_{bp} &= \varepsilon\left[\alpha\left(\Phi\right) - y_{bp}\right] y_{bp} \\
\dot{e} &= \left[y_{bp} - G\left(y_{bp}, \varpi\right)\right] e \\
\dot{\varpi} &= \left[F\left(e\right) - G\left(y_{bp}, \varpi\right)\right] \varpi \\
\dot{\Phi} &= \zeta\left[\left(1-\Phi\right)\exp\left(\mu\Phi + \mu_1\psi\gamma\frac{\dot{\varpi}}{\varpi}\right)\right. \\
&\quad \left. - \left(1+\Phi\right)\exp\left(-\mu\Phi - \mu_1\psi\gamma\frac{\dot{\varpi}}{\varpi}\right)\right]
\end{aligned}$$

Equilibrium conditions

$$\begin{aligned}
0 &= \varepsilon\left[\alpha\left(\Phi\right) - y_{bp}\right] y_{bp} \\
0 &= \left[y_{bp} - G\left(y_{bp}, \varpi\right)\right] e \\
0 &= \left[F\left(e\right) - G\left(y_{bp}, \varpi\right)\right] \varpi \\
\left(1-\Phi\right)\exp\left(\mu\Phi\right) &= \left(1+\Phi\right)\exp\left(-\mu\Phi\right)
\end{aligned}$$

Dynamic system

Proposition 5 If $\mu \leq 1$, the dynamic system admits two equilibrium solutions, $\left(y_{bp}^{E_1}, \Phi^{E_1}\right)$ and $\left(y_{bp}^{E_2}, \Phi^{E_2}\right)$, that satisfy:

$$\begin{aligned} y_{bp}^{E_1} &= \alpha(0) \\ G\left(\alpha(0), \varpi^{E_1}\right) &= \alpha(0) \\ e^{E_1} &= F^{-1}(\alpha(0)) \\ \Phi^{E_1} &= 0 \end{aligned}$$

and

$$\begin{aligned} y_{bp}^{E_2} &= \Phi^{E_2} = 0 \\ G\left(0, \varpi^{E_2}\right) &= 0 \\ e^{E_2} &= F^{-1}(0) \end{aligned}$$

such that the rate of employment and wage-share are different from zero.

Dynamic system

Proposition 6 If $\mu > 1$, the dynamic system has four additional equilibrium solutions:

$$
\begin{aligned}
y_{bp}^{E_i} &= \alpha\left(\Phi^{E_i}\right)\\
G\left(\alpha\left(\Phi^{E_i}\right), \varpi^{E_i}\right) &= \alpha\left(\Phi^{E_i}\right)\\
e^{E_i} &= F^{-1}\left(\alpha\left(\Phi^{E_i}\right)\right)\\
\left(1-\Phi^{E_i}\right)\exp\left(\mu\Phi^{E_i}\right) &= \left(1+\Phi^{E_i}\right)\exp\left(-\mu\Phi^{E_i}\right)
\end{aligned}
$$

and

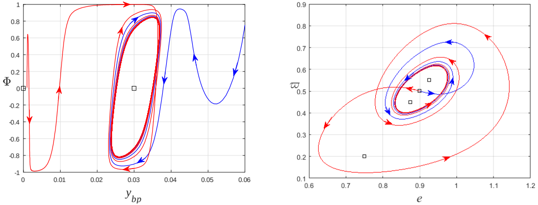
$$
\begin{aligned}
y_{bp}^{E_j} &= 0\\
G\left(0, \varpi^{E_j}\right) &= 0\\
e^{E_j} &= F^{-1}(0)\\
\left(1-\Phi^{E_j}\right)\exp\left(\mu\Phi^{E_j}\right) &= \left(1+\Phi^{E_j}\right)\exp\left(-\mu\Phi^{E_j}\right)
\end{aligned}
$$

Dynamic system

Proposition 7 When $\mu \leq 1$, the first equilibrium point of the dynamic system, $\left(y_{bp}^{E_1}, e^{E_1}, \varpi^{E_1}, \Phi^{E_1}\right)$, is locally stable as long as the sensitivity of sentiments to changes in income distribution, ψ, is **sufficiently** low and a **series of conditions** are satisfied. The second equilibrium point, $\left(y_{bp}^{E_2}, e^{E_2}, \varpi^{E_2}, \Phi^{E_2}\right)$, will be locally stable as long as the capacity of adaptation, $\alpha(0)$, is **sufficiently** small and **several other conditions** hold.

Dynamic system

Proposition 8 Regarding the first equilibrium point of the dynamic system, $\left(y_{bp}^{E_1}, e^{E_1}, \varpi^{E_1}, \Phi^{E_1}\right)$, for values of ψ **sufficiently** high in the neighbourhood of the critical value ψ_{HB}, it loses stability and the dynamic system admits a family of periodic solutions around it.



μ=0.75 ψ=5

Functional forms:

$F(e) = -f_0 + f_1 e, \; G(y_{bp}, \varpi) = -g_0 + g_1 y_{bp} + g_2 \varpi$

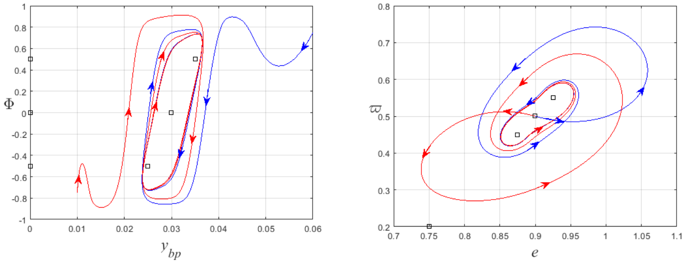
Parameter values: $f_0 = 0.15, \; f_1 = 0.2, \; g_0 = 0.01, \; g_1 = 0.5, \; g_2 = 0.05, \; \mu_1 = 2.35, \; \gamma = 2$

Dynamic system

Proposition 9 When $\mu > 1$, the equilibrium solutions $\left(y_{bp}^{E_3}, e^{E_3}, \varpi^{E_3}, \Phi^{E_3}\right)$ and $\left(y_{bp}^{E_4}, e^{E_4}, \varpi^{E_4}, \Phi^{E_4}\right)$ are locally stable as long as the sensitivity of sentiments to changes in income distribution, ψ, is **sufficiently** low and a **series of conditions** are satisfied. The equilibrium points $\left(y_{bp}^{E_5}, e^{E_5}, \varpi^{E_5}, \Phi^{E_5}\right)$ and $\left(y_{bp}^{E_6}, e^{E_6}, \varpi^{E_6}, \Phi^{E_6}\right)$, will be locally stable as long as the capacity of adaptation, $\alpha\left(\Phi^{E_j}\right)$, is **sufficiently** small and **several other conditions** hold.

Dynamic system

Proposition 10 Regarding the equilibrium points $\left(y_{bp}^{E_3}, e^{E_3}, \varpi^{E_3}, \Phi^{E_3}\right)$ and $\left(y_{bp}^{E_4}, e^{E_4}, \varpi^{E_4}, \Phi^{E_4}\right)$, for values of ψ **sufficiently** high in the neighbourhood of the critical value ψ_{HB}, they lose stability and the dynamic system admits a family of periodic solutions around them.



μ=1.1 ψ=2

Final considerations

- This article makes two contributions to the literature on growth and structural change:
  - We estimated the multisectoral version of Thirlwall's law and showed that increases in the BoPC rate of growth have a negative impact on the ratio of foreign trade income elasticities
  - We endogenised the capacity of adaptation of the economy, which we assumed to be a function of attitudes or sentiments toward change $\Rightarrow$ "Asia" *vs* "Latin America" *vs* "poverty traps" + "Structural cycles"

$$\Phi \uparrow \Rightarrow y_{bp} \uparrow \Rightarrow e \uparrow \Rightarrow \varpi \uparrow \Rightarrow \frac{\dot{q}}{q} \uparrow \Rightarrow e \downarrow \Rightarrow \varpi \downarrow \Rightarrow \Phi \downarrow$$

$$\Phi \downarrow \Rightarrow y_{bp} \downarrow \Rightarrow e \downarrow \Rightarrow \varpi \downarrow \Rightarrow \frac{\dot{q}}{q} \downarrow \Rightarrow e \uparrow \Rightarrow \varpi \uparrow \Rightarrow \Phi \uparrow$$

- Obrigado, Grazie, Thank you...