Investment and Structural Change, Real Exchange Rate and Economic Growth in Developing Countries

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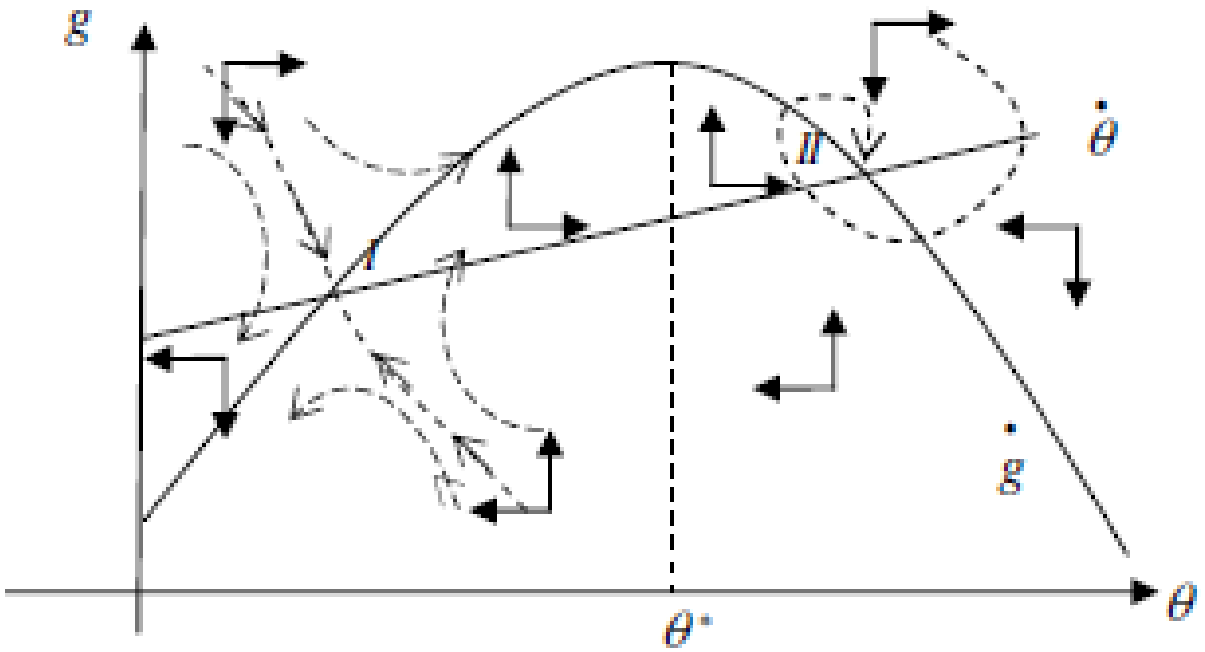
A Research Agenda

Some points to start:

- Our research is grounded in three main theoretical references:
  - i) Structuralist economic theory;
  - ii) Balance of Payments Constrained Growth Model;
  - iii) New Developmentalism;
- Then:
  - Economic growth results from a process of structural change.
  - Structural change can be defined as a change of the production system (and labor) across sectors (i. e, change in the participation of the sectors in the product composition).
  - Pro-growth structural change: a shift towards modern tradable activities in product composition.

- In this context, if the dynamics of production structures matter for growth, the question arises: what variables can promote structural change toward modern tradable activities?
- This agenda seeks to show that the competitive Real Exchange Rate (RER) is an important variable in this process for developing countries.

Background Model



- Conclusion:
  - i) competitive RER leads to faster growth (II - high equilibrium);
  - ii) overvalued RER slows down growth (I - low equilibrium).
  - iii) Only a high equilibrium is stable!

....just the another way to see the central argument (ND): competitive RER is important to economic growth!

- The next step is to look in more detail at each equation, the specified (and missing) transmission channels, and empirical gaps!
- Why?
  - because there is a vast literature that shows that a competitive RER positively affects the growth rate of developing countries.
  - But this doesn't apply to the literature on transmission channels. We need to move in this direction.

1) External constraints equation

- It is assumed that the **income** elasticity of demand for exports and imports is an endogenous function of the level of RER (θ)., i.e.:

$$\varepsilon = f(\bar{s}_\theta, a_\theta) \quad \text{with} \quad \frac{\partial \varepsilon}{\partial \bar{s}} \cdot \frac{\partial \bar{s}}{\partial \theta} > 0; \quad \frac{\partial \varepsilon}{\partial a} \cdot \frac{\partial a}{\partial \theta} > 0$$

$$\pi = f(\bar{s}_\theta, a_\theta) \quad \text{with} \quad \frac{\partial \pi}{\partial \bar{s}} \cdot \frac{\partial \bar{s}}{\partial \theta} < 0; \quad \frac{\partial \pi}{\partial a} \cdot \frac{\partial a}{\partial \theta} < 0$$

where:

- $\bar{s}_\theta$ is the number of goods produced by the country - directly affected by RER;
- a_θ is technological progress - indirectly affected by RER;

- Therefore, it is possible to rewrite the so-called Thirlwall's Law as:

$$y_t = \frac{\varepsilon(\theta)}{\pi(\theta)} \cdot y_E$$

- Taking the derivative, we obtain:

$$\frac{\partial y_t}{\partial \theta} = \frac{\pi(\theta) \cdot \left(\frac{\partial \varepsilon(\theta)}{\partial \theta}\right) - \varepsilon(\theta) \cdot \left(\frac{\partial \pi(\theta)}{\partial \theta}\right)}{(\pi(\theta))^2} \cdot y_E > \mathbf{0}$$

- In the in the multisectoral version of Thirlwall's law with endogenous elasticities, the growth rate of the domestic sector's income (σ_y^U) is given by:

$$\sigma_y^U = \frac{\sum_{i=1}^{n-1} \xi(\beta_{0,i} + \beta_{1,i}\theta) a_{i\hat{n}} a_{ni}}{\sum_{i=1}^{n-1} (\phi_{0,i} - \phi_{1,i}\theta) a_{i\hat{n}} a_{ni}} \sigma_y^A + \frac{\sum_{i=1}^{n-1} (\xi a_{i\hat{n}}^U - a_{\hat{i}n}^U) \rho_i^U a_{ni}^U}{\sum_{i=1}^{n-1} (\phi_{0,i} - \phi_{1,i}\theta) a_{i\hat{n}} a_{ni}}$$

where:

- n is the number of sectors; σ_y^A is the growth rate of foreign income, and ξ, $\beta_{0,i}$, $\beta_{1,i}$, $\phi_{0,i}$, $\phi_{1,i}$, $\xi a_{i\hat{n}}^U$, $a_{i\hat{n}}^U$, ρ_i^U, a_{ni}^U are parameters related to each sector.

- This equation shows that the overall growth performance of the U country is affected by the exchange rate through its effect on technological progress.
- Basically, there are two mechanisms:
  - i) firstly, allowing a country to obtain or keep comparative advantage in terms of producing and exporting a particular good;
  - ii) secondly, through the (change in) share of the industrial sector in GDP.

- To simplify, we can illustrate the effects of RER on the income-elasticity of exports in the multisectoral model like

$$\varepsilon = \sum_{i=1}^{k} \omega_{xi} \varepsilon_i$$

- Equation means that the mix of exports is composed of k goods, each one with a specific income-elasticity of demand for exports ε_i weighted by its share in the total exports ω_{xi}.
- The income-elasticity of the economy depends on the composition of total exports (productive structure).

- How can we identify the effects of RER on the **income** elasticity?

- **Composition Effect:** A competitive RER increases the share of export sectors with great income-elasticity within the productive structure:

$$\varepsilon = \sum_{i=1}^{k} \left[\omega_{xi}(\text{RER})\right] . \varepsilon_i$$

- **Sophistication Effect:** A competitive RER increases the income-elasticities of goods produced in the domestic economy:

$$\varepsilon = \sum_{i=1}^{k} \omega_{xi} . \left[\varepsilon_i(\text{RER})\right]$$

- **Diversification Effect:** A competitive RER increases the number of exported goods:

$$\varepsilon = \sum_{i=1}^{k(\text{RER})} \omega_{xi} . \varepsilon_i$$

and in empirical terms?

- There is limited empirical testing of elasticity endogeneity;
- Most studies focus on examining the ratio between elasticities ($\frac{\varepsilon}{\pi}$) (this approach doesn't make the channels clear).
- We acknowledge certain limitations in our ability to empirically test these relationships, including methodological constraints, data availability, and challenges in isolating the effects of specific variables.

- To move forward on this issue, our main **suggest** is to explore the varied responses of **individual** products (sectors) to exchange rate.
- Palazzo and Rapetti (2023) conducted a study using trade data from Argentina, employing the Mean Group Method to estimate macro trade elasticities at a four-digit product disaggregation. Their findings reveal a diverse range of responses in exports and imports at the individual product level to RER movements.

Indirect Testing Approaches

There is a well-developed international and national literature in this area.

- (our strategy) As the effects of exchange rate on income elasticities can be summarized as structural changes, we can define proxy variables for these changes and then test the impact of RER on them.

In the paper written with Gabriel, L. F (PSL Quarterly Review, 2018)

- The objective was show how RER impacts different economic sectors and the economic complexity index.
- i. e, we try to show whether the exchange rate can induce a Pro-growth structural change.

Panel data estimations -118 countries; 1990-2011

Table 1 – *Description of the variables used in the model, its measures and sources*

Abbreviation	Brief variable description	Source
GDPpc	*Per capita* GDP in real terms (US dollars – 2005).	IMF
GDPpcgr	Real *per capita* GDP growth rate	IMF
vamanu	Manufacturing sector share to GDP (value added, in %) – 15-37 divisions from the *International Standard Industrial Classification* (ISIC)*	WDI – GGDC
vaprim	Primary sector share to GDP (value added, in %) – 1-5 division from *International Standard Industrial Classification* (ISIC)*	WDI – GGDC
vaserv	Services sector share to GDP (value added, in %) – 50-99 divisions from *International Standard Industrial Classification* (ISIC)*	WDI – GGDC
gaptec	Technological gap between countries from Verspargen (1993) methodology	Based on PWT 8.0
misxrate	RER adjusted by the Balassa-Samuelson effect according to Rodrik (2008) – undervaluation measure	Based on PWT 8.0
ppp	Purchasing Power Parity (PPP) in relation to GDP of each country measured in 2005 US dollars	PWT 8.0
xrat	Nominal exchange rate for each country in terms of US dollars	PWT 8.0
rer	RER adjusted by Purchasing Power Parity (PPP)	Based on PWT 8.0
ainfla	Annual inflation rate (from the *Consumer Price Index* – CPI, for each country)	WDI
ainv	Gross fixed capital formation as a proportion of annual GDP	WDI
govexp	Government consumption in terms of goods and services in relation to GDP in real terms	World Bank
ttrade	Terms of trade: index calculated as the percentage ratio of the unit export value index in relation to the unit import value index – base year 2000	WDI
eci	Hausmann et al. (2011) complexity indicator	MIT

- The following panel data econometric models are tested:

$$\text{vamanu}_{it} = \beta_0 + \beta_1 \text{misxrate}_{it} + \beta_2 \text{gaptec}_{it} + \beta_3 \sum_{j=4}^{K} \beta_j Z_{i,tj} + \mu_t + \eta_i + u_{it}$$

$$\text{vaprim}_{it} = \beta_0 + \beta_1 \text{misxrate}_{it} + \beta_2 \text{gaptec}_{it} + \beta_3 \sum_{j=4}^{K} \beta_j Z_{i,tj} + \mu_t + \eta_i + u_{it}$$

$$\text{vaserv}_{it} = \beta_0 + \beta_1 \text{misxrate}_{it} + \beta_2 \text{gaptec}_{it} + \beta_3 \sum_{j=4}^{K} \beta_j Z_{i,tj} + \mu_t + \eta_i + u_{it}$$

$$\text{eci}_{it} = \beta_0 + \beta_1 \text{misxrate}_{it} + \beta_2 \text{gaptec}_{it} + \beta_3 \text{vaprim}_{it} + \beta_4 \text{vamanu}_{it} + \beta_5 \text{vaserv}_{it} + \beta_6 \sum_{j=4}^{K} \beta_j Z_{i,tj} + \mu_t + \eta_i + u_{it}$$

Results

Table 2 – *Panel GLS (Generalized Least-Squares) estimations for advanced or developed countries and emerging or developing countries, 1990-2011*

$VAMANU_{it}$	Broad sample	Advanced countries	Emerging or developing economies
misxrate	1.286***	0.704*	1.510***
	(7.38)	(2.54)	(7.60)
gaptec	0.00199	−0.345	0.00143
	(0.37)	(−0.84)	(0.27)
ainfla	0.00260***	0.0261***	0.00207***
	(4.30)	(6.67)	(3.32)
ainv	0.0170***	0.0758***	0.00854
	(3.37)	(3.78)	(1.62)
pop	−0.381***	−0.125	−0.469***
	(−5.52)	(−0.84)	(−6.93)
govexp	−0.0140	−0.204***	0.00282
	(−1.21)	(−5.56)	(0.23)
β_0	16.01***	20.77***	15.69***
	(59.29)	(21.15)	(58.22)
N	2112	380	1732

Note: *t* statistics in parenthesis. * p<0.05, ** p<0.01, *** p<0.001.

Correct signal
+
Stat. significance

Table 3 – *Panel GLS (Generalized Least-Squares) estimations for advanced or developed countries and emerging or developing countries, 1990-2011*

$VAPRIM_{it}$	Broad sample	Advanced countries	Emerging or developing economies
misxrate	−0.408	0.939***	−0.863**
	(−1.81)	(5.04)	(−2.80)
gaptec	−0.0163	0.494	−0.0188
	(−1.08)	(1.96)	(−1.26)
ainfla	0.00108***	0.0234***	0.00106***
	(4.24)	(7.24)	(4.44)
ainv	−0.0722***	0.0475***	−0.0793***
	(−8.36)	(3.89)	(−8.71)
pop	1.226***	−0.286**	1.142***
	(9.82)	(−2.64)	(7.81)
govexp	−0.229***	0.0251	−0.153***
	(−10.09)	(1.25)	(−6.34)
β_0	19.82***	1.273*	23.47***
	(35.66)	(2.20)	(39.60)
N	2184	398	1786

Note: *t* statistics in parenthesis. * p<0.05, ** p<0.01, *** p<0.001.

Correct direction

Table 4 – *Panel GLS (Generalized Least-Squares) estimations for advanced or developed countries and emerging or developing countries, 1990-2011*

$VASERV_{it}$	Broad sample	Advanced countries	Emerging or developing economies
misxrate	−0.192	−0.387	−0.772
	(−0.77)	(−1.18)	(−1.96)
gaptec	0.0199	0.0188	0.997
	(1.61)	(1.52)	(1.69)
ainfla	−0.000329	−0.000287	−0.0375***
	(−1.31)	(−1.21)	(−6.54)
ainv	0.0430***	0.0492***	−0.127***
	(5.14)	(5.47)	(−4.18)
pop	−0.995***	−0.754***	0.0154
	(−8.32)	(−5.57)	(0.07)
govexp	0.521***	0.415***	0.486***
	(19.39)	(13.98)	(7.06)
β_0	46.26***	44.77***	60.73***
	(76.56)	(69.24)	(32.76)
N	2184	398	1786

Note: *t* statistics in parenthesis. * p<0.05, ** p<0.01, *** p<0.001.

Not stat. significance

(N=68 and T=22)

Table 5 – *GLS (Generalized Least-Squares) panel estimations and PCSE (Panel Corrected Standard Errors) estimations – emerging or developing economies, 1990-2011*

ECI_{it}	(1)	(2)	(3)	(4)	(5)	(6)	(7)
misxrate	0.0246	0.0497	0.0790**	0.111***	0.109***	0.0668*	0.106**
	(1.05)	(1.73)	(2.82)	(4.29)	(3.90)	(2.05)	(2.75)
vaprim		−0.0185***	−0.0204***	−0.0156***	0.00768***	−0.00540*	−0.0186***
		(−13.06)	(−15.87)	(−9.12)	(−3.38)	(−2.03)	(−6.37)
vamanu			0.0135***	0.0204***	0.0195***	0.0237***	0.0285***
			(5.55)	(8.17)	(7.95)	(8.95)	(10.20)
vaserv				0.00925***	0.0118***	0.0159***	0.0160***
				(5.17)	(6.60)	(7.95)	(10.13)
gaptec					−0.00410***	−0.00354***	0.000586
					(−6.78)	(−5.55)	(1.21)
ainv					0.00251*	0.00529***	0.0139***
					(2.07)	(4.09)	(4.34)
pop						−0.0626***	−0.0862***
						(−4.91)	(−6.31)
ainfla						0.0000810	0.000403**
						(1.26)	(2.66)
ttrade						−0.000614**	−0.000600
						(−2.73)	(−1.48)
β_0	−0.465***	−0.0640	−0.313***	−0.921***	−1.045***	−1.253***	−1.451***
	(−15.68)	(−1.83)	(−6.15)	(−7.06)	(−7.74)	(−7.56)	(−7.14)
N	1419	1413	1344	1340	1303	1130	1130

Correct signal + Stat. significance

Conclusion: The RER can promote structural change towards a more complex economy

In the second paper written with Iasco Pereira, Hugo C. (Investigación Economica, 2022)

- We tested the relationship between exchange rate movements and structural change for Latin American countries over the period 1975-2017.
- It is performed two alternative specifications in a panel setting considering the measure of exchange rate misalignment calculated by Couhard (2017).
- The first specification introduces the exchange rate misalignment variable directly in order to test the effects of exchange rate movements in the structural composition.
- The second specification splits up the exchange rate overvaluations from the devaluation movements with a view to test the effects of exchange rate movements in the structural composition separately.

Table 1- Database: basic information and descriptive statistics

Variable	Unit of measure and coverage	Source	Obs.	$\bar{x}$	σ
industry	Ratio of industry value add to GDP (%) (1975-2017)	World Bank	581	16.96	4.39
primary	Ratio of primary value add to GDP (%) (1975-2017)	World Bank	582	12.04	12.04
services	Ratio of services value add to GDP (%) (1975-2017)	World Bank	582	53.34	7.66
complexity index	Economic complexity index (1975-2017)	OEC	588	-0.20	0.51
industrial employment	Growth rate of the industrial employment share (1975-2010)	GGDC 10 sector database	257	-0.005	0.04
mis	Exchange misalignment calculated as the actual exchange rate minus the equilibrium exchange rate (1975-2017)	CEPII	602	0.001	0.22
profit-share	One hundred minus the wage-share (1975-2014)	Tosoni (2017)	480	63.28	7.97
terms of trade	Percentage ratio of the export unit value indexes to the import unit value indexes (2000=100) (1980-2017)	World Bank	531	112.8	35.37
openness	The sum of exports and imports (% of GDP) (1975-2017)	World Bank	602	58.85	30.34
government	Government consumption (% of GDP) (1975-2014)	PWT 9.0	560	15.24	5.78
Inflation	Consumer prices (annual %) (unbalanced)	World Bank	596	79.12	615.3
income level	GDP per capita (constant local currency and constant 2010 U.S dollar) (1975-2017)	World Bank	602	5,238	3,002

Coeficients with the correct sign and statistical significance

Table 2- Structural change, exchange misalignment and covariates: first specification (5-years)

	industry		primary		services		complexity index		industrial employment	
mis	-4.54***		-2.32		5.31**		-0.17***		-0.05***	
	(1.99)		(1.84)		(2.47)		(0.06)		(0.01)	
		1.40		-2.08		-1.92		-0.11**		-0.01
mis_{t-1}		(2.25)		(1.66)		(2.27)		(0.05)		(0.02)
	0.02	0.06	0.07	0.08	-0.07	-0.13*	-0.003	-0.002	-0.0005	-0.0008
profit-share	(0.06)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)	(0.003)	(0.003)	(0.001)	(0.001)
	-0.03**	-0.02*	-0.03***	-0.02***	0.02*	0.02	-0.001***	-0.001**	-0.0001*	-0.0001
terms of trade	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.0007)	(0.0007)	(0.0001)	(0.0001)
	0.05*	0.05*	-0.03	-0.04**	0.01	0.01	0.001	0.001	-0.0006	-0.0006
openness	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.001)	(0.001)	(0.0005)	(0.0007)
	-0.08	-0.13*	0.08	0.08	0.32***	0.38***	0.01***	0.01***	0.0009	0.001
government	(0.07)	(0.08)	(0.06)	(0.06)	(0.09)	(0.09)	(0.003)	(0.003)	(0.0006)	(0.0008)
	0.001	0.0005	-0.0009	-0.001	-0.0001	0.0004	0.0001	0.00009***	-0.00001	-0.00002**
inflation	(0.0007)	(0.0006)	(0.0007)	(0.0009)	(0.001)	(0.001)	(0.0004)	(0.00003)	(0.00001)	(0.00001)
	-8.68***	-8.68***	5.65***	5.36***	-0.65	-1.28	0.07	0.09	-0.03	-0.0007
income level	(2.76)	(2.76)	(2.06)	(2.15)	(2.92)	(3.05)	(0.11)	(0.12)	(0.03)	(0.05)
	76.07***	68.67***	-32.27**	-30.36*	47.16**	56.39***	-1.37	-1.58*	0.34	0.11
constant	(22.24)	(24.35)	(15.36)	(15.85)	(21.56)	(22.38)	(0.91)	(0.95)	(0.30)	(0.43)
Sample	94	94	94	94	94	94	96	96	49	49
R^2	0.74	0.72	0.90	0.90	0.86	0.85	0.95	0.95	0.64	0.54

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.

Again, the conclusion is that the RER can promote structural changes towards a more complex economy.

Table 3- Structural change, exchange misalignment and covariates: second specification (5-years)

	industry		primary		services		complexity index		industrial employment	
over	-11.36***		-2.13		6.88		-0.08		-0.12***	
	(4.12)		(3.72)		(4.68)		(0.17)		(0.03)	
dev	3.61		-2.56		3.44		-0.25*		0.02	
	(4.53)		(3.26)		(4.50)		(0.15)		(0.03)	
$over_{t-1}$		-0.31		-3.68		0.92		0.008		0.01
		(5.15)		(2.54)		(4.54)		(0.16)		(0.04)
dev_{t-1}		3.83		0.17		-5.94		-0.23		-0.04
		(4.87)		(3.23)		(5.76)		(0.15)		(0.04)
profit-share	0.01	0.07	0.07	0.08	-0.07	-0.13*	-0.002	-0.002	-0.0007	-0.0009
	(0.06)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)	(0.003)	(0.003)	(0.001)	(0.002)
terms of trade	-0.02*	-0.02*	-0.03***	-0.02***	0.02*	0.02	-0.001***	-0.001**	-0.0001	-0.0001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.0007)	(0.0007)	(0.0001)	(0.0001)
openness	0.05*	0.05*	-0.03	-0.04*	0.01	0.01	0.001	0.001	-0.0004	-0.0007
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.001)	(0.001)	(0.0005)	(0.0007)
government	-0.06	-0.13*	0.08	0.08	0.32***	0.38	0.01***	0.01***	0.001*	-0.001
	(0.07)	(0.08)	(0.06)	(0.06)	(0.09)	(0.09)	(0.003)	(0.003)	(0.0008)	(0.008)
inflation	0.001*	0.0007	-0.0009	-0.001	-0.0002	0.0002	0.0001***	0.00008**	-0.00001*	-0.00002**
	(0.0007)	(0.0007)	(0.0007)	(0.0009)	(0.001)	(0.09)	(0.00004)	*	9.46e-06	(0.00001)
								(0.00003)		
income level	-7.24***	-8.04***	5.61**	5.49**	-0.98	-1.52	0.05	0.07	-0.008	-0.003
	(3.02)	(2.99)	(2.29)	(2.15)	(2.92)	(3.09)	(0.12)	(0.11)	(0.03)	(0.05)
constant	66.43***	67.70***	-31.99*	-31.26*	49.37**	58.00***	-1.23	-1.44	0.16	0.15
	(1.19)	(24.49)	(16.99)	(15.86)	(21.87)	(22.96)	(0.98)	(0.91)	(0.28)	(0.43)
Sample	94	94	94	94	94	94	96	96	49	49
R^2	0.75	0.72	0.90	0.90	0.86	0.85	0.95	0.95	0.67	0.55

Notes: * significant at 10% of critical level, ** significant at 5%, *** significant at 1%. The standard deviation is between the parenthesis.

About the second equation...

The the growth rate of investment (investment function) takes the following functional form:

$$g_i = \gamma + \alpha_1 u + \alpha_2 h + \alpha_3 \theta - \alpha_4 \theta^2 \tag{1}$$

γ = the "autonomous" investment; u the rate of capacity utilization; h = share of profits; θ = level of the real exchange rate (RER); α_s are positive parameters.

- RER depreciation has a positive effect on the competitiveness and profitability of tradable goods sectors, stimulating investment (particularly in technology) in firms that produce exportable goods;
- On the other hand, RER depreciation also has the effect of drop real wages (due to decreased demand) and increasing the cost of imported inputs, including capital goods.

- We face two challenges here:
  - i) The first pertains to limitations in the employed approach: this equation specification only considers the direct effects on the income growth rate.
  - ii) The second is of empirical nature.

- Estimating this equation empirically poses several challenges;
- Firstly, because the equation is non-linear;
- Secondly, we have good reasons to suspect its limitations, primarily capturing the direct effect of the RER on the trade sector;
- In practice, it's likely that h is also influenced by the RER;
- In other words, income distribution is affected by variations in the RER level.
- This opens a **new door** within this research agenda.

- If **profit** is affected by RER, then we need to know, for example:
  - i) what is the exchange rate pass through to the inflation rate;
  - ii) If RER affects real wages;
  - iii) whether RER affects the profit rate and/or the share of profit in income;

in empirical terms...

- (in a paper under review) We empirically investigated the influence exerted by the RER on investments in 81 sectors of the Brazilian manufacturing industry, between 2007 and 2018.

- The term $x_{s,t-1} \cdot \text{rer}_{s,t}$ captures the influence of changes in the RER via the **export channel**;
- The term $m_{s,t-1} \cdot \text{rer}_{s,t}$ captures the influence of changes in the RER via the **cost channel**;
- The term $p_{s,t-1} \cdot \text{rer}_{s,t}$ captures the the influence of changes in the RER on sectoral investment through the **import penetration channel**.

Table - Estimates of first and second specifications (all sectors of Brazilian manufacturing industry)

	(1)[a]	(2)[a]	(3)[a]	(4)[a]	(5)[a]	(6)[a]	(7)[a]	(8)[a]
	First specification				Second specification			
	GMM-diff		GMM-sys		GMM-diff		GMM-sys	
$I_{s,t-1}$	-0.55**	-0.54**	-0.62***	-0.52***	-0.58**	-0.62***	-0.62***	-0.57***
	(0.28)	(0.26)	(0.21)	(0.16)	(0.30)	(0.24)	(0.20)	(0.16)
$sales_{s,t}$	1.42***	1.39***	1.51***	1.35***	1.55***	1.54***	1.53***	1.38***
	(0.36)	(0.29)	(0.33)	(0.21)	(0.35)	(0.28)	(0.30)	(0.21)
$x_{s,t-1}*rer_{s,t}$	7.40***	8.12***	5.99***	5.20***				
	(2.62)	(2.15)	(1.82)	(2.00)				
$m_{s,t-1}*rer_{s,t}$	-0.76	-6.07*	0.34	-1.59***				
	(2.15)	(3.32)	(1.44)	(2.39)				
$p_{s,t-1}*rer_{s,t}$		6.10		1.80				
		(3.85)		(2.69)				
$\theta_{s,t-1}*x_{s,t-1}*rer_{s,t}$					12.5***	14.07***	9.29***	8.24**
					(4.57)	(4.33)	(3.21)	(3.77)
$\theta_{s,t-1}*ms_{,t-1}*rer_{s,t}$					-0.64	-10.60*	0.69	-3.20
					(3.56)	(6.37)	(2.19)	(4.60)
$\theta_{s,t-1}*p_{s,t-1}*rer_{s,t}$						11.69*		4.17
						(6.58)		(4.39)
constant			-0.17***	-0.17***			-0.17***	-0.18***
			(0.04)	(0.03)			(0.03)	(0.04)
AR(2)	0.92	0.91	0.68	0.96	0.83	0.63	0.66	0.75
Sargan test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen test	0.22	0.22	0.45	0.10	0.33	0.30	0.42	0.10
Groups	80	80	81	81	80	80	81	81
Number of instruments	21	27	31	39	21	27	30	37

Notes: [a] performed using the robust option.

- The variable $x_{s,t-1} \cdot \text{rer}_{s,t}$ is statistically significant at the 1% critical values and positive in all the estimates. The parameter in column (2) equals 8.12. i.e, the export channel plays a crucial role.
- In turn, the variable $m_{s,t-1} \cdot \text{rer}_{s,t}$ is statistically significant at the 10% critical values (only in the column (2) estimate) and negative. The parameter equals -6.07. (Some relevance of the cost channel)

- (in a second paper under review) We empirically investigated the influence of RER pass-through on prices in the manufacturing sectors of the Brazilian economy over the period from 2010 to 2019.

Table 1 - Sectoral Pass-Through (long-run: 12 months): GMM estimates

	Nominal exchange rate pass-through				*Sectoral effective exchange rate*			
	First Specification		*Second Specification*		*First Specification*		*Second Specification*	
Devaluation/ Sector	*1%*	*1 s.d.*[a]	*1%*	*1 s.d.*[a]	*1%*	*1 s.d.*[b]	*1%*	*1 s.d.*[b]
10	0.47	2.14	0.48	2.18	0.15	0.56	0.13	0.49
11			0.11	0.50	-0.12	-0.47	-0.13	-0.51
12	0.75	3.42	0.80	3.64	0.80	3.09	0.87	3.36
13	0.13	0.59	0.01	0.04			0.06	0.22
14	0.33	1.50	0.30	1.36	-0.38	-1.55	-0.12	-0.49
15	0.26	1.18	0.25	1.14	0.23	0.95	0.35	1.45
16	0.32	1.45	0.33	1.50	0.34	1.39	0.38	1.55
17	0.64	2.91	0.65	2.96	0.50	1.95	0.72	2.81
18	-0.17	-0.77	-0.03	-0.13				
19							0.16	0.75
20b	-0.22	-1.0	0.00	0.0				
20c	0.63	2.87	0.76	3.46				
21	0.10	0.45	0.46	2.09	-0.05	-0.16	-0.23	-0.75
22	0.7	0.31	0.07	0.31				
23	0.15	0.68	0.24	1.09	0.46	2.18	0.53	2.52
24							0.01	0.04
25	0.23	1.04	0.24	1.09	0.04	0.16	0.04	0.16
26	0.35	1.59	0.34	1.55				
27	-0.4	-0.18	-0.08	-0.36			-0.07	-0.26
28	0.8	0.36	0.06	0.27				
29	0.3	0.13	0.03	0.13	0.09	0.37	0.03	0.12
30	0.78	3.55	0.99	4.51	0.11	0.55	0.08	0.40
31	-0.1	-0.04	0.00	0.0	0.17	0.66	0.17	0.66
Extractive	0.20	0.91	0.21	0.95	0.27	1.17	0.53	2.30
PPI	0.18	0.82	0.17	0.77	0.34	1.47	0.41	1.78

Notes: (1) specification 1 was run using 4 degrees of freedom of test-J (the instruments regressions contains a

- Results for the pass-through from 1% of exchange rate devaluation:
  - Few sectors have a pass-through greater than 50%;
  - The vast majority have a pass-through of less than 50%;

Concluding remarks

- The results highlight a stylized fact: the **RER has a positive impact on the economic growth of developing countries**.
- The influence of RER on growth manifests in diverse ways.
- While acknowledging the progress made, it's evident that there is much work to be done.
- The Central Bank has the potential to contribute significantly to economic growth by ensuring a stable and competitive exchange rate is maintained over an extended period.

Thank you!

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