

# Common trends in producers' expectations, the nonlinear linkage with Uruguayan GDP and its implications in economic growth forecasting

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# Motivation

- **Importance of expectations concerning economic fundamentals and cyclical fluctuations.** Recent empirical studies have shown that macroeconomic fluctuations are not only a product of the current economic situation but are also very frequently influenced (and stressed) by agents' expectations (Karnizova, 2010; Leduc & Sill, 2010; Patel, 2011; Conrad & Loch, 2011).
- **Expectation indicators developed from surveys among agents** (entrepreneurs, consumers or experts), are nowadays widely used because of their predictive power of the main macroeconomic variables. See Pesaran & Weale (2006) for an extensive review of this empirical literature.

- Theoretical frameworks and empirical strategies for analysing how expectations are influenced by the macroeconomic context and, inversely, how they influence economy and decision making are stated in:
- Karnizova, 2010, Leduc & Sill, 2010; Patel, 2011; Beaudry & Portier, 2005; Beaudry & Portier, 2006; Eusepi & Preston, 2008; Floden, 2007; Jaimovich & Rebelo, 2007; Li & Mehkariz, 2009; Kurz et al., 2003; Mertens, 2007; Westerhoff, 2006; Bondt & Diron, 2008; Brown & Taylor, 2006; Paradiso et al., 2014; Wen, 2010; Clavería, 2010; Clavería et al. 2006; 2007; 2015; 2016; 2017 (amongst others).

- However, literature applied to the study of Latin American economies is scarce.
- Uruguay, a small and open Latin American country, has traditionally been subject to external shocks, particularly from its neighbours Argentina and Brazil (an unstable neighbourhood). Those shocks come in strong cyclical fluctuations and episodes of crisis.
- Recent studies for Uruguay have shown the importance of agents' expectations in explaining and predicting Uruguayan macroeconomic main variables in the short term (inflation, manufacturing production, etc., see Licandro & Mello, 2014; Borraz & Gianelli, 2010; Lanzilotta et al., 2008; Lanzilotta, 2006; 2015)
- Evidence found in some of these works and the implications for economic policy motivates the present research.

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# Objective

Three main objectives:

- analyse the importance of agents' expectations (of manufacturing sector) in predicting GDP growth,
- identify common trends in the expectations of producers,
- identify empirical linkages between expectations and Uruguayan GDP growth.

But also:

- determine policy implications
- and follow up previous studies for Uruguay (Lanzilotta, 2006; 2015)



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## Methodological framework

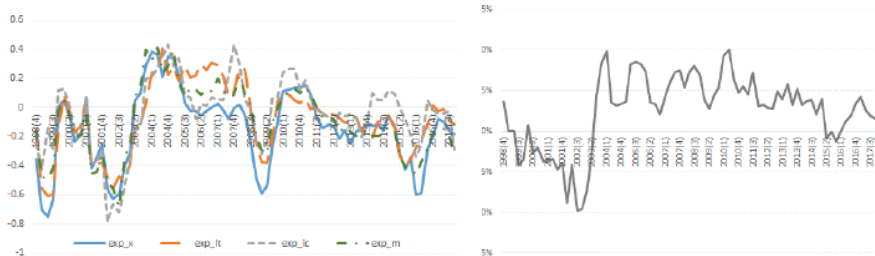
Predominantly empirical and exploratory approach.

- We break down the manufacturing sector into 4 groups differentiated by their trade participation and production specialisation (according to Laens & Osimani, 2000): export industries, import-substitution industries; intra-sectoral trade (b2B) industries; low-trade industries.
- We estimate a multivariate structural model and test the existence of common underlying trends between expectations (following Carvalho & Harvey, 2005; Carvalho et al., 2007).
- Finally, applying the procedure proposed by Breitung (2001) and Holmes Hutton we test the existence of a long-run relationship between producers' expectations the Uruguayan GDP growth.

## The data

- The information on producers' expectations comes from the monthly industrial surveys conducted by the CIU since 1997.
- This survey asks manufacturing sector entrepreneurs about their expectations of the economy evolution (amongst other dimensions) in the next 6 months. They are asked to state whether they expect the situation to improve, worsen or remain the same.
- The aggregate indicator (split into four groups) is calculated by applying the *Balance methodology* (employed by Eurostat and many empirical research studies Kangasniemi et al., 2010; Kangasniemi & Takala, 2012; amongst others).
- Uruguayan real GDP growth: interannual rate (source BCU).
- Sample: 1998Q1-2017Q4, quarterly frequency.

## Expectation indicators (left panel) and Uruguayan GDP growth (right panel)



Sample: 1998.Q1-2017.Q4, Source: based on CIU and BCU data

Graphical analysis of the 4 expectation indicators (left panel) demonstrates that they have a similar evolution (suggesting the possibility of a common trend)

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In accordance with the characteristics of the four series, we initially formulate an unrestricted specification of a local level model with drift:

### Local level model with drift:

$$exp_{it} = \alpha_j + \mu_{it} + \epsilon_{it}, \quad \epsilon_{it} \sim NIID(0, \sigma_{it}^2)$$

$$\mu_{it} = \mu_{it-1} + \eta_{it}, \quad \eta_{it} \sim NIID(0, \sigma_{it}^2)$$

where:

$exp_{it}$ : expectation indicator of group  $i$   $\mu_{it}$ : is the underlying level of group  $i$ ,  
 $\epsilon_{it}; \eta_{it}$ : are white noise disturbance, both normally distributed and independent of each other.

Additionally equations present autoregressive components (to correct for autocorrelation) and qualitative variables for the correction of outliers.

Unrestricted multivariate structural model (UnModel).

Vector of endogenous variables:  $[exp_x, exp_{lt}, exp_{ic}, exp_m]$ .

Quarterly data, 1998Q1 – 2017Q4

Model estimated: Y = Level + Irregular + Cycle + AR(1) (strong convergence)	<i>exp_x</i>	<i>exp_lt</i>	<i>exp_ic</i>	<i>exp_m</i>
I. Standard deviations of the component residues:				
Irregular	0.0183213	0.0168855	0.03906136	0.0315031
Level	0.1435112	0.1253643	0.11070953	0.1072958
Cycle	-	-	-	-
AR(1)	0.0442764	0.04725177	0.09790924	1.02441375
AR coefficient	0.61585	0.86513	0.56430	0.12878
II. Model diagnostic statistics:				
Normality (Bowman-Shenton)	5.8586	7.4957	2.5458	7.6502
T	72	73	70	73
Rd <sup>2</sup>	0.27656	0.21453	0.27642	0.34623

Note: x: export industries; m: import-substitution industries; ic: intra-sectoral trade industries; lt: expectations of low-trade industries. AR(1): autoregressive process (order = 1).

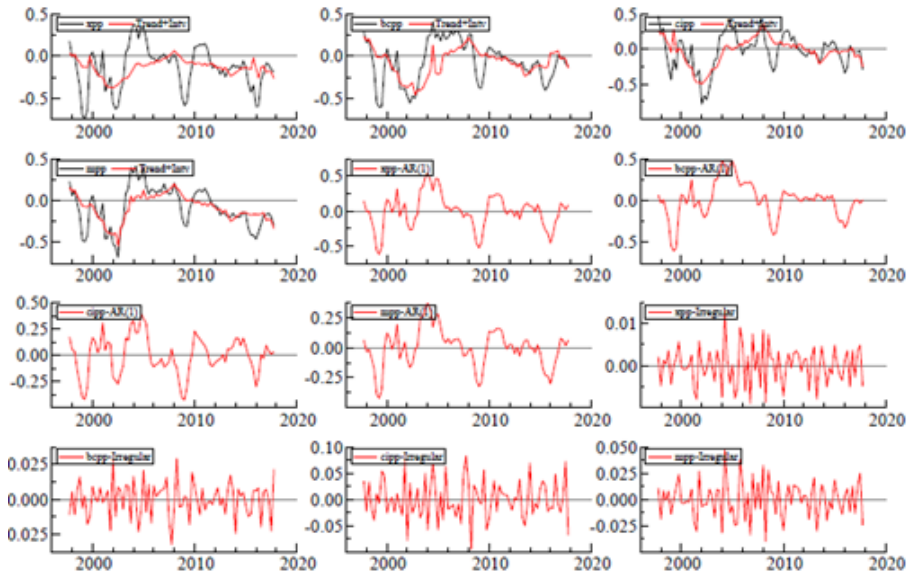
- The variance-covariance matrix shows a high correlation between the levels of the expectation series. The matrix rank is 1 (2 at a lower significance level). This justified the restriction of common levels between the 4 indicators.
- Eigenvalues of the matrix of variances suggest that expectations of intra-sectoral trade, low-trade and import-substitution industries may be specified as dependent (of exporters' expectations).

### Restricted multivariate structural model

Model estimated:				
Y = Level + Irregular + Cycle + AR(1) (strong convergence) <i>exp_lt, exp_ic, exp_m: dependent</i>	<i>exp_x</i>	<i>exp_lt</i>	<i>exp_ic</i>	<i>exp_m</i>
I. Standard deviations of the component residues:				
Irregular	0.0075090	0.0180425	0.0511940	0.0249947
Level	0.0399903	-	-	-
Cycle	-	-	-	-
AR(1)	0.1406744	0.1179466	0.1192950	0.09542264
II. Model diagnostic statistics:				
Normality (Bowman-Shenton)	3.6559	6.4634	1.5909	5.4138
T	72	73	70	73
Rd <sup>2</sup>	0.33485	0.26135	0.2985	0.42233



# Components of the multivariate structural model with common trends, 1998Q1 -2017Q4



The model estimated (ignoring cyclical and autoregressive components) can be written as:

### Restricted multivariate structural model

$$\exp_{xt} = \mu_t^* + \epsilon_{xt},$$

$$\exp_{l_{tt}} = 1.384\mu_t^* + 0.03994 + \epsilon_{l_{tt}},$$

$$\exp_{i_{ct}} = 1.865\mu_t^* + 0.2439 + \epsilon_{i_{ct}},$$

$$\exp_{m_t} = 1.215\mu_t^* - 0.1556 + \epsilon_{m_t},$$

$\mu_t^*$  is a univariate random walk with drift.

Therefore the level components have the following relationship:

### Level components

$$\exp_{l_{tt}} = 1.384\mu_{xt} + 0.03994,$$

$$\exp_{i_{ct}} = 1.865\mu_{xt} + 0.2439,$$

$$\exp_{m_t} = 1.215\mu_{xt} - 0.1556,$$

where the common trend is the one estimated for export industries  $\mu_{xt}$ .

- Previous international (Kangasniemi et al. (2010); Kangasniemi & Takala, 2012) and local research (Lanzilotta, 2015) allows the hypothesis that expectations have a relevant role in GDP forecasting.
- To prove this we analysed the existence of a cointegration relationship between the underlying trend of industrial expectations and the Uruguayan GDP growth.
- In order to avoid restricting the modeling we applied a set of 'free models' (following Breitung, 2001, and Ye Lim et al., 2011). Breitung propose testing the existence of cointegration without imposing any parametric model. When cointegration is accepting, the linearity of the underlying relationship is tested.

- Results demonstrate cointegration and linearity. We verified the existence of a long term relationship between the underlying trend of industrial expectations,  $\mu_{xt}$ , and Uruguayan GDP growth, which is non-linear.

**Table 4. . Results of nonparametric cointegration test and linearity test**

	Test Statistics	
	$\Xi_T^*[1]$	$T \cdot R^2$
$[\mu_{exp,xt}, \Delta_4 \ln GDP]$	0.0175**	7.4689***
Significance Level	Critical values	
10%	0.025	2.706
5%	0.020	3.841
1%	0.014	6.635

Notes: The hypothesis of no cointegration is rejected if the rank statistic,  $\Xi_T^*[2]$ , is below the respective critical value and the hypothesis of linearity is rejected if the score statistic,  $T \cdot R^2$ , exceeds the  $\chi^2$  critical values. \*, \*\* and \*\*\* denote significance at 10%, 5%, according with the grades of freedom of each estimation.

Causality Holmes & Hutton  $\mu_{xt}, \Delta_4 \ln GDP$ 

Table 5. . Results of nonparametric causality test

H-H causality test, H0: nc	Uruguay	
	Probability	NC
d(exp)-->d2(lGDP)	0.000	A
d2(lGDP)-->d(exp)	0.143	R
exp-->d4lGDP	0	A
d4lGDP-->exp	0	A

Notes: F-statistic, NC: H0: noncausality

- Causality between the variables applying the nonparametric procedure proposed in Holmes & Hutton (1990).
- Results confirm the bidirectional causality between Uruguayan GDP growth and expectations when the test is performed in levels (i.e. for the long run). In the short-run (first differences of the variables) the evidence uniquely allows accepting causality from expectation to GDP growth

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## Main findings:

- Industrialists' expectations follow a single common trajectory, determined by expectations in the exporter group.
- This finding shows the importance of most trade-oriented industries in spreading macroeconomic expectation shocks, what may be associated with its importance in the Uruguayan manufactured production (over 50 %) and significantly backwards spillover effect.
- In addition, their exposure to international trade makes them more competitive and provides them with access to extensive and more complete information on the relevant macroeconomic and international context.
- The *learning hypothesis* (Eusepi & Preston, 2008) may explain the transmission of expectations. This is believed to take place among agents who do not receive this kind of information directly.

- Results also confirm what some international studies have postulated (Kangasniemi et al., 2010; Kangasniemi & Takala, 2012; Clavería, 2010; Clavería et al. 2006; 2007; 2015; 2016; 2017): expectation indicators provide valuable information for anticipating and predicting the future of the economy.
- The identification of a common trend in industrialists' expectations, determined by the export group, reflects the structure of the Uruguayan open economy whose dynamic is highly dependent on the long-term performance of the external sector.
- Another interesting result of this research is the confirmation that the relationship between expectations and the growth of Uruguayan GDP is non-linear.



- **Implications for economic policy:** the influence of the most trade-oriented industries on overall expectations and then on GDP growth is a signal for policymakers seeking to mould expectations and create a climate of optimism during recessions so that their duration and consequences are lessened.
- **Future research:** which factors ultimately determine expectations in the key sectors and the identification of non-linear model that links expectations with Uruguayan GDP growth.

THANKS