Bias in economic news in Colombia: the reporting of the nominal exchange rate and the central bank response

Rodrigo Taborda

rodrigo.taborda@urosario.edu.co

Facultad de Economía
Universidad del Rosario, Bogotá

10th Workshop on Media Economics
Bogotá, October 19-20, 2012

Exchange rate swings

- Since 1991, Colombia has had a market determined exchange rate.
- As the exchange rate swings, there are winners and losers.
- However, in Colombia, the number of news reporting the behavior of the exchange rate (Col $ pesos per 1 US Dollar) is (apparently) higher for revaluation (Vs. devaluation).
- With an unbiased media, coverage of its behavior and consequences should be balanced, reporting both devaluation and revaluation.

Questions

1. Is it real the over-reporting of revaluation?
2. If this is the case, why revaluation is more worthy of press attention than devaluation? Is it the media, or an exogenous player inflating the news?
3. With what purpose?
4. Is he successful?

Answers

1. Real? Yes, in a test of means and regression analysis, asymmetry or the uneven reporting of news is established.
2. Why? There is an interest group colluding –implicitly or explicitly– with the media to highlight the effects of revaluation (Corneo, 2006 model).
3. Purpose? Create sympathy among the people and public entities for assistance. Text analysis shows a high correlation between an interest group – public authorities – assistance.
4. Successful? Yes, in a regression analysis of central bank intervention on the exchange rate, the number of news turns out to be a good explanatory variable.

Corneo (2006)

- A suitable model for the problem at hand is the voting model of Corneo (2006) "Media capture in a democracy: The role of wealth concentration." *Journal of Public Economics* 90 (1-2).
- The sequence of events in Corneo (2006) is:
  1. An interest group seeks to form a coalition with the media.
  2. The media reaches the citizen presenting a state of the world accordingly to have formed a coalition or not.
  3. Based on this state of the world citizens vote in the next elections for a policy that alleviates the state of the world.
  4. All actors become winners, the interest group, media and politicians.

15+ years of market determined Nominal Exchange Rate (NER)

- Since late 1960s Colombia had a fixed, constantly increasing NER.
- The adoption of single and market determined exchange rate is part of the reforms in the early 90s in Colombia (and several LA countries).
- From Dec. 1/1991 to Jan 23/1994, exchange rate bond or *Certificado de cambio*.
- From Jan. 24/1994 to Sept 25/1999, exchange rate band.
- Since Sept 26/1999, dirty float.

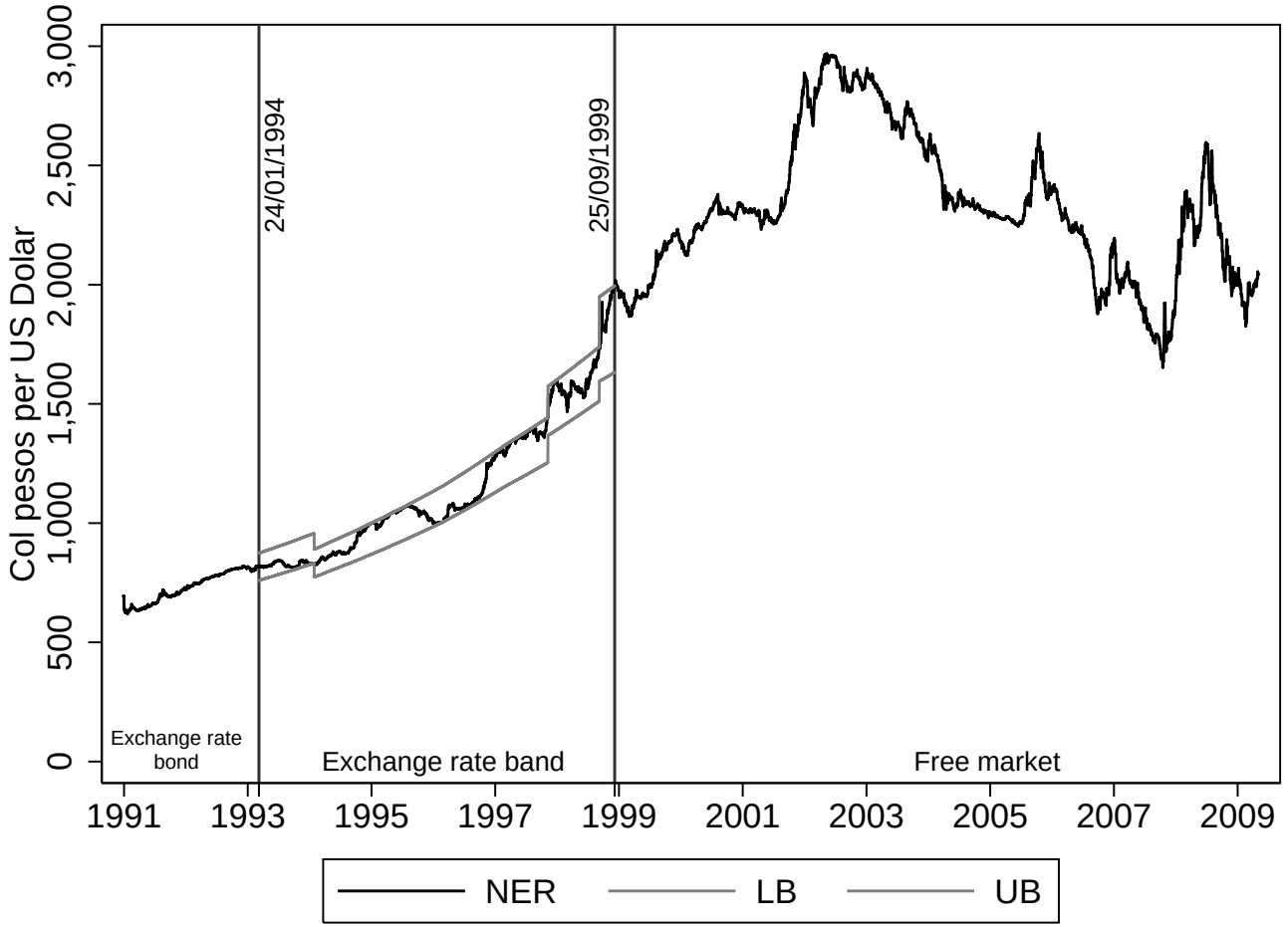


Figure 1. Colombia's Nominal Exchange Rate (NER).

The number of news

- The number of news, editorials and op-eds comes from the electronic archive of Colombia's main newspaper conglomerate, Casa Editorial El Tiempo.
- A secondary source of news, for robustness check, is the website ngrams.cavorite.com
- The words "devaluación" (devaluation) and "revaluación" (revaluation) where used as key words for the search.
- The search was conducted from January 1992 to December 2009. With an output of 2,109 news, editorials and op-eds from El Tiempo archives.
- News from sections: science and technology, culture and leisure, international, car sales, home sales, Bogotá local news, and paid commercial information were excluded from the sample.

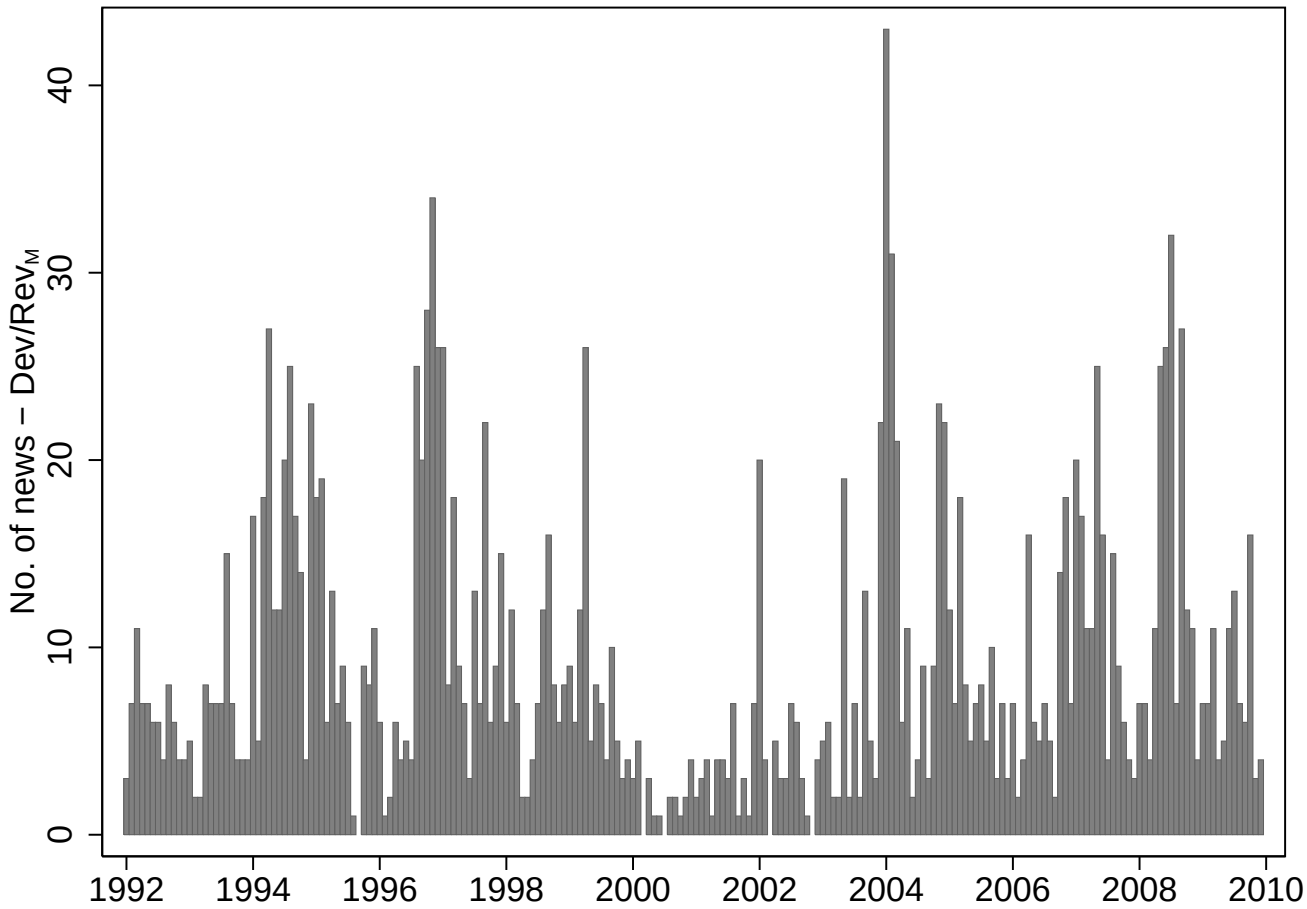


Figure 2. Devaluation/Revaluation news, editorials and op-eds.
Note: Number of news, editorials and op-eds published by the *El Tiempo*, *Portafolio* and *Cambio*.

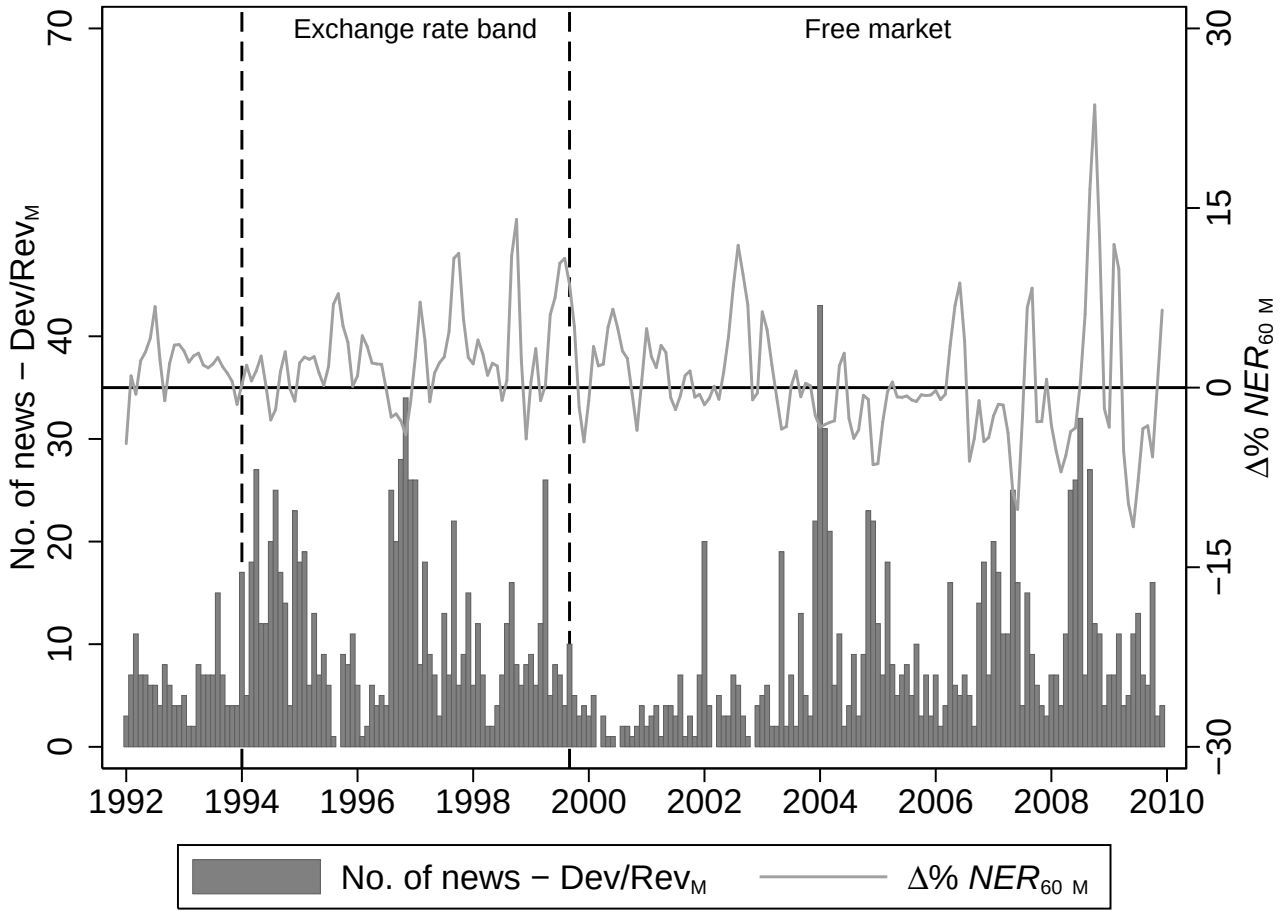


Figure 3. NER behavior, news, editorials and op-eds.

The number of news

- Two measures of news.
- The absolute number of news

$$No.\ of\ news_{M(El\ Tiempo)} = \sum_{i}^{I} News_i$$

- The relative number of news

$$Relative\ No.\ of\ news_M = \frac{No.\ of\ news_{M(El\ Tiempo)}}{No.\ of\ news_{M(\text{“}Economa\text{”}\ n\text{-}grams)}} \times 100$$

Testing for media bias

- In this study **media bias** is defined as the uneven reporting of the behavior of the nominal exchange rate.
- If media were unbiased, the number of news reporting devaluation and revaluation should not be different.
- To test media bias two procedures are undertaken:
  1. Test of means. Does the number of news differ between revaluation and devaluation episodes?
  2. A Negative Binomial Regression Model (NBRM) (poisson) is estimated, regressing the number of news against the behavior of the exchange rate, duration of the devaluation/revaluation and market period dummy:

$$No.\ News_M = f(\Delta\%^{+} NER_{mM}, \Delta\%^{-} NER_{mM}, Duration, Market\ dummy, Ownership\ dummy, Year\ dummy, Month\ dummy)$$

Equality of means

Table 1. Equality of means and Wilcoxon test of equal distribution

		Revaluation $N = 96$		Devaluation $N = 121$		Test	
No. of news	$m = 30$	Mean	SD	Mean	SD	Stat	P-value
All news	T test of means	10.312	8.613	7.727	6.471	-2.443	0.015
	Wilcoxon test					-2.067	0.019
Ed. and op-eds	T test of means	7.802	6.714	6.090	5.311	-2.0411	0.042
	Wilcoxon test					-1.509	0.065
Relative No. of news	$m = 30$	Mean	SD	Mean	SD	Stat	P-value
All news	T test of means	1.71	1.444	1.255	1.107	-2.546	0.011
	Wilcoxon test					-2.067	0.019
Ed. and op-eds	T test of means	0.409	0.445	0.274	0.315	-2.499	0.013
	Wilcoxon test					-2.345	0.009

Note: *N* is the number of devaluation / revaluation episodes, *Mean* is the average number of news, *SD* is the standard deviation, *Stat* is the statistic of each test and the *P-value* the probability of equal means and distribution correspondingly.

Variables

No. News$_M$ and *Relative No. of news*$_M$: Dependent variable.

$\Delta\%^- NER_{mM}$: The percentage change of the NER $\times$ Dummy when there is a revaluation.

$\Delta\%^+ NER_{mM}$: The percentage change of the NER $\times$ Dummy when there is a devaluation.

Duration $\Delta\% NER_{mM}$: Is the duration of a devaluation or revaluation period.

Dummy market period: Takes the value of 1 for post exchange rate band period.

Dummy ownership: Change in newspaper ownership.

Lags and interaction: Plus one lag and interaction for the post-crawling band period.

$$\begin{aligned} \textit{No. News}_M = f(&\Delta\%^+ NER_{mM}, \Delta\%^- NER_{mM}, \textit{Duration}, \\ &\textit{Market dummy, Ownership dummy,} \\ &\textit{Year dummy, Month dummy}) \end{aligned}$$

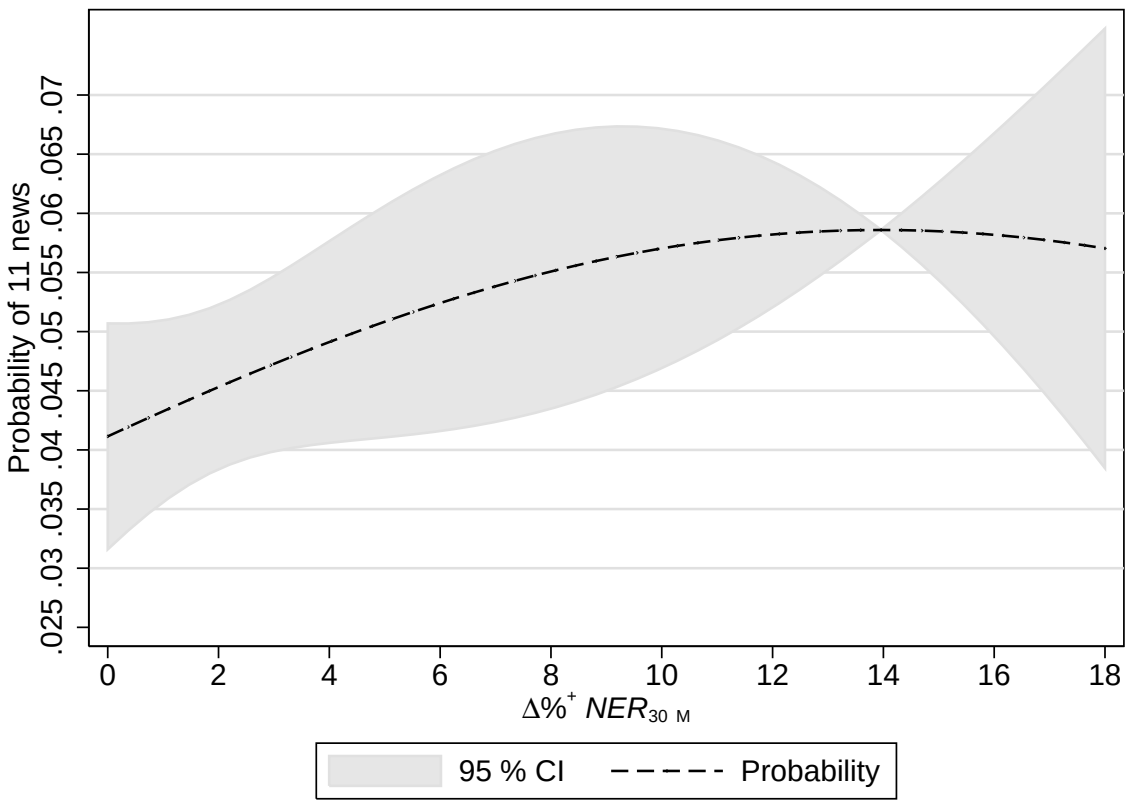
Table 2. Regression results $m = 30$

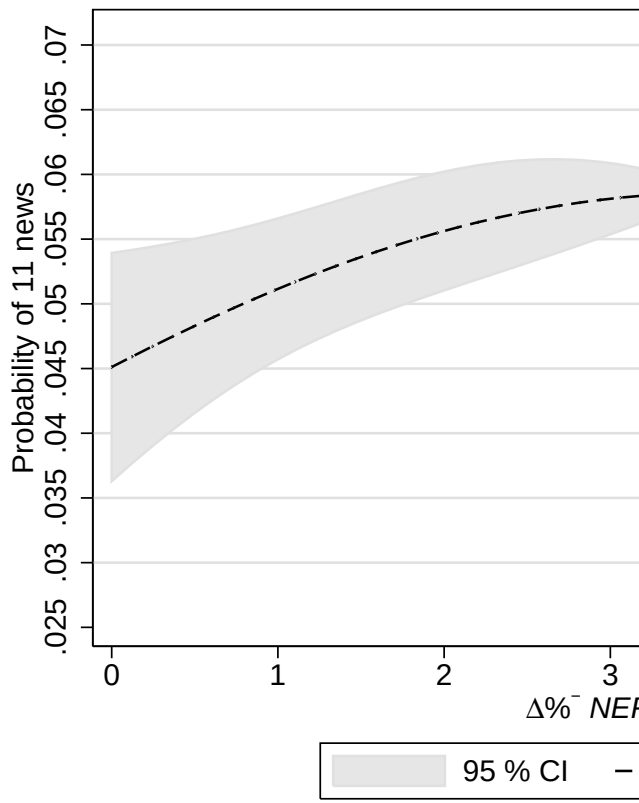
	1	2	4
$\Delta\%^{+} NER_{30M}$	0.0191	0.038	0.0351
	-0.0266	-0.027	-0.0272
$t-1$		-0.0432^{c}	-0.0429
		-0.0262	-0.0265
$\Delta\%^{-} NER_{30M}$	0.0965^{b}	0.113^{b}	0.115^{b}
	-0.0448	-0.0471	-0.0488
$t-1$		0.0185	0.0155
		-0.0451	-0.0463
Market period dummy			-0.612
			-0.419
Ownership dummy			0.616
			-0.51
Constant	2.085^{a}	2.069^{a}	2.065^{a}
	-0.213	-0.228	-0.251
Ln Alpha	-1.204^{a}	-1.280^{a}	-1.295^{a}
	-0.135	-0.138	-0.139
Observations	217	216	216
Month dummy test P-value	0.618	0.733	0.709
Year dummy test P-value	0	0	7.29^{e-11}
AIC	1335	1325	1326
BIC	1440	1436	1445
R^2 p	0.0751	0.0814	0.0829
ll	-636.6	-629.3	-628.2

Note: Negative Binomial Regression Model. Standard errors in parenthesis, a. p<0.01, b. p<0.05, c. p<0.1

Predicted probabilities

Using regression 4, $m = 30$, the figure shows the predicted probability of 11 news (the average monthly news) for different levels of **devaluation** and **revaluation**.





An interest group

- Following the finding of uneven reporting of the behavior of the exchange rate, comes the question of the existence of an interest group.
- Anecdotic evidence points out to exporters.
- To go beyond usual suspects, **text analysis** is performed upon the **content** of the news used to determine the media bias in the previous section.

Text analysis

- Also called text mining, content analysis, statistical analysis of text. The **purpose** is to extract information from text and transform it into a number.
- An approach to media slant, a second dimension of media bias.
- Steps towards text analysis:
  1. Collect text, assemble a *corpus* suitable for computer "reading".
  2. Tidy up text: text to lower case, control or remove blanks, stop-words (in spanish: el, lo, los, las, etc), punctuation, plurals, prefixes and suffixes, etc.
  3. Solve the conflict: words Vs. meaning.
  4. Count the words / meaning.
  5. Do some statistics based on the counting.
- Several software options, for this study the package `tm: Text Mining Package` in `R statistics software` was used.

Words Vs. meaning

- Meaning is beyond words.
  - asistencia (assistance) ⇐ asistencia, ayuda, financiación, subsidio, subsidios (assistance, help, financing, subsidy, subsidies).
  - bancodelarepública (central bank) ⇐ banco de la república, banco, emisor, junta directiva (central bank, bank, issuer, board).
  - bandacambiaria (crawling band) ⇐ banda cambiaria (crawling band).
  - crecimientoeconómico (economic growth) ⇐ crecimiento económico (economic growth).
  - dólar (dollar) ⇐ dólares (dollar).
  - estadosunidos (United States) ⇐ estados unidos (United States).
  - flores (flowers) ⇐ floricultor, floricultores (flower growers).

Words Vs. meaning

- Meaning is beyond words.
  - gobierno (government) $\Leftarrow$ ministro, ministerio (minister, ministry).
  - medidas (measures) $\Leftarrow$ medida (measures).
  - salario (wages) $\Leftarrow$ salarios (wages).
  - tasadecambio (exchange rate) $\Leftarrow$ tasa de cambio, tasa de cambio nominal (exchange rate, nominal exchange rate).
  - tasadecambioreal (real exchange rate) $\Leftarrow$ tasa de cambio real (real exchange rate).
  - tasadeinterés (interest rate) $\Leftarrow$ tasa de interés (interest rate).

Unstructured analysis

- Text analysis of a corpus generates a huge amount of words count.
- There is need to channel this myriad towards a meaningful number, still without imposing any structure.
  1. Request the most repeated words
  2. Request the most repeated words (over a threshold) associated with the purpose of the research.

  1. Words that appear more than 1,500 times in the corpus. Having about 1,800 press articles, this means words that almost always appear in each article.
  2. Words with correlation higher than 25% w.r.t. words of interest: Devaluación (devaluation), revaluación (revaluation), bancodelarepública (Colombia's central bank).

The most repeated words

Table 3. Words appearing more than 1,500 times in the corpus.

bancodelarepública	colombia	crecimiento
devaluación	dólar	economía
exportaciones	**gobierno**	**inflación**
interés	mayor	mercado
millones	país	parte
pasado	peso	pesos
poltica	precio	precios
presidente	**revaluación**	sector
tasadecambio	tasas	

Note: The table shows from left to right the words that appear more than 1,500 times in the corpus.

Words with ¿ 25% correlation

Table 4. Words with a 25% correlation or higher.

Devaluation		Revaluation		Colombia's central bank	
devaluación	1	revaluación	1	bancodelarepública	1
dólar	0.31	peso	0.38	gobierno	0.43
tasadecambio	**0.28**	**bancodelarepública**	**0.37**	**revaluación**	**0.37**
efecto	0.26	**dólar**	**0.37**	**hacienda**	**0.36**
venezuela	0.25	**exportadores**	**0.34**	manejo	0.34
		gobierno	**0.33**	**tasadecambio**	**0.34**
		tasadecambio	**0.32**	dólar	0.33
		frenar	**0.29**	**inflación**	**0.33**
		mayor	0.28	monetaria	0.33
		tema	0.28	bandacambiaria	0.32
		controlar	0.27	**frenar**	**0.32**
		importante	0.27	interés	0.32
		inflación	0.27	política	0.31
		parte	0.27	cambiario	0.30
		últimos	0.27	meta	0.30
		exterior	0.26	público	0.30
		fenómeno	0.26	tasas	0.30
		problema	0.26	divisas	0.29
		sido	0.26	medida	0.29
		capitales	0.25	medidas	0.29
		país	0.25	**mercado**	**0.28**
		sino	0.25	**controlar**	**0.27**

Structured analysis

- Without imposing any structure **key words** such as "**exporters**", "**central bank**", "**government**", **to stop** ("controlar" and "frenar"), were found relevant.
- The correlation of these words unveil the existence of a pattern within the content of the news being studied.
- A **second** approach is to add more words of interest and find the association among themselves.
- The result of this is summarized throughout **cluster analysis** in an association tree.
- Additional words were selected to level the odds with respect to the ones of interest.

Table 5. Words used in the hierarchical clustering analysis.

Cathegory	Spanish	English
Economic variables	competitividad desempleo industria inflación exportaciones importaciones tasadeinterés	competitiveness unemployment industry inflation exports imports interest rate
Goods	banano café flores petroleo	banana coffee flowers oil
Interest group	andi fenalco exportadores importadores	Colombia's national industry association Colombia's national retailers association exporters importers
Keywords	**revaluación** **devaluación**	**revaluation** **devaluation**
Positive and negative wording	crisis éxito progreso	crisis success progress
Public institutions	**bancodelarepública** gobierno	**Colombia's central bank** government
Public assistance	**asistencia**	**assistance**

Dendrogram 1992 - 2009

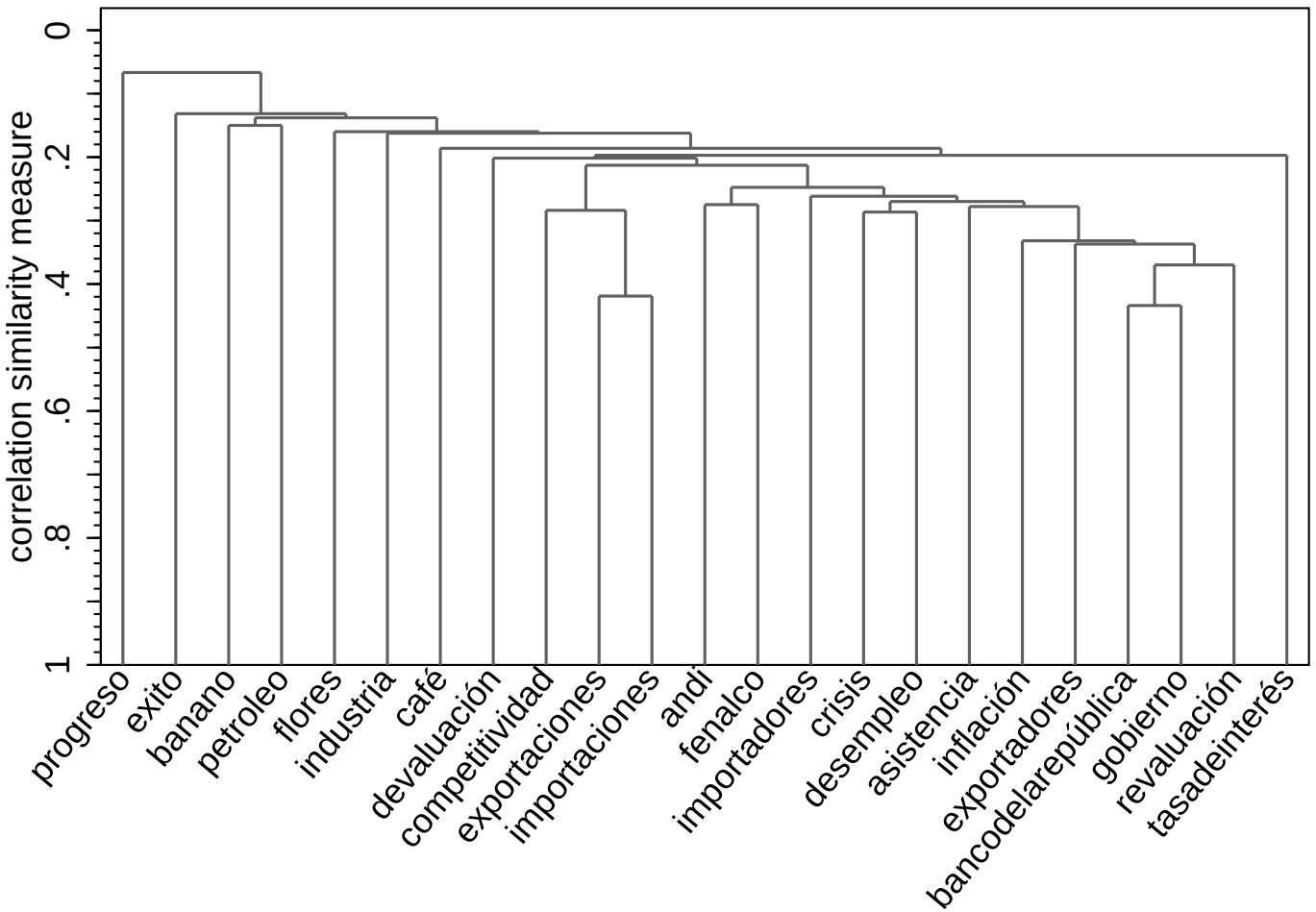


Figure 4. Dendrogram exchange rate band and floating period

Dendrogram 1999 - 2009

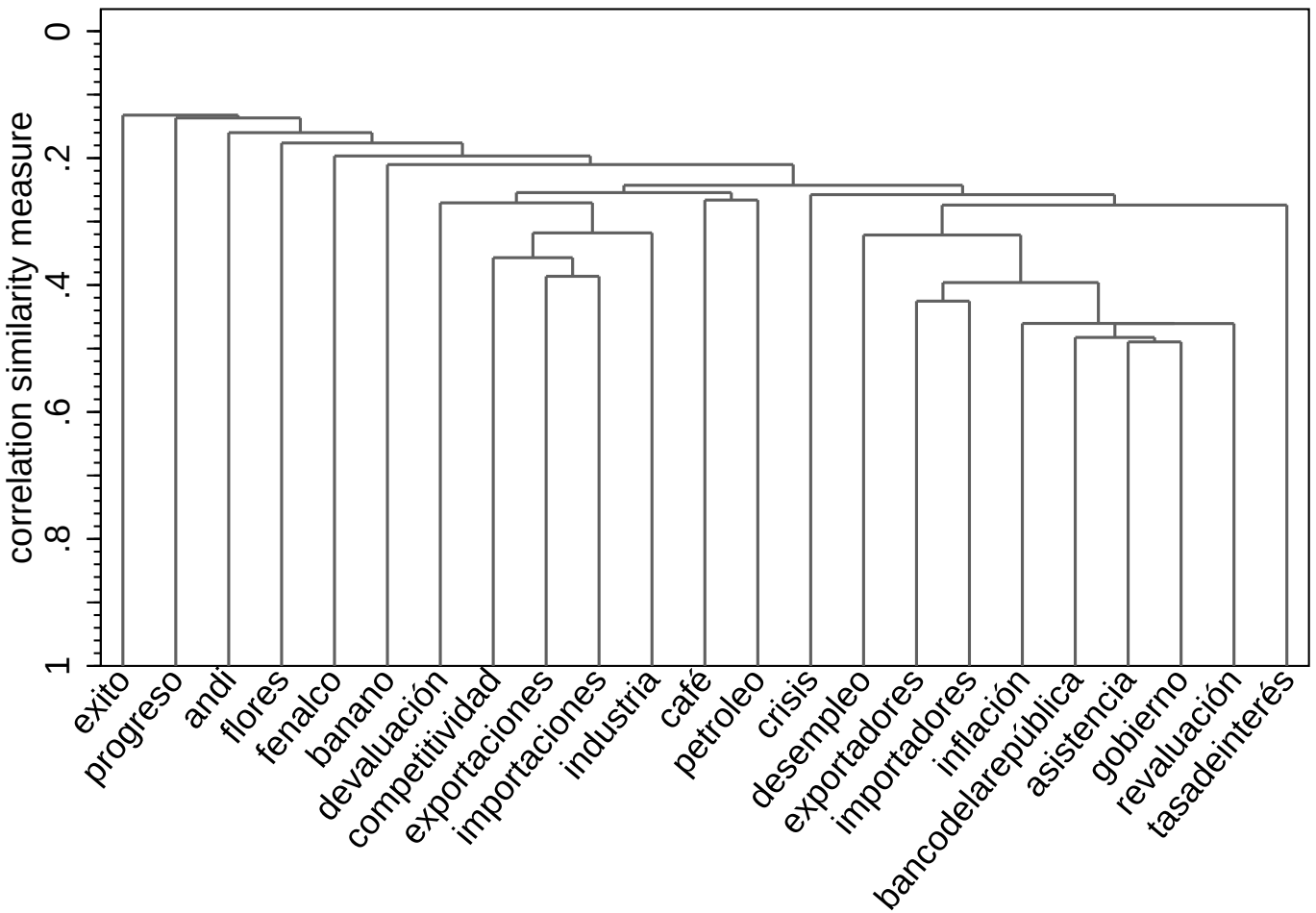


Figure 5. Dendrogram floating period

Interest group & purpose

- Previously media bias was established as the over-reporting of news during revaluation.
- Unstructured text analysis shows that revaluation (as a word) is correlated with words such as: **exporters**, **central bank**, **government**, **to stop** ("controlar" and "frenar").
- This new piece of information helps to identify the bias not only in terms of counting news, but also using **the content of the news**, answering the question of the existence of an interest group and its purpose.
- "**devaluation**" is not correlated with any word associated with an interest group.

Interest group & purpose

- Framing text analysis to a particular group of words gathered around broad categories, shows how "exporters", "central bank" and "government" **naturally become a group**.
- The finding that "bancodelarepública" and "gobierno" are correlated forming a cluster with "exportadores" and "asistencia" even though a broad set of new words is included, allows to suggests the **purpose of seeking help and intervention**.

Policy response

- Does media bias influence exchange rate policy?
- Two policy options: fiscal and monetary.
- On the fiscal side, there are: tax rebates, subsidies, government assistance upon those affected by the exchange rate swings.
- On the monetary side: central bank intervention in the market.
- The first is constantly offered although hard to be implemented, followed and assessed.
- The second has a better chance to be studied.

Central bank intervention

- Colombia's central bank **plays a role** in the exchange rate market with the purpose of: reducing **volatility**, accumulate **international reserves** or serve its primary duty to control **inflation** within the inflation targeting framework.
- Only monthly data describing intervention is available.
- A probit regression is fitted using these variables plus the number of news, which are **biased** and **linked to exporters** and the request of assistance to economic authorities.

Central bank intervention

Two measures of news are used:

$$Relative\ No.\ of\ news_M = \frac{No.\ of\ news_{M(El\ Tiempo)}}{No.\ of\ news_{M(\text{“Economía” n-grams})}} \times 100$$

$$Relative\ No.\ of\ news\ -\ Rev/Dev_M = \frac{No.\ of\ news_{M(\text{“revaluación” n-gramas})}}{No.\ of\ news_{M(\text{“devaluación” n-gramas})}}$$

Variables

Relative No. News$_M$ and *Relative No. News*$_{\frac{Revaluacion_M}{Revaluacion_M}}$: The absolute and relative monthly number of news (used in the media bias estimation).

SD_{SM} The volatility of the NER, defined as the monthly average of the standard deviation of the last S days.

π - *Target* Inflation, measured as the deviation from the inflation target.

Int. Reserves International reserves, measured as the m days percentage change.

Real interest rate differential Col-US Real interest rate differential between the Prime rate (US) and colombian (DTF) savings interest rate.

Variables

Ind. employment Δ_m Industry employment. Measured as the m days percentage change of industrial employment as reported by the monthly manufacturing survey.

Ind. output Δ_m Industry output. Measured as the m days percentage change of industrial output as reported by the monthly manufacturing survey.

$$\begin{aligned} CB\ buy_M = f(&Relative\ No.\ News_M, SD_{SM}, \pi\ \text{-}\ Target, \\ &Int.\ Reserves_{SM}, Real\ Interest\ rate\ diff_M, \\ &Ind.\ employment\Delta_m, Ind.\ output\ \Delta_m, \\ &Year\ dummy,\ Month\ dummy) \end{aligned}$$

Table 6. Probit estimation for central bank intervention in the NER market.

	$m = 30$		$m = 60$	
	Reg 3.	Reg 7.	Reg 3.	Reg 7.
Relative No. News$_M$	0.0671^c		0.0660^b	
	(0.0345)		(0.0307)	
Relative No. News $\frac{Revaluacion_M}{Revaluacion_M}$		0.612^a		0.696^a
		(0.156)		(0.169)
SD_{mM}	-0.0167	-0.0107	-0.000526	0.00525
	(0.0116)	(0.0116)	(0.00691)	(0.00811)
π − *Target*	0.374^b	0.469^b	0.367^b	0.507^b
	(0.179)	(0.208)	(0.164)	(0.199)
Int. Res$_{mM}$ %	-0.0936^b	-0.0856^b	-0.0868^a	-0.0911^a
	(0.0386)	(0.0368)	(0.0281)	(0.0284)
Real interest rate differential Col-US	0.189	0.311^b	0.220^c	0.408^a
	(0.125)	(0.142)	(0.126)	(0.141)
Ind. employment Δ_m	-0.413	-0.425	-0.0249	-0.0217
	(0.327)	(0.332)	(0.222)	(0.237)
Ind. output Δ_m	0.0324	0.0744^b	0.0168	0.0522^a
	(0.0250)	(0.0297)	(0.0128)	(0.0171)
Constant	-1.654	-1.205	-1.258	-1.069
	(1.512)	(1.498)	(0.892)	(0.824)
Observations	124	124	124	124
Year dummy test P-value	6.75e-05	0.000193	2.58e-06	3.29e-05
Month dummy test P-value	0.0379	0.0300	0.0320	0.0417
Pseudo R^2	0.359	0.418	0.362	0.428
LL	-54.29	-49.25	-54.02	-48.45
AIC	164.6	154.5	164.0	152.9
BIC	243.6	233.5	243.0	231.9

Predicted probability: No. news

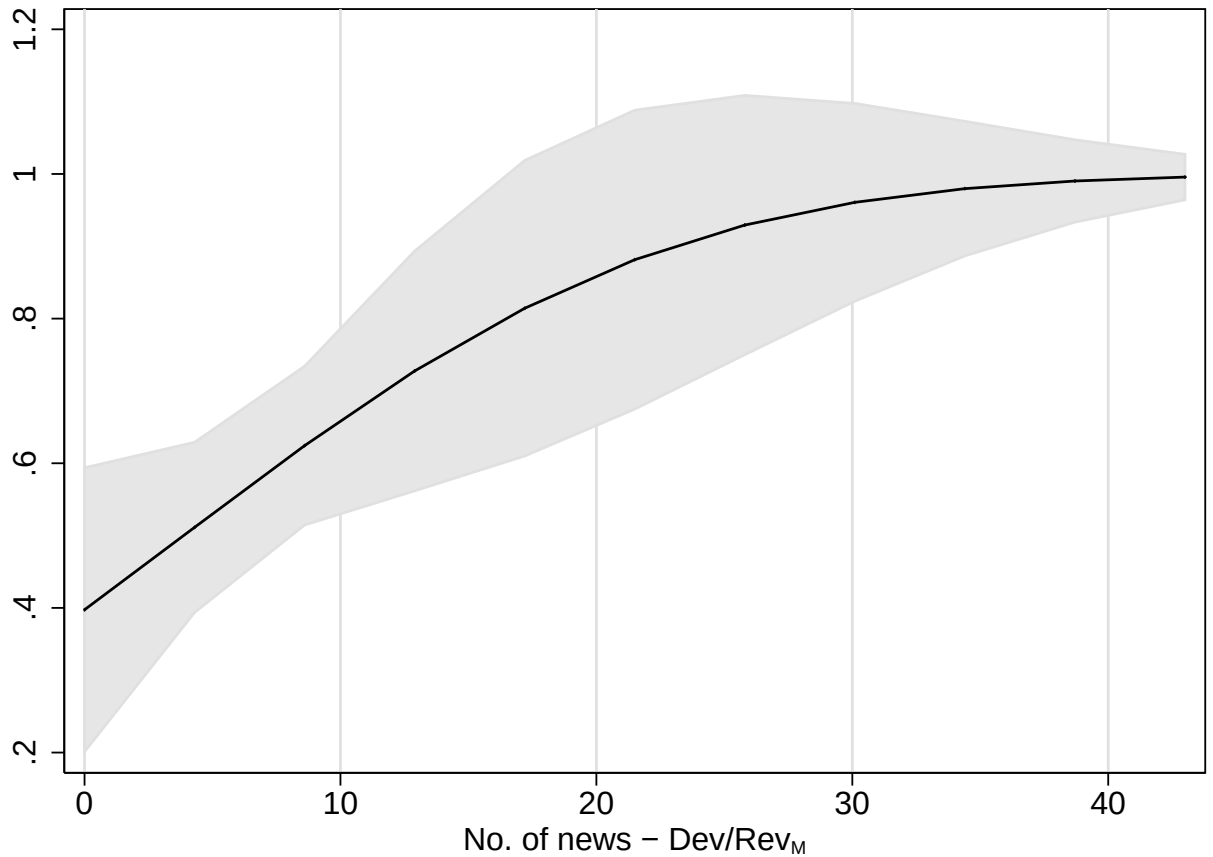


Figure 6. Predicted probabilities No. news.

Predicted probability: Volatility

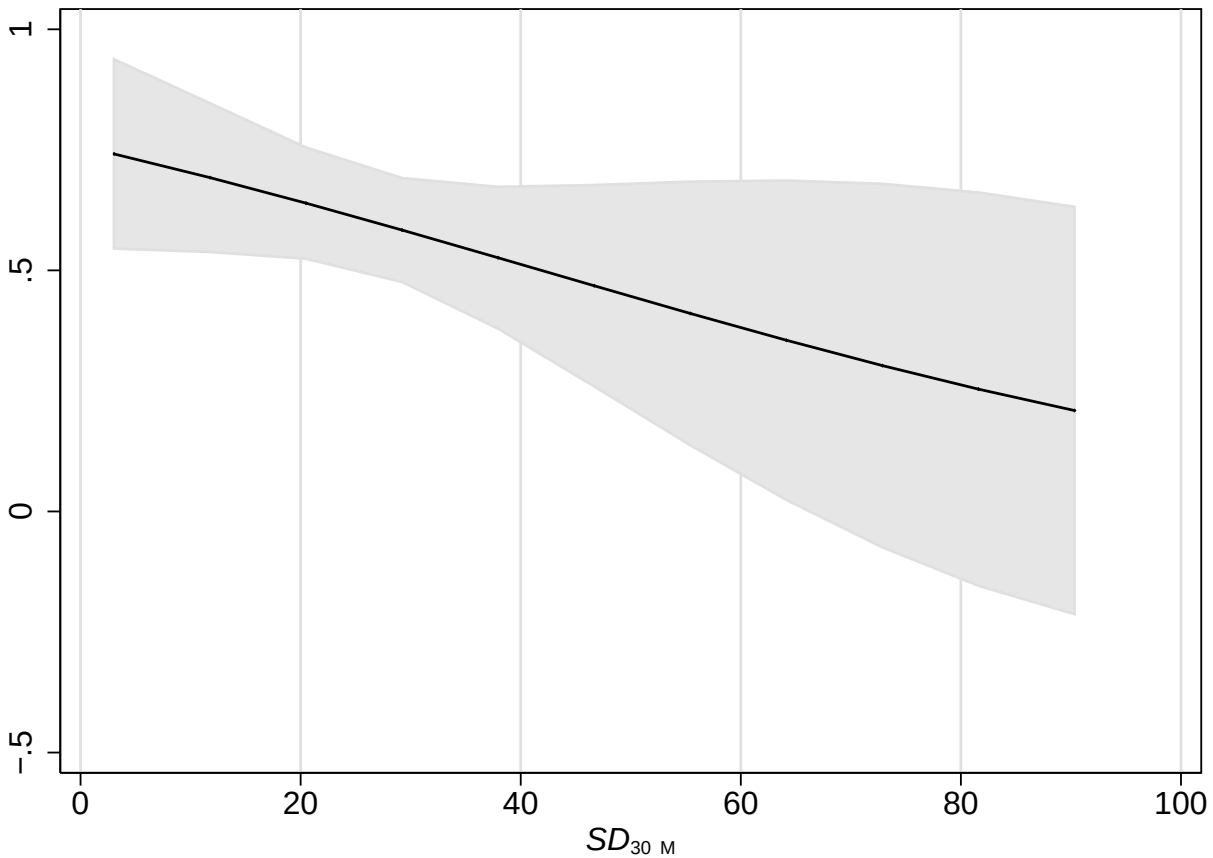


Figure 7. Predicted probabilities Volatility.

Predicted probability: Inflation

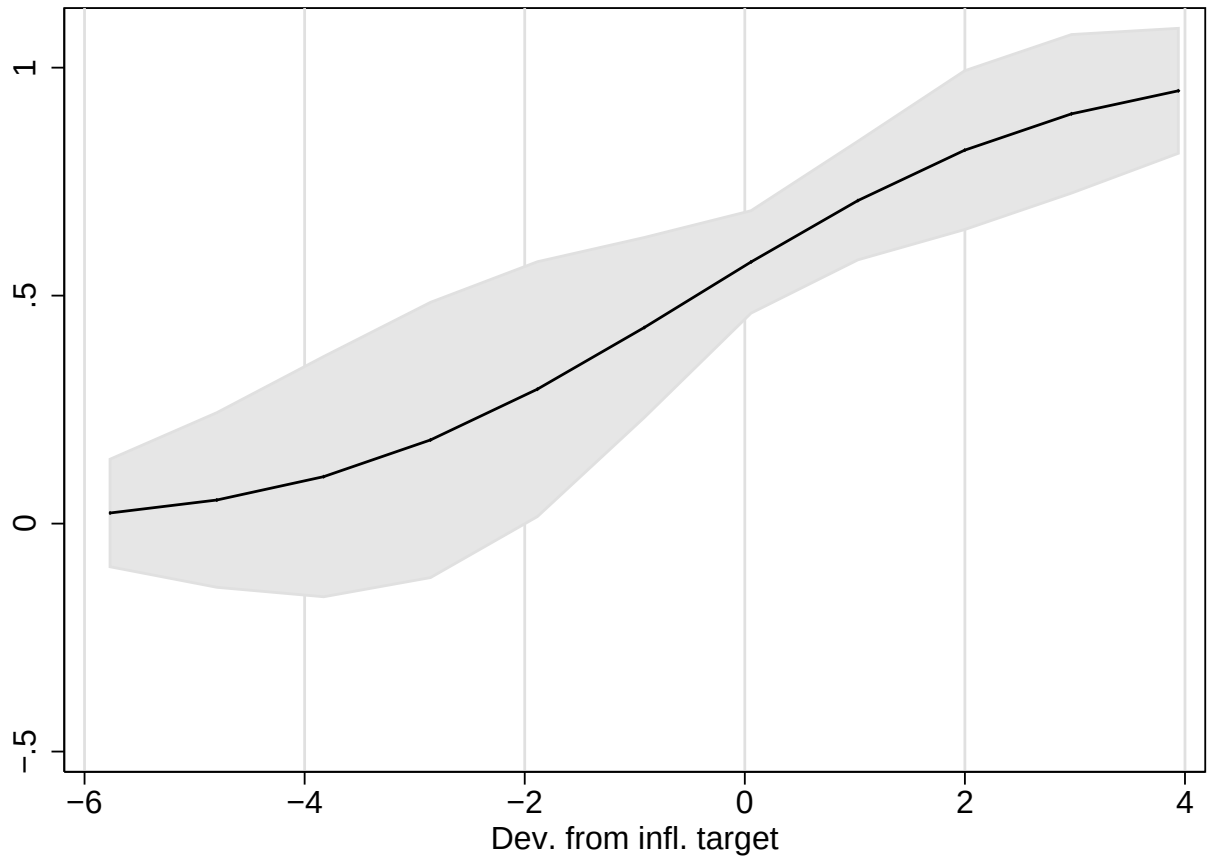


Figure 8. Predicted probabilities Inflation.

Predicted probability: International reserves

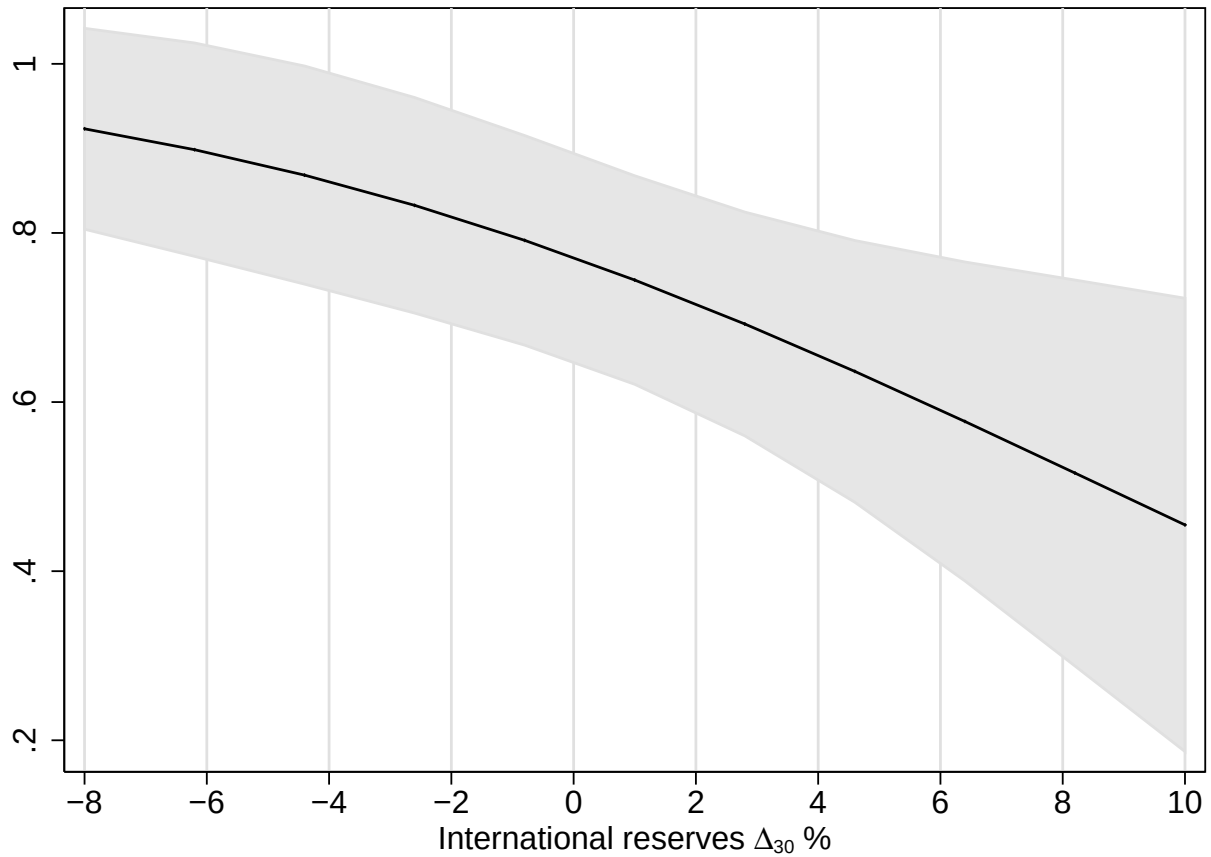


Figure 9. Predicted probabilities International reserves.

Policy response

- Econometric results show **international reserves**, **interest rate differential** and **inflation** are good explanatory variables.
- Also, the **number of news** is a good explanatory variable.
- Once all the variables are included, significance and magnitude do not change.
- Potential **endogeneity** of the number of news is examined using as instrument the number of news lagged one period.
- Test of endogeneity accepts the null of no correlation between the residuals of the structural equation and the reduced-form equation, suggesting no endogeneity.

Contributions & implications

- Tackle media bias as an asymmetric behavior (testable in a regression analysis).
- Using text analysis to recover more information from the news rather than simply numbering.
- Bring to the table a, so far, unobserved variable, such as the influence of an interest group into the policymaking process through news and its content.
- Approach the characterization of central bank as an entity with soul and content.

Conclusion

- Is there an over-reporting of revaluation?
  - Yes, in an accounting exercise and regression analysis, there is asymmetry between the number of news and the exchange rate.
- Why revaluation is more worthy of press attention than devaluation? Is it the media, or an exogenous player inflating the news?
  - There is an interest group colluding –implicitly or explicitly– with the media to highlight the effects of revaluation (Corneo, 2006 model).
- With what purpose?
  - Create sympathy among the people and public entities for assistance. Text analysis shows a high correlation between an interest group – public authorities – assistance.
- Is he successful?
  - Yes, in a regression analysis of central bank intervention on the exchange rate, the number of news turns out to be a good explanatory variable.

Corneo (2006) in Colombia

This model translated to behavior of the NER and news in Colombia is the following:

1. Exporters form a tacit / explicit coalition with the media.
2. The media reaches the citizen presenting a state of the world of catastrophic events of revaluation.
3. Based on this state of the world citizens favor policies and politicians in favor of measures against revaluation.
4. Incumbent or challenging politicians become the new face and allied of exporters.
5. Measures are taken against revaluation or its effects.
6. All actors become winners, the interest group, media and politicians.

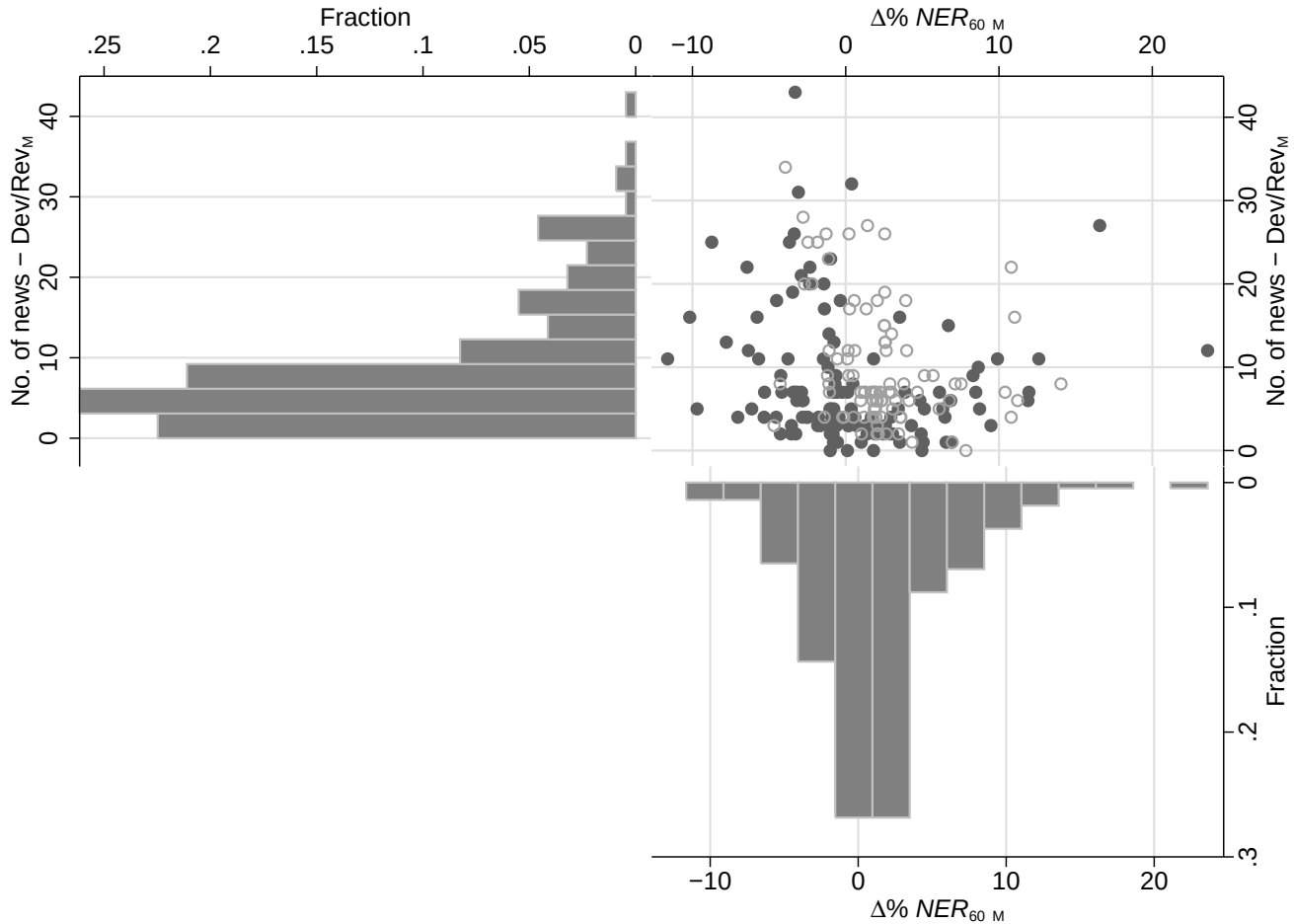


Figure 10. Distribution and scatter plot of NER and news.
Note: Hollow circles correspond to pre-market observations, solid circles to market period observations.

Acronyms

NBRM	Negative Binomial Regression Model
NER	Nominal Exchange Rate