

Predicting Market Reactions to News: An LLM-Based Approach Using Spanish Business Articles

Jesús Villota Miranda

cemfi

Introduction

- ❑ Financial Markets constantly **react** to new information
- ❑ *Efficient Market Hypothesis* (EMH) suggests markets incorporate **immediately**, but *reality shows otherwise...*
- ❑ A vast body of research has focused on **understanding** market reactions to news, yet *several gaps remain...*

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ISSUE #1: Over-reliance on methods that fail to capture economic nuances

Sentiment analysis categorize text as *positive / neutral / negative*

e.g: *Dictionaries, FinBERT*

Tetlock, P. C., Saar-Tsechansky, M., & Macskassy, S. A. (2008) [JF]

Loughran, T., & McDonald, B. (2011) [JF]

Z. T. Ke, B. T. Kelly, and D. Xiu (2019)

Lopez-Lira, A., & Tang, Y. (2023)

Tetlock
(2007) [JF]

Bollen, J., Mao, H., & Zeng, X. (2010) [JCS]

García, D. (2013), Jegadeesh, N., & Wu, D. (2013) [JFE]

Lee, C.-C., Gao, Z., & Tsai, C.-L. (2020).

Hanley, K. W., & Hoberg, G. (2010) [RFS]

Cellnex will face more competition in Europe

Telefónica's (TEF.MC) subsidiary, Telxius Telecom, has agreed to sell its telecommunications tower division in Europe and Latin America to American Tower (AMT), which will expand the latter's presence in Europe and increase competition for the Spanish wireless telecommunications group Cellnex Telecom (CLNX.MC), according to Equita Sim. The transaction "represents the entry of a new independent tower operator into the Spanish market and potentially more competition for future growth in the European market as well," says the brokerage firm.

Overall Sentiment: **Positive**

Source: *DowJones*

2021/01/13 6:43 PM

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41% Positive

33% Negative

26% Neutral

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Topic models categorize text into *broad themes* e.g: *LDA, NMF, HDP*

Hansen, S., McMahon, M., & Prat, A. (2018) [QJE]

Antweiler, W., & Frank, M. Z. (2006) [JF]

Bybee, L., Kelly, B. T., Manela, A., & Xiu, D. (2021) [JF]

Bybee, L., Kelly, B. T., & Su, Y. (2021) [RFS]

3 Topics identified

Source: *DowJones*

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Topic 1:
Telecommunications

Topic 2:
Business

Topic 3:
Geography

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Topic models	categorize text into <i>broad themes</i>	e.g: <i>LDA, NMF, HDP</i>
Vector-based	represent text as vectors capturing <i>semantic & contextual similarities</i>	e.g: <i>Word2Vec, GloVe, BERT</i>

*Feng, W., Wei, F., &
Nguyen, U. T. (2020)*

*Jha, M., Liu, H., &
Manela, A. (2022)*

*Hoberg, G., & Phillips, G.
(2016) [JPE]*

*Barbaglia, L., Consoli, S.,
Wang, S. (2021)*

*Huang, A. H., Wang, H.,
& Yang, Y. (2023)*

Source: *DowJones*

2021/01/13 6:43 PM

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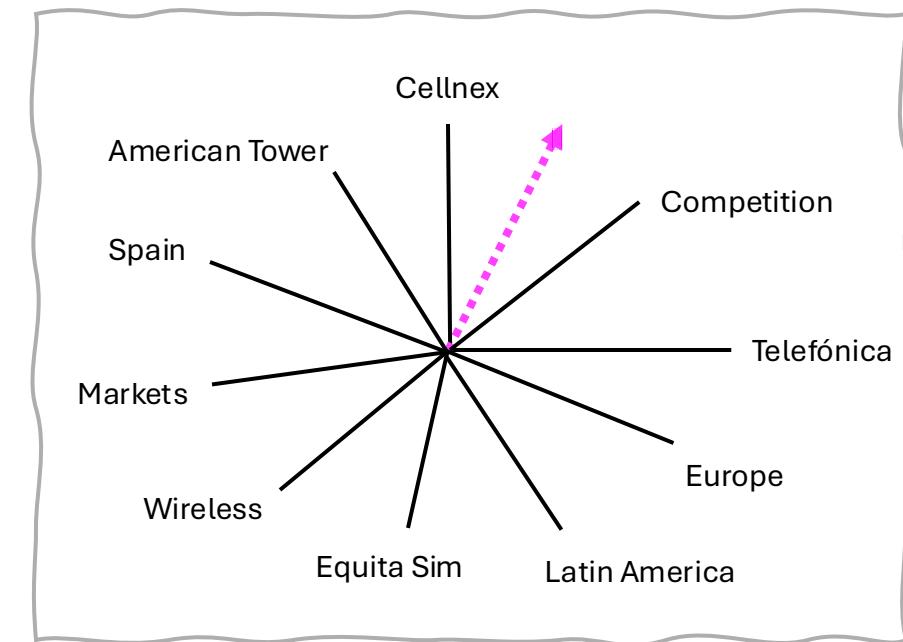
[234
324
873
907
403
376
675
376
289
783
476
573
:
862]

Source: DowJones

2021/01/13 6:43 PM

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Sentiment analysis

Overall Sentiment:
Positive

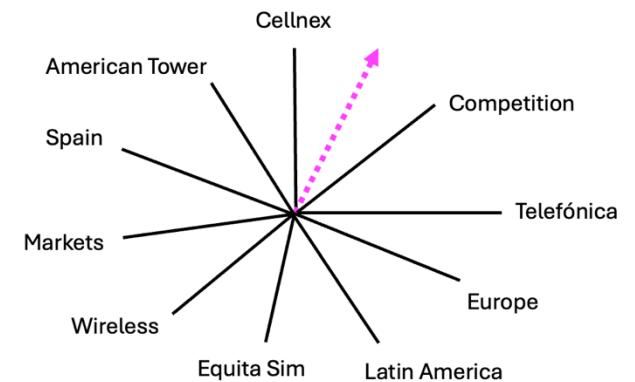
Topic models

Topic 1: Telecommunications

Topic 2: Business

Topic 3: Geography

Vector-based



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ISSUE #2: Lack of Firm-Specific focus

- Most studies **fail to identify** how news affects **individual firms**
- Instead, they focus on **broader market indices** (e.g., S&P500, DJIA, VIX).
- Named Entity Recognition (i.e.: *identification of named entities*) is still **underdeveloped** in finance

García, D.
(2013) [JF]

Manela, A., & Moreira, A.
(2017) [JFE]

Cutler, D. M., Poterba, J.
M., & Summers, L. H.
(1989) [NBER]

Mitchell, M. L., &
Mulherin, J. H.
(1994) [JF]

Bollen, J., Mao, H., &
Zeng, X. (2010) [JCS]

Baker, S. R., Bloom,
N., & Davis, S. J.
(2016) [QJE]

Baker, S. R., Bloom, N.,
Davis, S. J., & Sammon, M.
(2021) [RAPS]

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ISSUE #3: Over-Reliance on Headlines

- Many studies rely on news **headlines**, which lack the full nuance & context of complete articles.
- Headlines are too **simplistic** to fully capture the complexity of news and its impact on markets.

Feng, W., Wei, F., &
Nguyen, U. T. (2020)

Chan, W. S. (2003) [JFE]

Oncharoen, P., &
Vateekul, P. (2018)

Lopez-Lira, A., & Tang, Y. (2023)

J. Chen, G. Tang, G. Zhou, & W.
Zhu. (2023)

CONTRIBUTION:

This paper addresses these 3 issues by...

leveraging *Large Language Models (LLMs)* to achieve an

[1] economically nuanced

[2] firm-specific analysis

[3] of full news articles

to predict market reactions to news.

CAVEATS:

The goal of this paper is **NOT** to

- ✗ parse the biggest available dataset of +10 million news articles
- ✗ get rich implementing the most realistic & sophisticated trading strategy

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Instead, the goal of this paper **IS** to

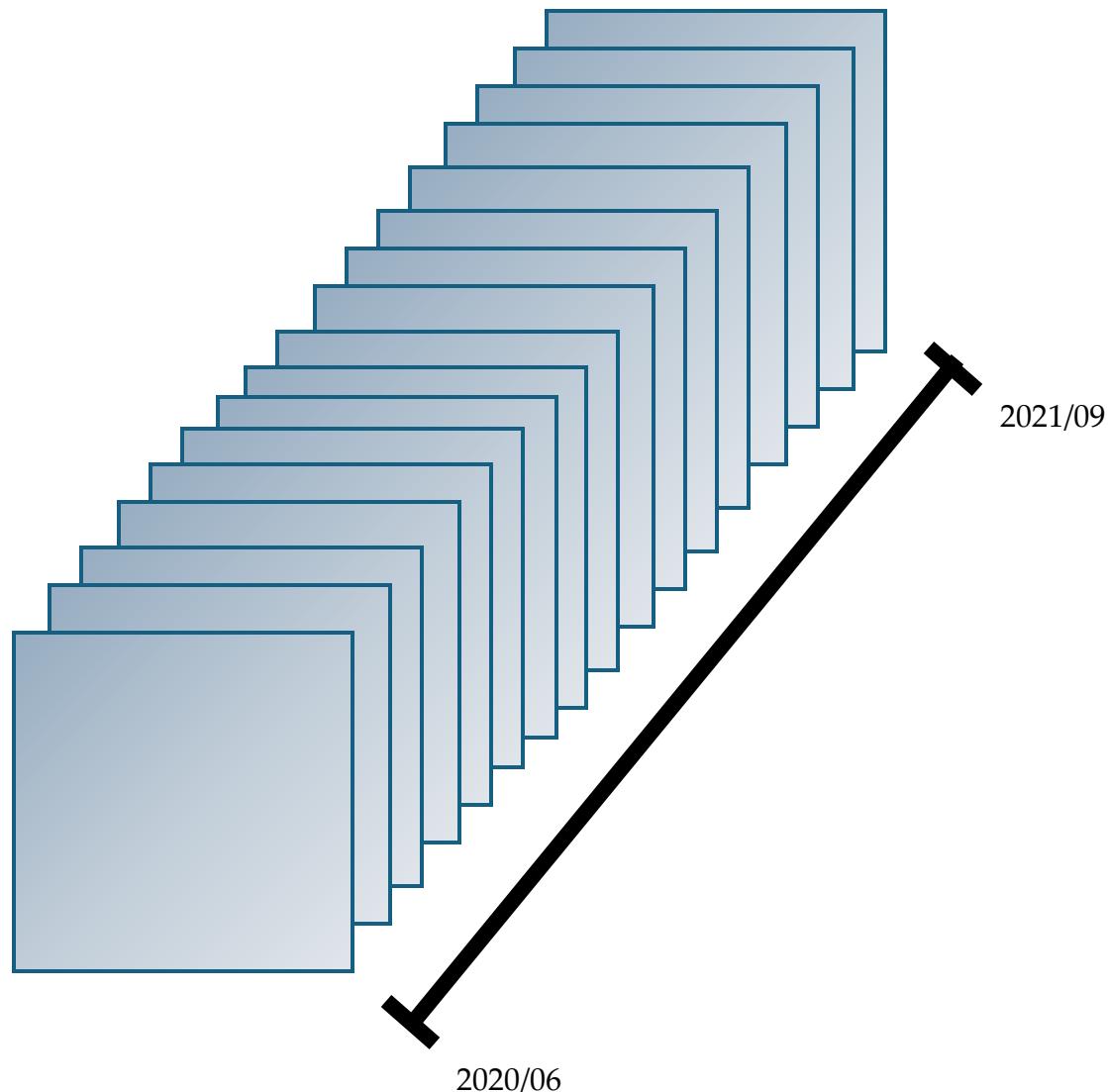
- ✓ introduce a **novel methodology** for analyzing news articles in a granular & firm-specific way
- ✓ show the **utility** of this new methodology with a reduced dataset (*proof of concept*)
- ✓ **understand** market reactions to news by building a simple trading strategy

Introduction

Introduction

Data

Overview



- ❑ 2613 **Spanish Business News Articles**
- ❑ *Source:* **DowJones Newswires**
- ❑ *Time span:* **2020/06 – 2021/09**
- ❑ Filtered to explicitly mention **IBEX-35 firms**
- ❑ **Firm identification (NER)**
 1. regex: find pattern: <(TICKER.MC)>
 2. validate with LLM
 3. Filter for IBEX-35 firms

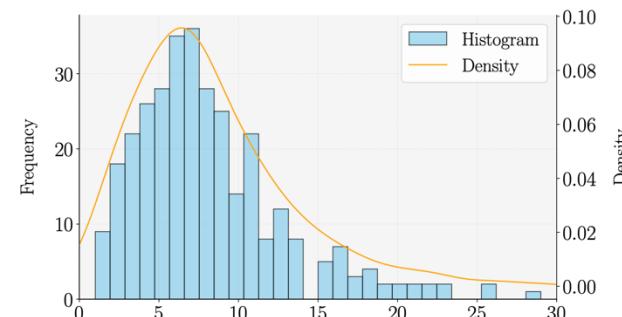
What are IBEX-35 firms?

35 Spanish firms w/ highest market cap

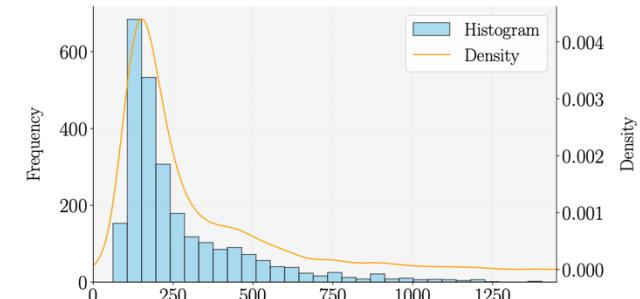
Why focus on IBEX-35 firms?

- ✓ *most liquid & traded stocks*
- ✓ *consistent media coverage*

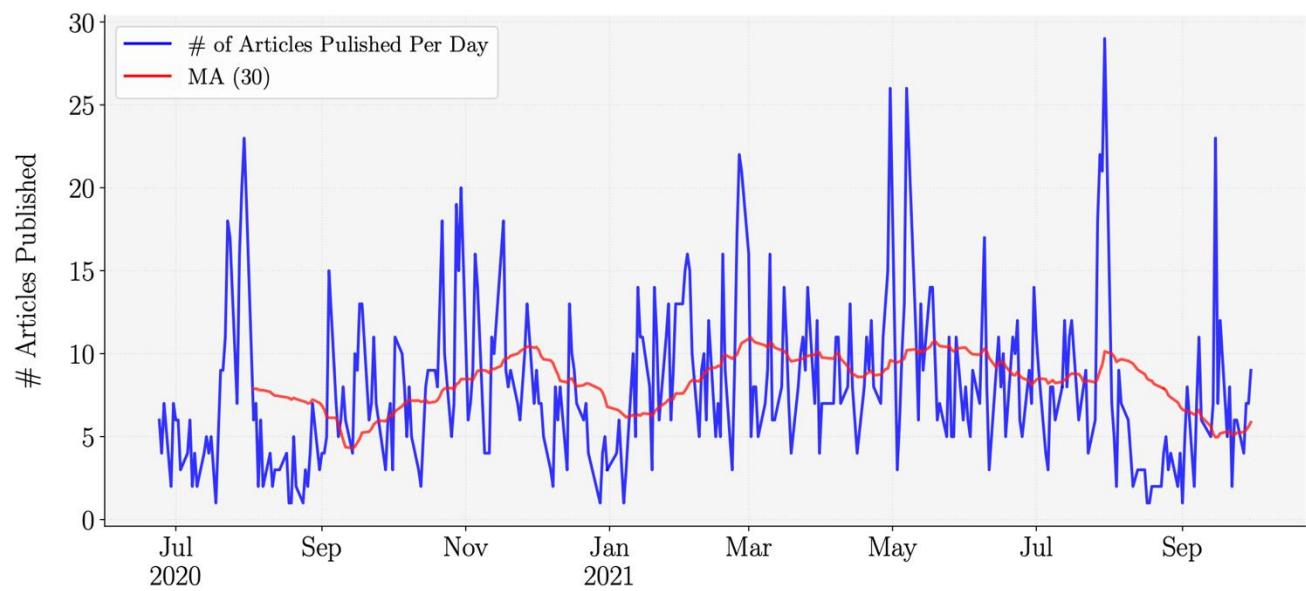
Summary Statistics

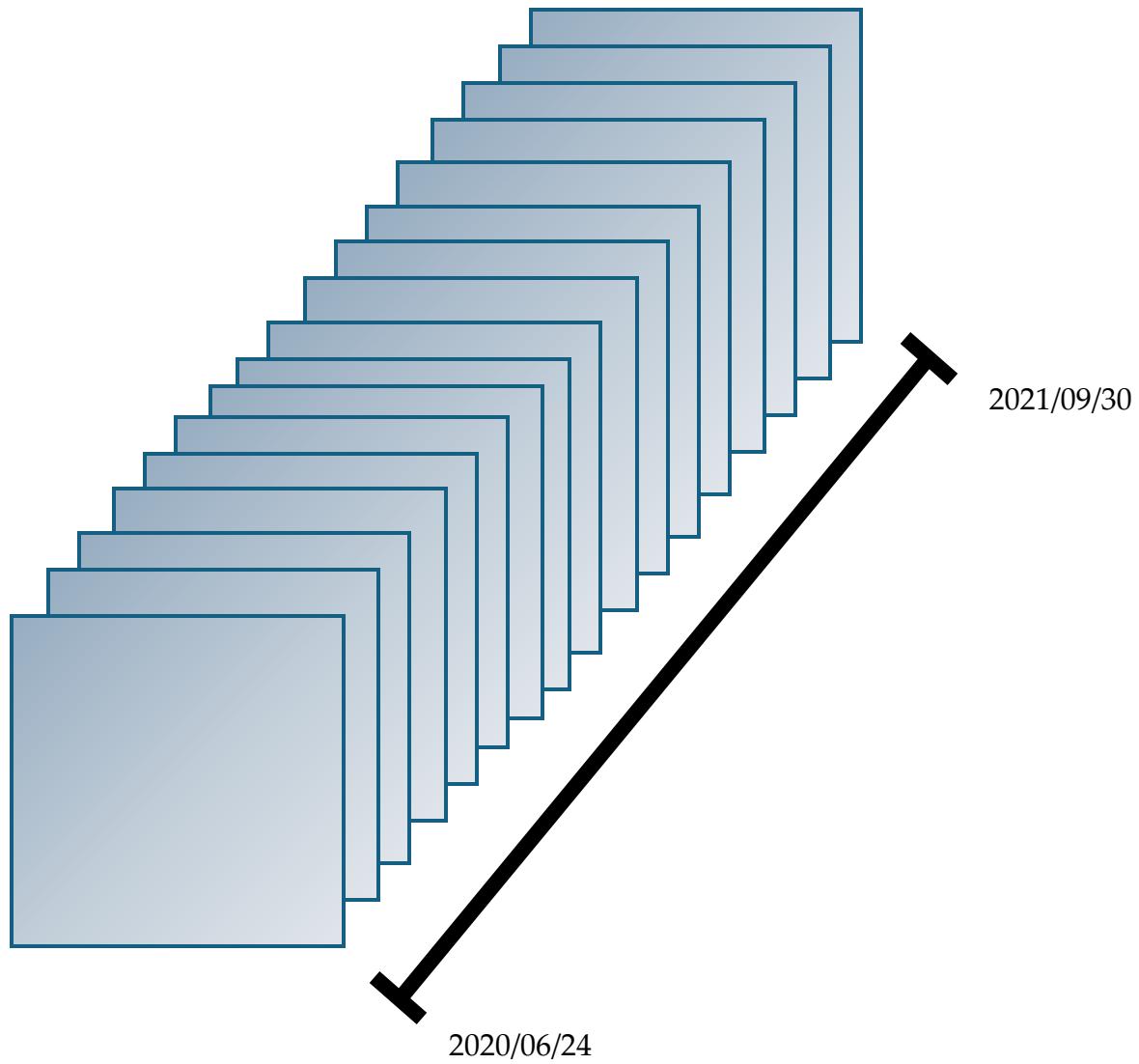


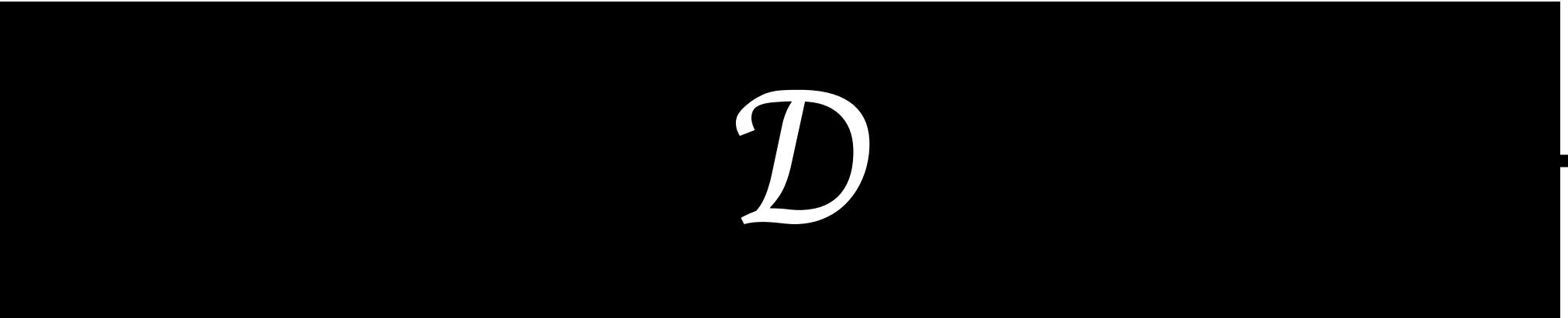
(A) Number of News Articles per Day



(B) Number of Words per Article







\mathcal{D}

2020/06/24

2021/09/30

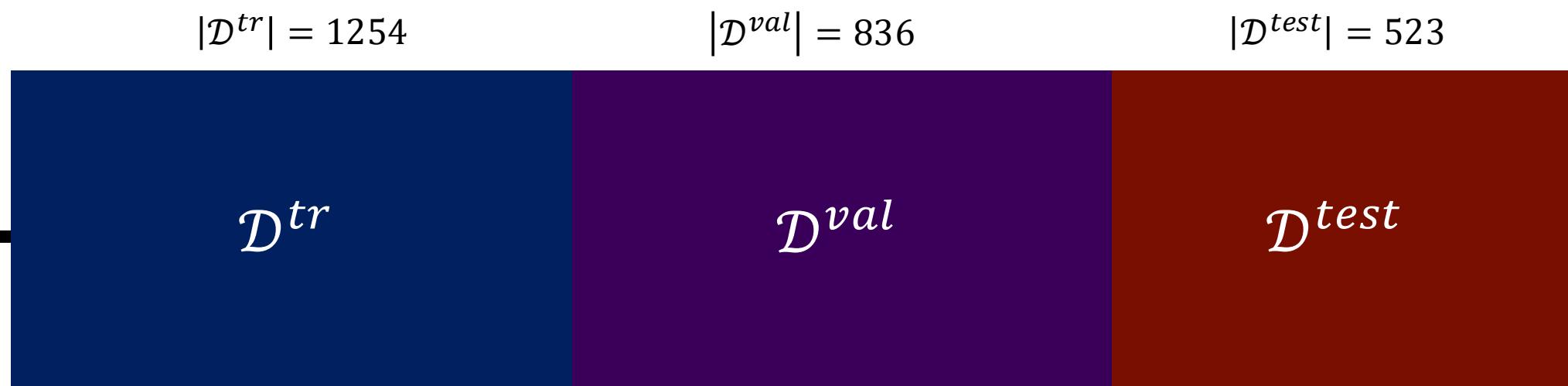
$|\mathcal{D}| = 2613$

\mathcal{D}

2020/06/24

2021/09/30

Data Splitting



2020-06-24

2021-02-12

2021-06-21

2021-09-30



2020-06-24

2021-02-12

2021-06-21

2021-09-30

Obtain the centroids
for Kmeans clustering

Hyperparameter selection

Cluster selection & Trading Strategy design

Test the Trading Strategy

Introduction

Data

Introduction

Data

Methodology

How do we, humans, understand information?

- Do we reduce it to *positive / neutral / negative*?
- Do we decompose it into an underlying topic structure?
- Do we think of it as a vector in \mathbb{R}^{512} ?

Probably not

Source: *DowJones*

2021/01/13 6:43 PM

Cellnex will face more competition in Europe

Telefónica's (TEF.MC) subsidiary, Telxius Telecom, has agreed to sell its telecommunications tower division in Europe and Latin America to American Tower (AMT), which will expand the latter's presence in Europe and increase competition for the Spanish wireless telecommunications group Cellnex Telecom (CLNX.MC), according to Equita Sim. The transaction "represents the entry of a new independent tower operator into the Spanish market and potentially more competition for future growth in the European market as well," says the brokerage firm.

How would a human read a business article?

Source: *Dow Jones*

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Telefónica

Its subsidiary sold a tower division



It's a positive thing for Telefónica in the short term as it generates cash flow for further investment, but not a big deal.

Cellnex Telecom

expects more competition!



It's bad news in the short-term, as it means more competition... but it's not the end of the world

We can mimic human reading with a **Large Language Model**

Define a *human-mimicking news parser* through a **Function Calling schema**

Function-calling schema

for each **article**:

Identify the set of Spanish **firms** (IBEX-35) directly affected by the article
(ignore irrelevant mentions to other firms for mere context)

for each **firm** in **firms**:

Classify the news-implied firm-specific **shock** according to the schema

- **Shock Type** {demand, supply, financial, technological, policy}
- **Shock Magnitude** {minor, major}
- **Shock Direction** {positive, negative}

Justify your choice



Source: DowJones

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Jesus: *Extract all the firms affected by the news article*

LLM:

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LLM: Cellnex Telecom (CLNX.MC)

Telefónica's (TEF.MC)

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Jesus: *Classify the news-implied firm-specific shocks*

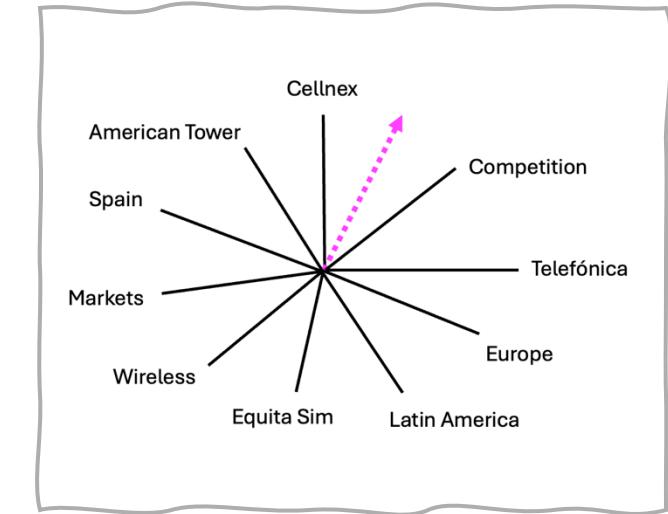
	shock_type	shock_direction	shock_magnitude
LLM:	Cellnex Telecom (CLNX.MC)	supply	minor
	Telefónica's (TEF.MC)	financial	positive

	shock_type	shock_direction	shock_magnitude
Cellnex Telecom (CLNX.MC)	supply	minor	negative
Telefónica's (TEF.MC)	financial	minor	positive

Jesus: *Why this answer?*

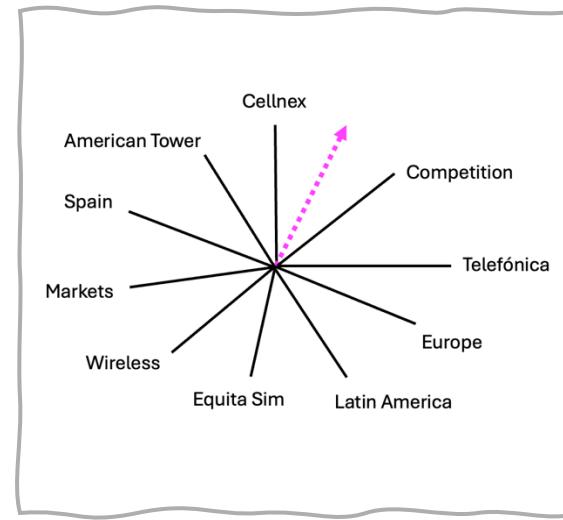
- LLM:
- ✓ The news about American Tower's expansion in Europe may increase competition for **Cellnex**, which is why it's classified as a **minor negative supply shock**.
 - ✓ On the other hand, **Telefónica** benefits from the sale of its tower division, which is why it's classified as a **minor positive financial shock**.

Overall Sentiment:
Positive



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Topic 3: Geography

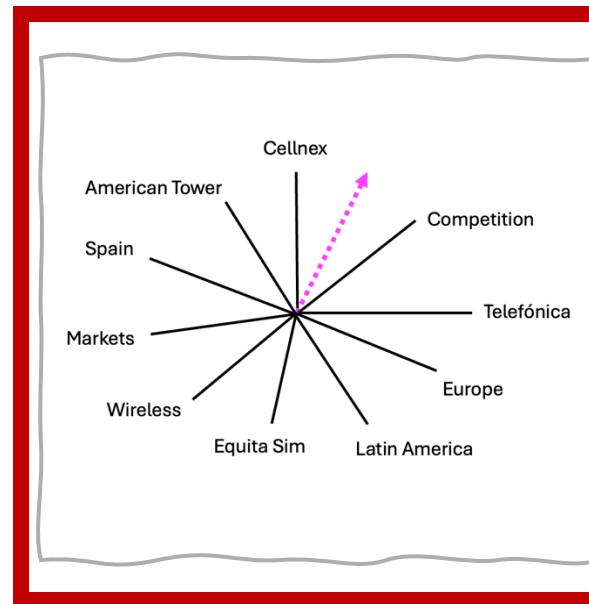


shock_type	shock_direction	shock_magnitude
supply	minor	negative
financial	minor	positive

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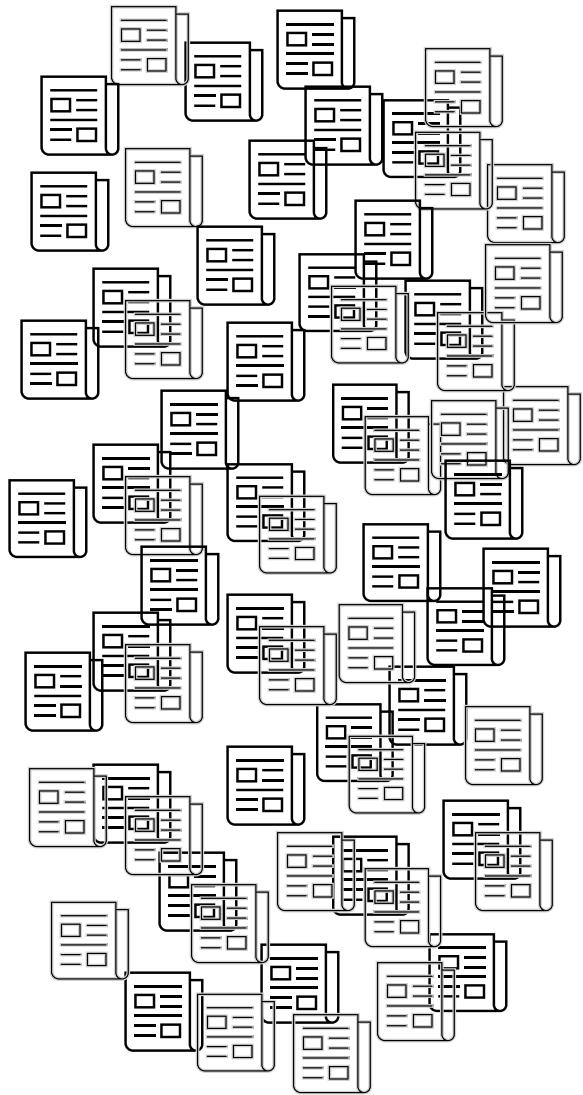
Methodology

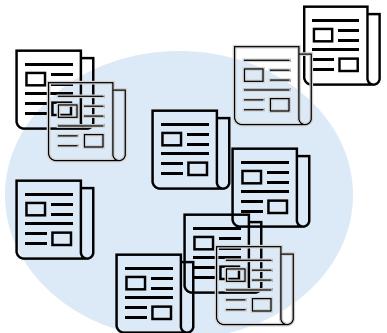
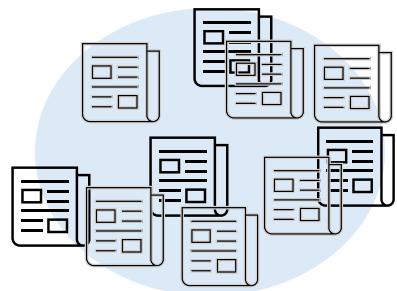
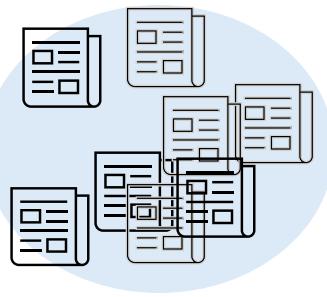
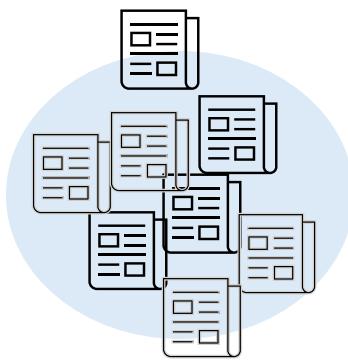
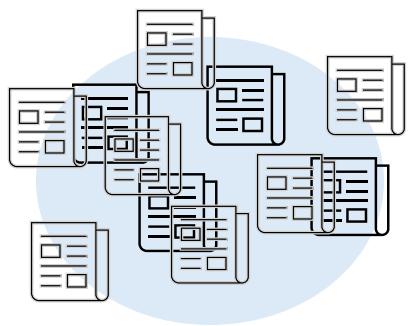
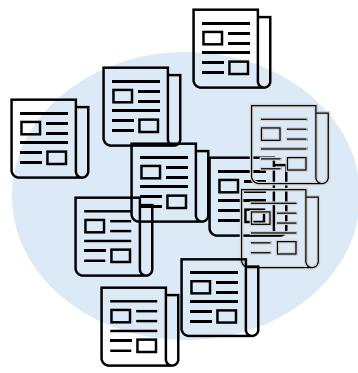
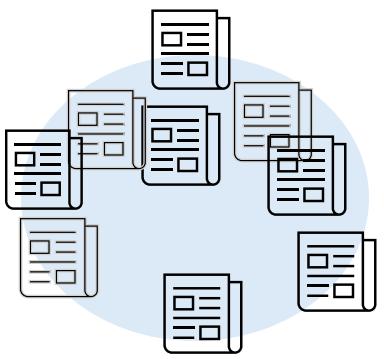
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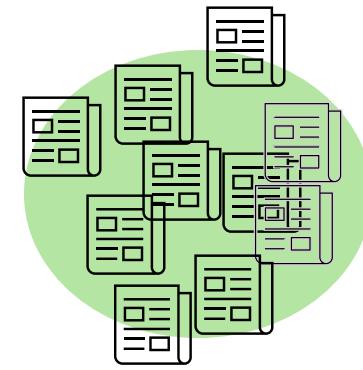
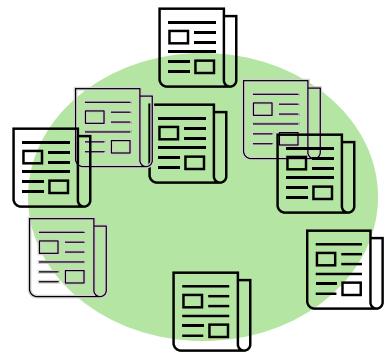
Methodology

Technicalities

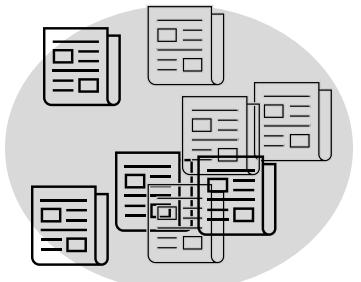
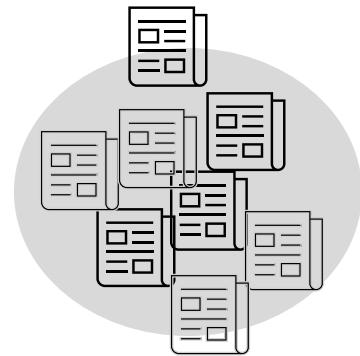
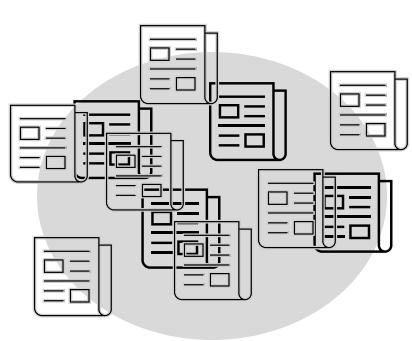




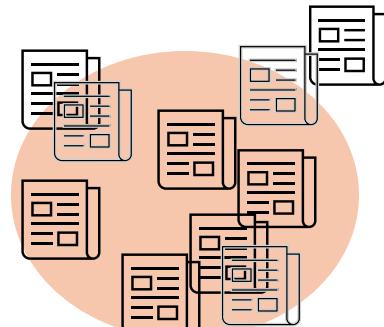
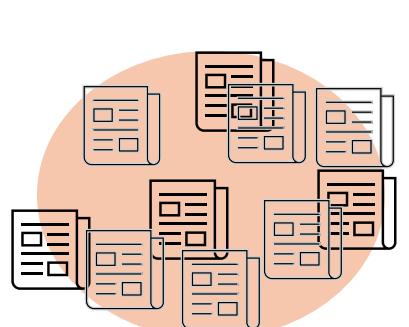
“Good clusters” (Long)



“Neutral clusters” (No trade)



“Bad clusters” (Short)

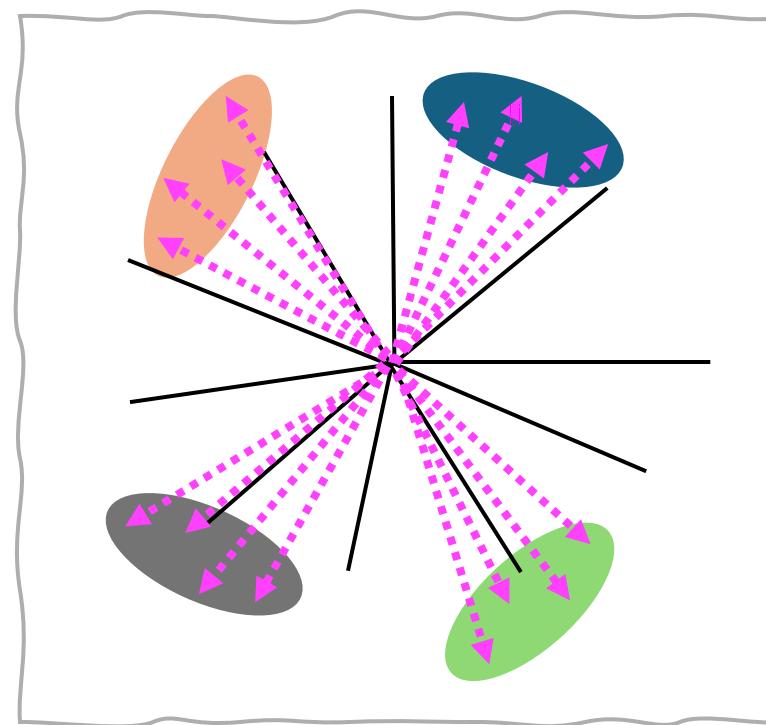


Vector-based model (benchmark)

❑ Transformer: Multilingual Sentence Transformer (512-dimensional embeddings)

❑ Clustering: KMeans

- optimal # of clusters = **26** (*maximize silhouette score in training sample*)
- centroids obtained in *training* sample; fitted to *validation & test* sample



Vector-based model (benchmark)

KMeans Clusters

Firm-specific & Industry-specific clusters

#	Title	Articles
0	Miscellaneous (Colonial, Acciona, Amadeus, Grifols, Endesa, IAG, Bankinter...)	<ul style="list-style-type: none"> Colonial forecasts rental income of EUR338m in 2020 Acciona's asset sales will allow it to grow in renewables Sabadell recommends selling Amadeus shares due to worse sales forecast.
1	Quarterly & Semi-Annual Earnings Reports	<ul style="list-style-type: none"> Enagás 1H net profit falls 9.8% due to lower income and extraordinary items. Iberdrola: Net profit of EUR1.025m in Q1 Santander almost quintuples Q1 profit due to absence of Covid provisions.
2	BBVA & Sabadell Financial Performance & Strategic Movements	<ul style="list-style-type: none"> Interest rate hike in Turkey favors BBVA's net interest margin Sabadell reorganizes business in Spain following the arrival of the new CEO. Fitch downgrades Banco Sabadell's rating one notch to low grade.
3	Telefónica & Cellnex Telecommunications Tower Sales & Market Dynamics	<ul style="list-style-type: none"> Telefónica shares soar after selling towers of its subsidiary in Europe and Latin America. Telefónica hires Goldman Sachs to sell its British tower business Dutch Competition Authority authorizes Cellnex to integrate 3,150 Deutsche Telekom towers.
4	CaixaBank : Mergers and Strategic Moves in the Banking Sector	<ul style="list-style-type: none"> CaixaBank and Bankia approve their merger project CaixaBank closes its first issuance of green bonds in pounds for 500 million CaixaBank-Bankia merger could generate EUR500m in savings
5	Telefónica, Indra, & MásMóvil Regulatory and Strategic Moves in Telecom	<ul style="list-style-type: none"> Indra to partner with Telefónica in the deployment of fiber optics in Germany. Telefónica launches a buyback offer for its hybrid bonds of EUR1.000m. EU refers Liberty Global and Telefónica agreement to UK regulator
6	Siemens Gamesa : Supply Agreements, Profitability Targets in Renewable Energy	<ul style="list-style-type: none"> Siemens Gamesa will supply turbines to Elawan's 150 MW wind farm in Spain. Siemens Gamesa lowers its profitability target for 2021. Siemens Gamesa will supply 160 MW for the largest wind farm in the Philippines.
7	Cellnex : Strategic Acquisitions and Financial Moves in Telecom Infrastructure	<ul style="list-style-type: none"> Cellnex launches a EUR1.850m debt issue Cellnex agrees to buy 10,500 telecommunications towers in France for EUR5.200m Benetton family sells 2.5% of Cellnex to Singapore sovereign fund
8	Acciona, Endesa, Enagás & Naturgy Strategic Moves & Regulatory Developments in the Energy Sector	<ul style="list-style-type: none"> Naturgy and Enagás study project to produce green hydrogen in Asturias Break of ties between Algeria and Morocco may damage gas flow to Spain Acciona: Energy business IPO on track for 1H
9	Repsol : Strategic Moves and Challenges in the Energy Sector	<ul style="list-style-type: none"> Repsol to produce green hydrogen at Petronor refinery in 2022 Repsol and Talgo to jointly promote the creation of renewable hydrogen trains Repsol gains access to a portfolio of renewable assets in Chile through a joint venture
10	Ferrovial, Acciona Strategic Expansions and Financial Maneuvers in Infrastructure	<ul style="list-style-type: none"> Ferrovial closes the sale of Broadspectrum to Ventia for EUR291m Acciona awarded the construction of 2 roads in Poland for EUR642m Renfe awards on-board services contract to Ferrovial for EUR272m
11	Solaria : Strategic Moves and Market Challenges in Renewable Energy	<ul style="list-style-type: none"> Solaria invests EUR220m in Europe's largest photovoltaic park. Solaria will supply energy to Shell and Axpo with Europe's largest photovoltaic plant Goldman Sachs downgrades Solaria recommendation after stock rise.
12	Iberdrola Strategic Collaborations and Renewable Energy Developments	<ul style="list-style-type: none"> Iberdrola will build a self-consumption plant for Lactalis factory in Spain. Iberdrola and Mapfre launch a renewable energy co-investment vehicle in Spain. Iberdrola partners with Mitsubishi to decarbonize the industry.

LLM-based model

- ❑ Model: LLaMA 3 70b
- ❑ Host: GroqCloud API
- ❑ Function Calls ~1'30"/article
- ❑ Clustering: **Cartesian product of shock classifications**
{shock_type × shock_magnitude × shock_direction}

(supply, minor, positive)	(technological, minor, positive)
(supply, minor, negative)	(technological, minor, negative)
(supply, major, positive)	(technological, major, positive)
(supply, major, negative)	(technological, major, negative)
(demand, minor, positive)	(policy, minor, positive)
(demand, minor, negative)	(policy, minor, negative)
(demand, major, positive)	(policy, major, positive)
(demand, major, negative)	(policy, major, negative)
(financial, minor, positive)	
(financial, minor, negative)	
(financial, major, positive)	
(financial, major, negative)	

LLM-based model

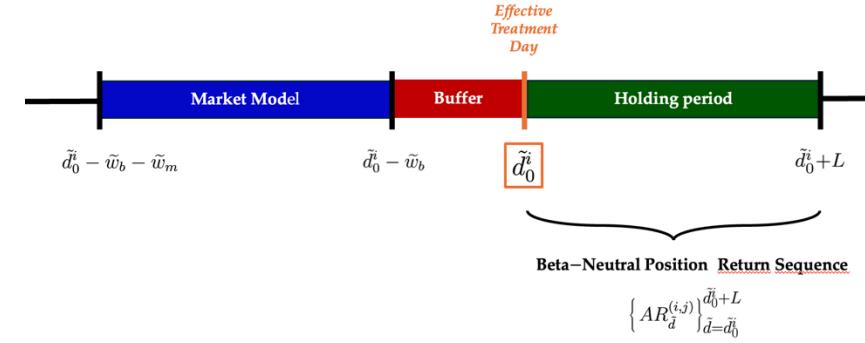
Shock clusters

Clusters are based on firm-specific economic shocks

#	Title	Articles
0	Demand, Minor, Positive	<ul style="list-style-type: none"> Meliá's recovery will be fast, but it will not be completed until 2023 Tourism sector aid in Spain will have a limited impact on listed companies Spanish airports will recover pre-pandemic traffic by the end of 2025
1	Demand, Minor, Negative	<ul style="list-style-type: none"> Tallgrass will contribute fewer dividends to Enagás -JPMorgan Cazenove Aena's stock decline is due to sector visibility -Sabadell ObservaTUR believes Spain's economic situation will worsen and calls for more measures
2	Demand, Major, Positive	<ul style="list-style-type: none"> Solaria invests EUR220m in Europe's largest photovoltaic park Acciona will build Sao Paulo metro line for EUR2.3 billion Inditex returns to profit in H1 and continues to recover from the pandemic
3	Demand, Major, Negative	<ul style="list-style-type: none"> Passenger traffic at Aena airports falls 79.9% year-on-year in September UPDATE: Naturgy's net profit falls 45.6% in 9m due to Covid-19 impact Possible capital increase by IAG already priced in
4	Supply, Minor, Positive	<ul style="list-style-type: none"> Repsol returns to profit in Q2 due to crude price increase Naturgy receives LNG supply contract for ships for 2 years in Spain Acciona Energía starts up 238 MW photovoltaic complex in Chile
5	Supply, Minor, Negative	<ul style="list-style-type: none"> Enagás operating results worse than expected -Bankinter IFM rules out extending acceptance period for Naturgy takeover bid and changing conditions Changes in Siemens Gamesa's onshore wind business will take time
6	Supply, Major, Positive	<ul style="list-style-type: none"> Capital Energy wins renewable auction in Spain Repsol expects to start exploiting its huge gas reserve in Brazil in 2026 Repsol will invest EUR657m to expand its industrial complex in Sines, Portugal
7	Supply, Major, Negative	<ul style="list-style-type: none"> Iberdrola halts \$1.2 billion investment in Mexico 85% of Acciona workers at Nissan agree to contract termination CaixaBank reduces workforce adjustment by 500 employees to 7,791 -Source
8	Financial, Minor, Positive	<ul style="list-style-type: none"> Norwegian fund Norges Bank takes 1.14% stake in Naturgy amid IFM takeover bid Sabadell closes green bond issue for EUR500m -Source CaixaBank-Bankia merger goals are credible -Deutsche Bank
9	Financial, Minor, Negative	<ul style="list-style-type: none"> UPDATE2: Bankia's profit falls 57.6% in 2020 due to provisions for pandemic impact Iberdrola bond spreads will not be affected by Galán's indictment for now Court maintains precautionary suspension of rent payments to Aena
10	Financial, Major, Positive	<ul style="list-style-type: none"> UPDATE: Endesa's net profit soars in 2020 due to lower impairment charges Telefónica will reduce debt by EUR5bn after closing Virgin Media and O2 merger Fluidra buys US company S.R. Smith for \$240m

Stock market positions

- Each $(article, firm)$ pair implies a position held over $L = 4$ days
- Positions are *market beta-neutral* → delivers *abnormal returns*



Trading Strategy

- LONG-SHORT cluster-based trading

Cluster-selection algorithms

- *Greedy*
 - LONG *maximize* [SR in *validation* sample] s.t. $SR > 0$ in validation sample
 - SHORT *minimize* [SR in *validation* sample] s.t. $SR < 0$ in validation sample
- *Stable:*
 - LONG: *minimize* [rank difference between SR in *training* Vs. *validation*] s.t. $SR > 0$ in both samples
 - SHORT: *minimize* [rank difference between SR in *training* Vs. *validation*] s.t. $SR < 0$ in both samples

of selected clusters in each leg (LONG / SHORT) is upper bounded by a hyperparameter $\theta = [0.5k]$

Hyperparameters

- L and θ optimize the SR in the validation sample

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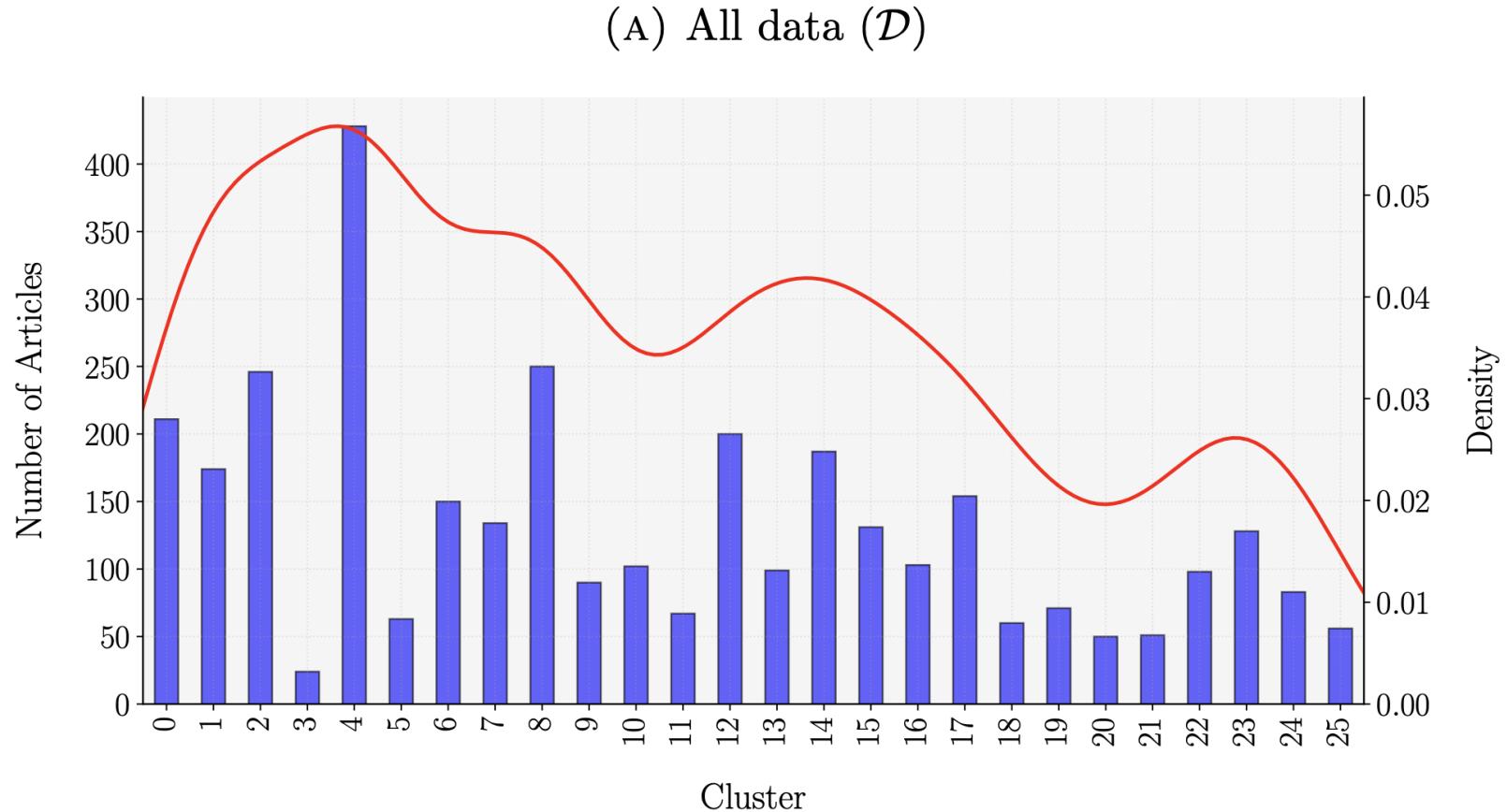
Results

- Distribution of Articles through Clusters*

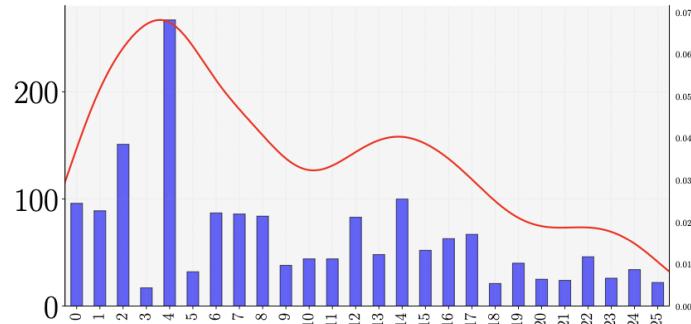
Vector-based model (benchmark)

KMeans Clusters

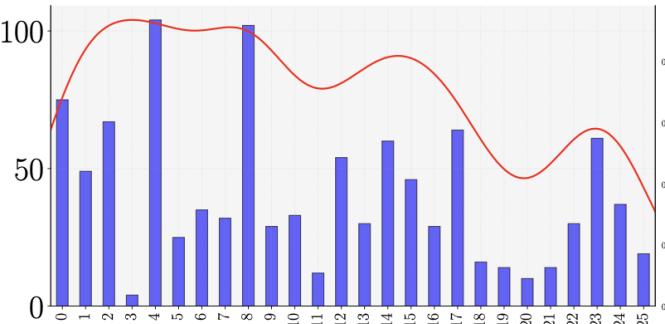
- ✗ *Unstable distribution profile across splits*
- ✗ *Temporal instability*



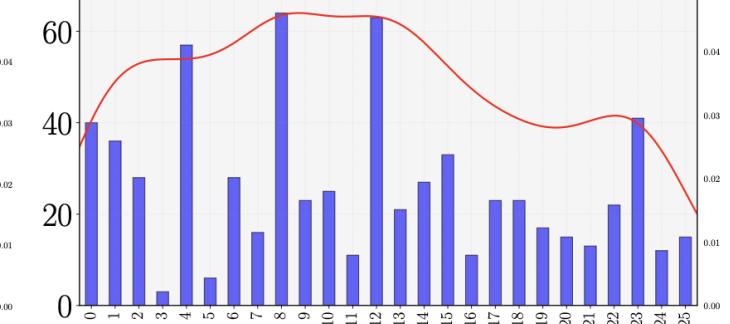
(B) Training data (\mathcal{D}^{tr})



(C) Validation data (\mathcal{D}^{val})



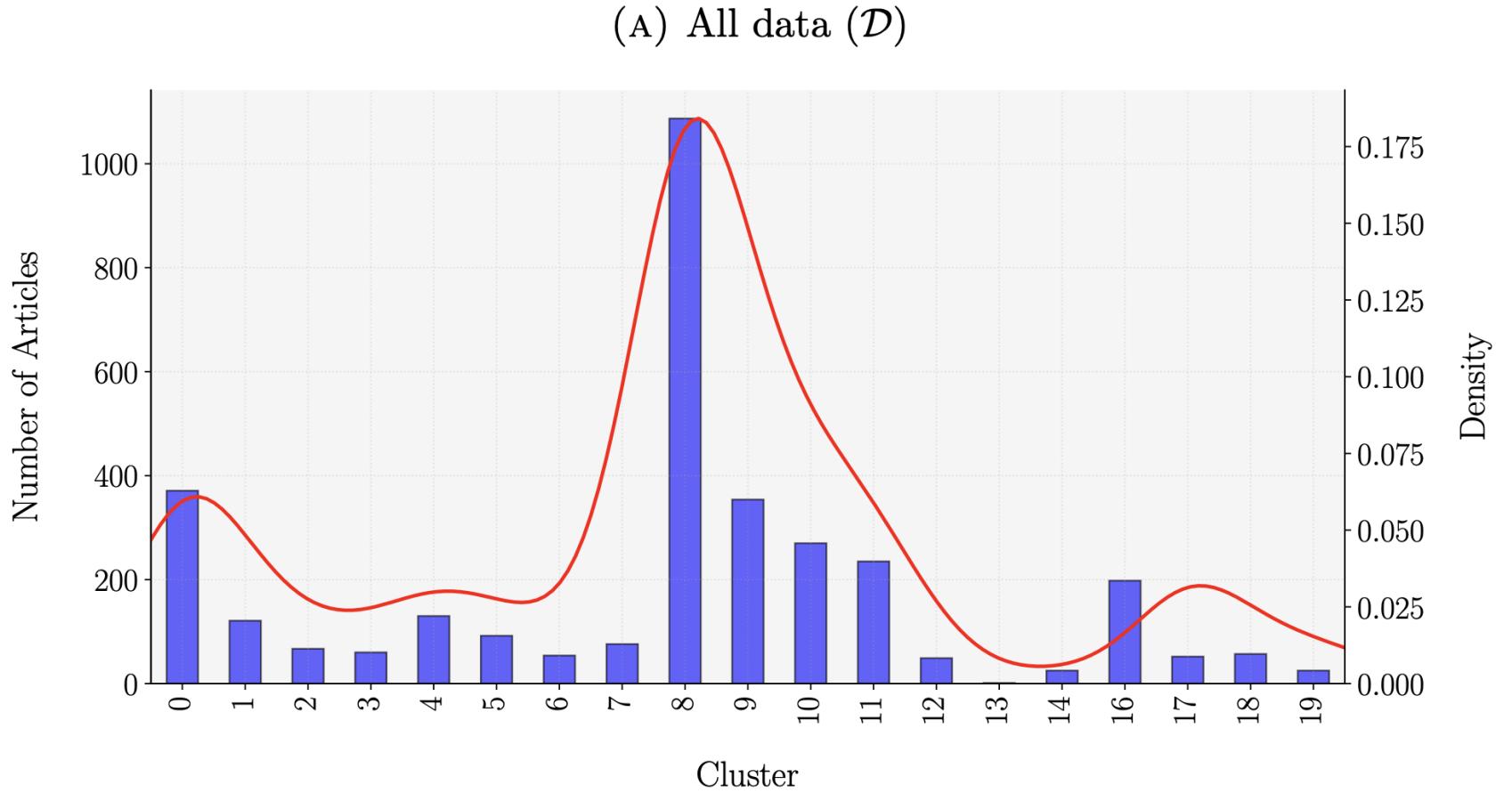
(D) Test data (\mathcal{D}^{test})



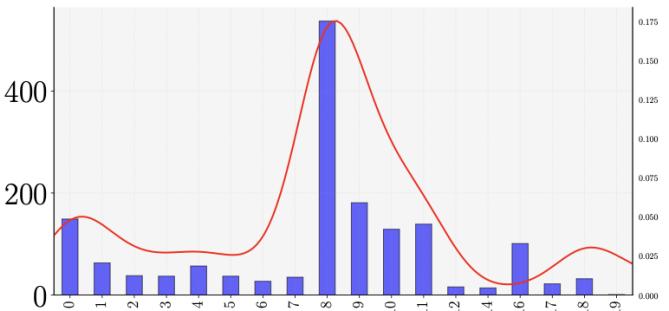
LLM-based model

Shock clusters

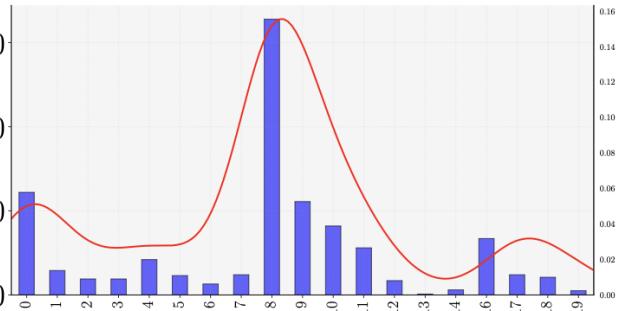
- ✓ *Stable distribution profile across splits*
- ✓ *Temporal stability*



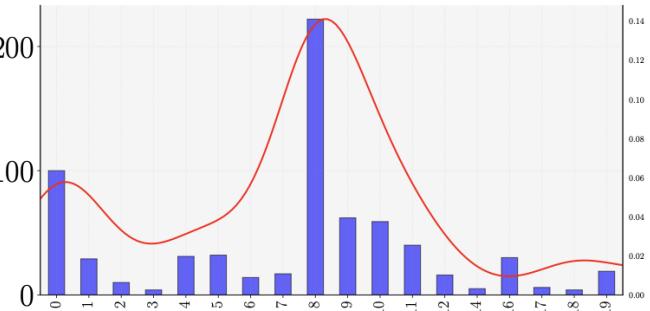
(B) Training data (\mathcal{D}^{tr})



(C) Validation data (\mathcal{D}^{val})



(D) Test data (\mathcal{D}^{test})



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Results

- Distribution of Articles through Clusters*
- Trading Signals*

Vector-based model (benchmark)

KMeans Clusters

- ✗ Over-reliance of signals on the past performance of a cluster (e.g: financial performance topics)
- ✗ Short-lived signals due to temporal instability

	Cluster	Greedy	Stable
0	Miscellaneous (Colonial, Acciona, Amadeus, Grifols, Endesa, IAG, Bankinter...)	SHORT	
1	Quarterly & Semi-Annual Earnings Reports	SHORT	
2	BBVA & Sabadell: Financial Performance & Strategic Movements	SHORT	
3	Telefónica & Cellnex: Telecommunications Tower Sales & Market Dynamics	LONG	LONG
4	CaixaBank: Mergers and Strategic Moves in the Banking Sector		
5	Telefónica, Indra, & MásMóvil: Regulatory and Strategic Moves in Telecom	LONG	
6	Siemens Gamesa: Supply Agreements, Profitability Targets in Renewable Energy	SHORT	
7	Cellnex: Strategic Acquisitions and Financial Moves in Telecom Infrastructure	LONG	
8	Acciona, Endesa, Enagás & Naturgy: Strategic Moves & Regulatory Developments in the Energy Sector	LONG	
9	Repsol: Strategic Moves and Challenges in the Energy Sector	LONG	
10	Ferrovial, Acciona: Strategic Expansions and Financial Maneuvers in Infrastructure	SHORT	SHORT
11	Solaria: Strategic Moves and Market Challenges in Renewable Energy	LONG	LONG
12	Iberdrola: Strategic Collaborations and Renewable Energy Developments	SHORT	
13	IAG: Financial Performance	LONG	
14	Santander & CaixaBank: Financial Moves and Sustainability Initiatives	SHORT	
15	ACS & Acciona: Strategic Movements and Infrastructure Projects	SHORT	SHORT
16	Telefónica: Financial Performance and Strategic Moves	LONG	
17	Meliá and Spanish Tourism Sector: Challenges Amidst the Pandemic	SHORT	
18	Takeover Bids for Naturgy and MásMóvil	SHORT	
19	Naturgy: Financial Performance	SHORT	SHORT
20	PharmaMar, Grifols: Regulatory Approvals and Market Moves in the Pharmaceutical Sector	LONG	LONG
21	Repsol: Financial Performance	LONG	LONG
22	Aena: Financial Performance	LONG	LONG
23	Enagás, Endesa, Iberdrola, Red Eléctrica: Regulatory and Market Challenges in the Energy Sector	SHORT	
24	BBVA, CaixaBank, Banco Sabadell: Layoffs and Restructuring	LONG	LONG
25	Inditex, Acerinox: Market Performance and Strategic Developments in the Post-Covid Context	SHORT	SHORT

Vector-based model (benchmark)

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7	Cellnex: Strategic Acquisitions and Financial Moves in Telecom Infrastructure	LONG	
8	Acciona, Endesa, Enagás & Naturgy: Strategic Moves & Regulatory Developments in the Energy Sector	LONG	
9	Repsol: Strategic Moves and Challenges in the Energy Sector	LONG	
10	Ferrovial, Acciona: Strategic Expansions and Financial Maneuvers in Infrastructure	SHORT	SHORT
11	Solaria: Strategic Moves and Market Challenges in Renewable Energy	LONG	LONG
12	Iberdrola: Strategic Collaborations and Renewable Energy Developments	SHORT	
13	IAG: Financial Performance	LONG	
14	Santander & CaixaBank: Financial Moves and Sustainability Initiatives	SHORT	
15	ACS & Acciona: Strategic Movements and Infrastructure Projects	SHORT	SHORT
16	Telefónica: Financial Performance and Strategic Moves	LONG	
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25	Inditex, Acerinox: Market Performance and Strategic Developments in the Post-Covid Context	SHORT	SHORT

LLM-based model

Shock clusters

✓ *Clean & Interpretable trading signals based on economic shocks*

✓ *Long-lasting signals: they depend on the nature of the firm-specific shock*

	Cluster	Greedy	Stable
0	(demand, minor, positive)		
1	(demand, minor, negative)	SHORT	
2	(demand, major, positive)	SHORT	SHORT
3	(demand, major, negative)	LONG	LONG
4	(supply, minor, positive)	LONG	
5	(supply, minor, negative)	SHORT	
6	(supply, major, positive)	LONG	
7	(supply, major, negative)	SHORT	
8	(financial, minor, positive)	LONG	LONG
9	(financial, minor, negative)		SHORT
10	(financial, major, positive)	LONG	
11	(financial, major, negative)	SHORT	
12	(technology, minor, positive)	LONG	
13	(technology, minor, negative)		
14	(technology, major, positive)	SHORT	
15	(technology, major, negative)		
16	(policy, minor, positive)	SHORT	SHORT
17	(policy, minor, negative)	SHORT	SHORT
18	(policy, major, positive)	SHORT	SHORT
19	(policy, major, negative)	SHORT	SHORT

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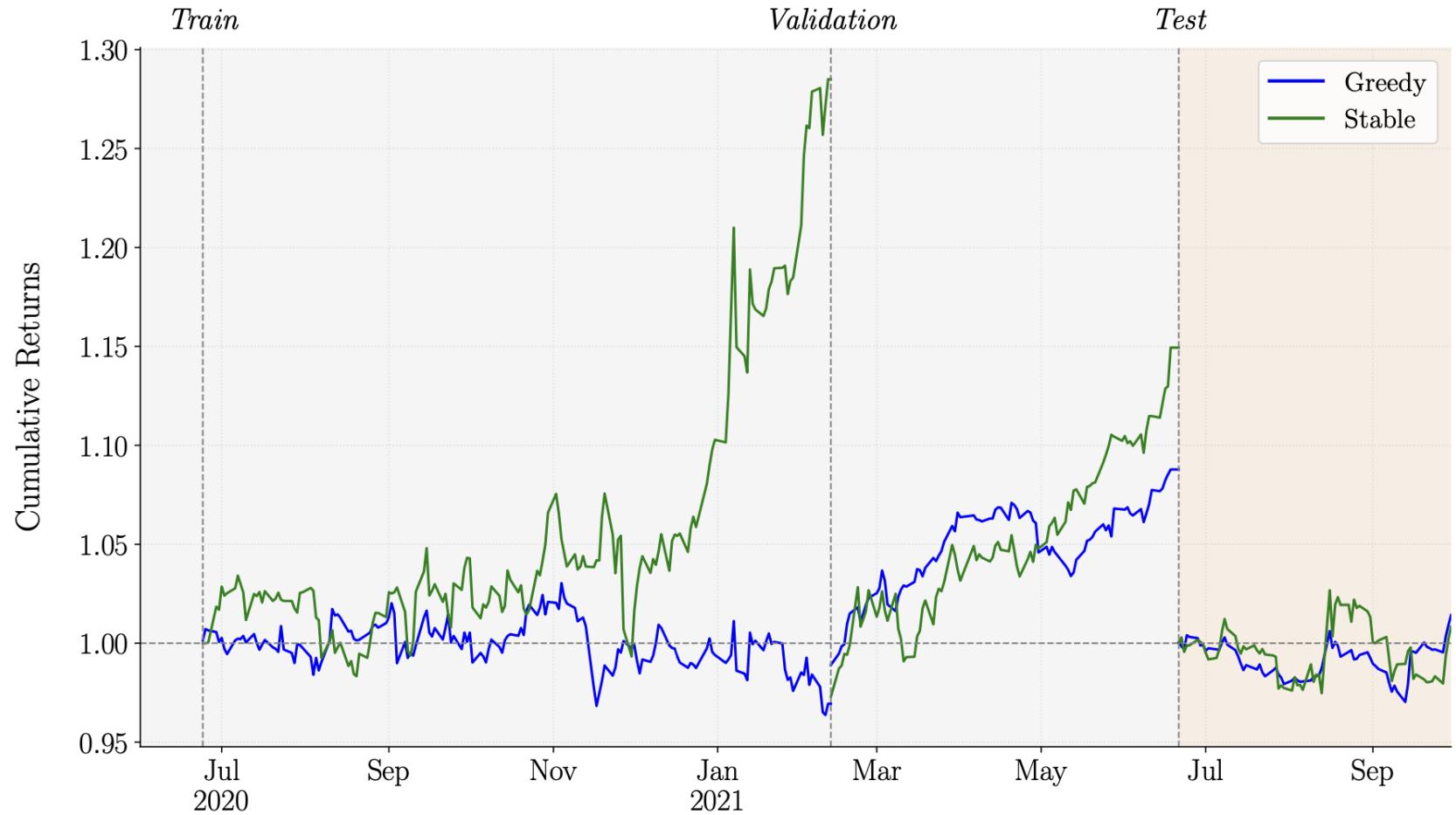
Results

- Distribution of Articles through Clusters*
- Trading Signals*
- Trading Strategy*

Vector-based model (benchmark)

KMeans Clusters

- ✗ Negligible out-of-sample profitability
- ✗ Evidences the poor temporal generalizability of the method
- ✗ The model is **not** able to anticipate market trends



Split	Algorithm	Cum. Return	Avg. Return (daily)	St. Deviation (daily)	Sharpe Ratio (annual)
All	<i>Greedy</i>	1.070	0.021	0.006	0.54
	<i>Stable</i>	1.489	0.121	0.011	1.82
Train	<i>Greedy</i>	0.969	-0.019	0.007	-0.41
	<i>Stable</i>	1.285	0.151	0.012	1.97
Validation	<i>Greedy</i>	1.088	0.094	0.005	3.23
	<i>Stable</i>	1.149	0.155	0.008	2.93
Test	<i>Greedy</i>	1.014	0.019	0.004	0.70
	<i>Stable</i>	1.008	0.011	0.009	0.20

LLM-based model

Shock clusters

- ✓ Robust out-of-sample profitability
- ✓ Evidences the improved temporal generalizability of the method
- ✓ The model is able to anticipate market trends



Split	Algorithm	Cum. Return	Avg. Return (daily)	St. Deviation (daily)	Sharpe Ratio (annual)
All	<i>Greedy</i>	1.311	0.082	0.006	2.17
	<i>Stable</i>	1.365	0.095	0.005	2.78
Train	<i>Greedy</i>	1.113	0.065	0.007	1.44
	<i>Stable</i>	1.179	0.100	0.006	2.53
Validation	<i>Greedy</i>	1.086	0.093	0.005	2.86
	<i>Stable</i>	1.054	0.059	0.004	2.16
Test	<i>Greedy</i>	1.083	0.105	0.004	4.30
	<i>Stable</i>	1.099	0.124	0.004	4.38

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Conclusions

- By guiding an LLM through **news-parsing schema**, we were able to obtain a structured analysis of **news-implied firm-specific economic shocks**
- Even in a **volatile** period, the LLM-based method produced **stable distribution profiles** of articles through clusters across splits, demonstrating the **temporal stability** of the methodology.
- The LLM-based **trading signals** are both **long-lasting & economically relevant**, as they are based on trading economic shocks.
- The LLM-based **trading strategy** effectively **identifies winners & losers**, illustrating the parser's ability to **anticipate market trends** by comprehending the market implications of economic shocks

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Predicting Market Reactions to News: An LLM-Based Approach Using Spanish Business Articles

Jesús Villota Miranda

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