



**DSM**

NUTRITION • HEALTH • SUSTAINABLE LIVING

# Fish Oil Price Prediction

Dutch Summer of AI – Final Presentation

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19-08-2022



# Background



# Fish Oil ?



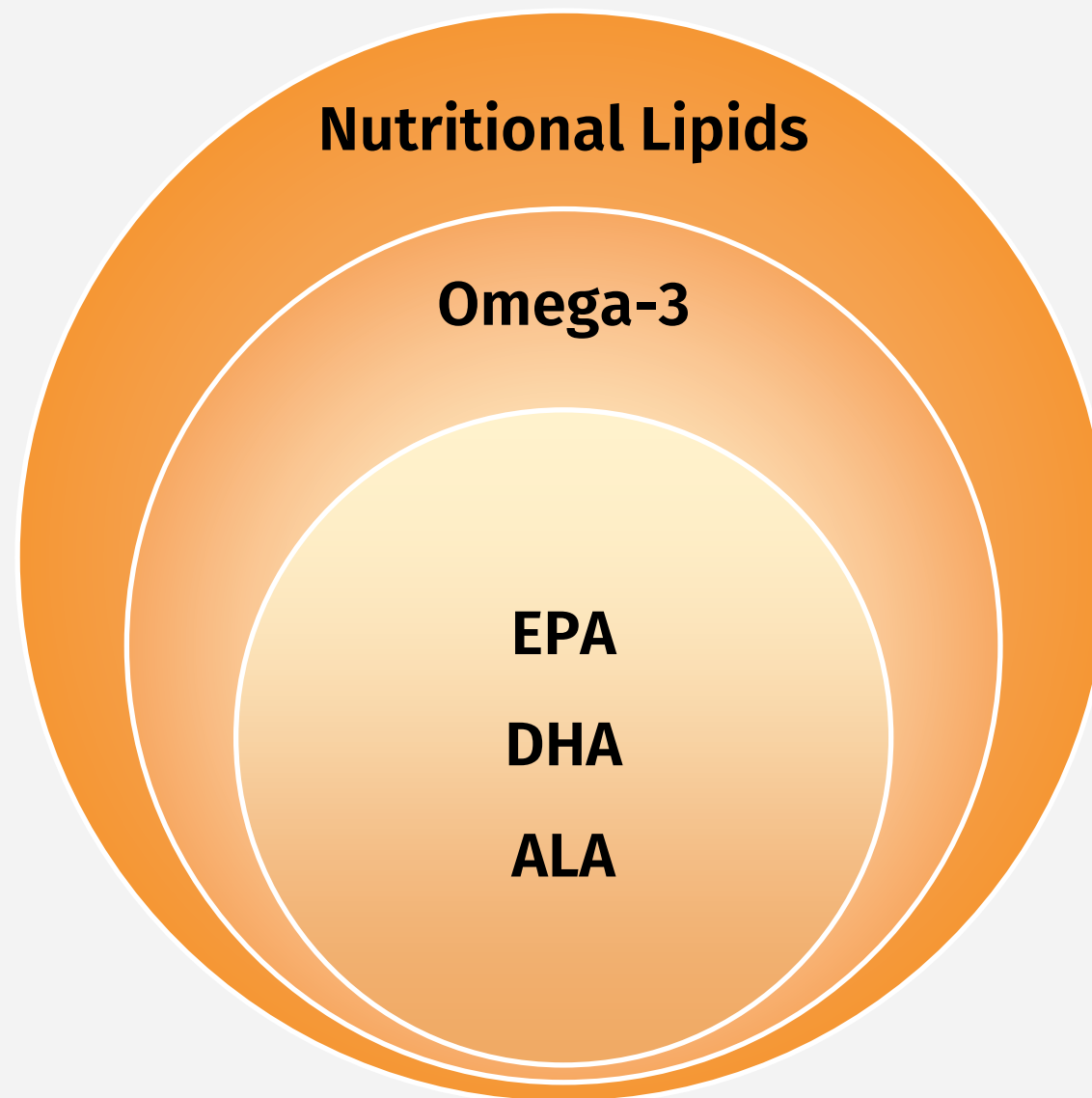
**Reduce the chance of  
abnormal heart rhythm**



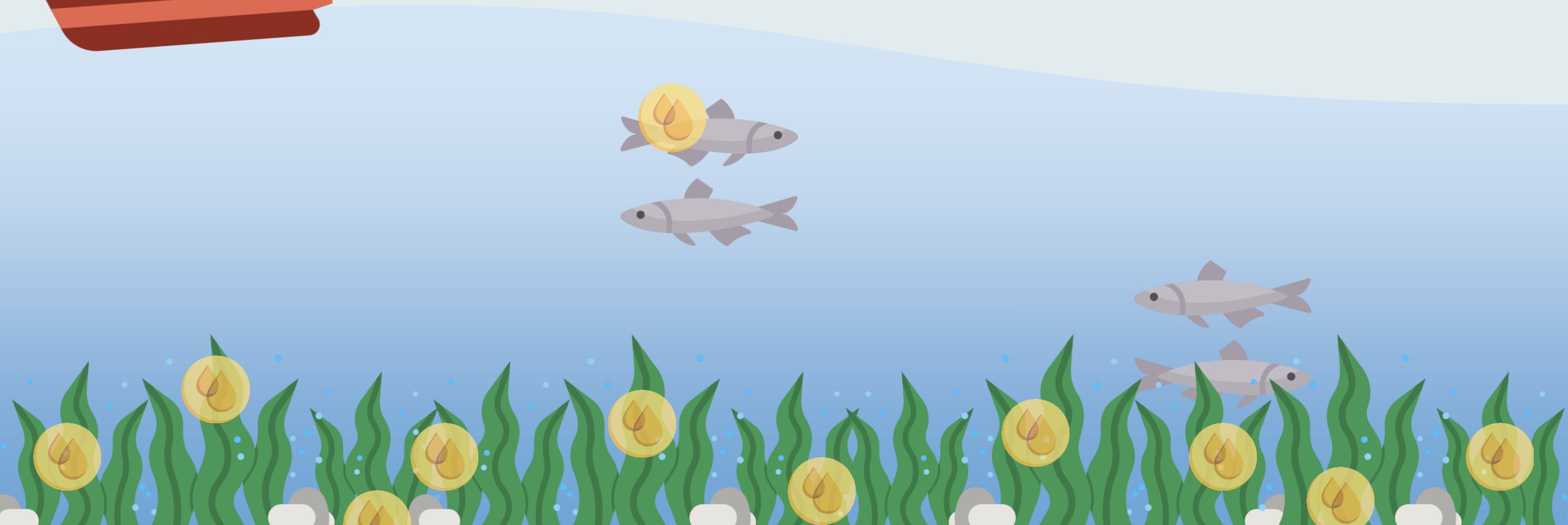
**Reduce the likelihood  
of heart attack and  
stroke**

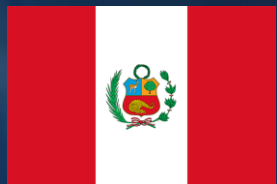
**Omega-3**

**Lower blood pressure**









Peru

# The Challenge

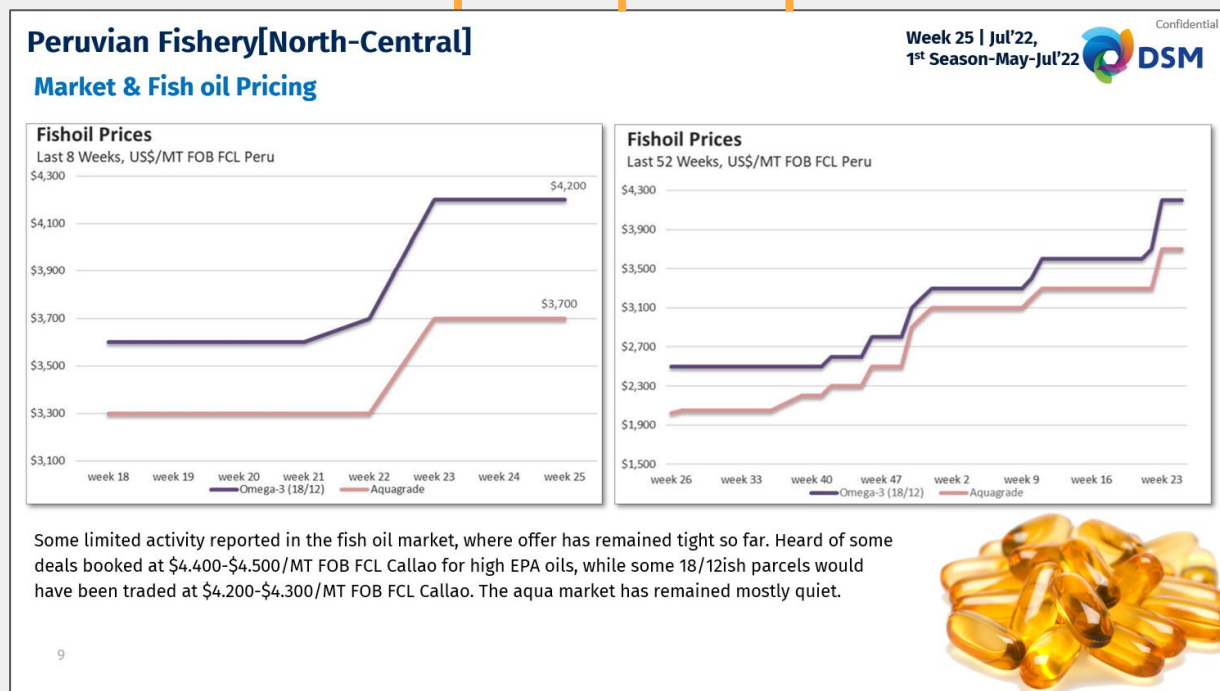
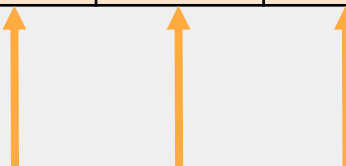


Can we identify, by using AI or any other digital tools, the **best moment** to buy the **fish oil** based on the expectation of whether its **price** will increase or decrease?

# Data sources provided by DSM

Three months worth of (bi-)weekly non-structured PDF documents containing a situation report of the last two weeks in Peru of the year 2022.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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# Data sources provided by DSM

Three months worth of (bi-)weekly non-structured PDF documents containing a situation report of the last two weeks in Peru of the year 2022.

- Extracted features manually

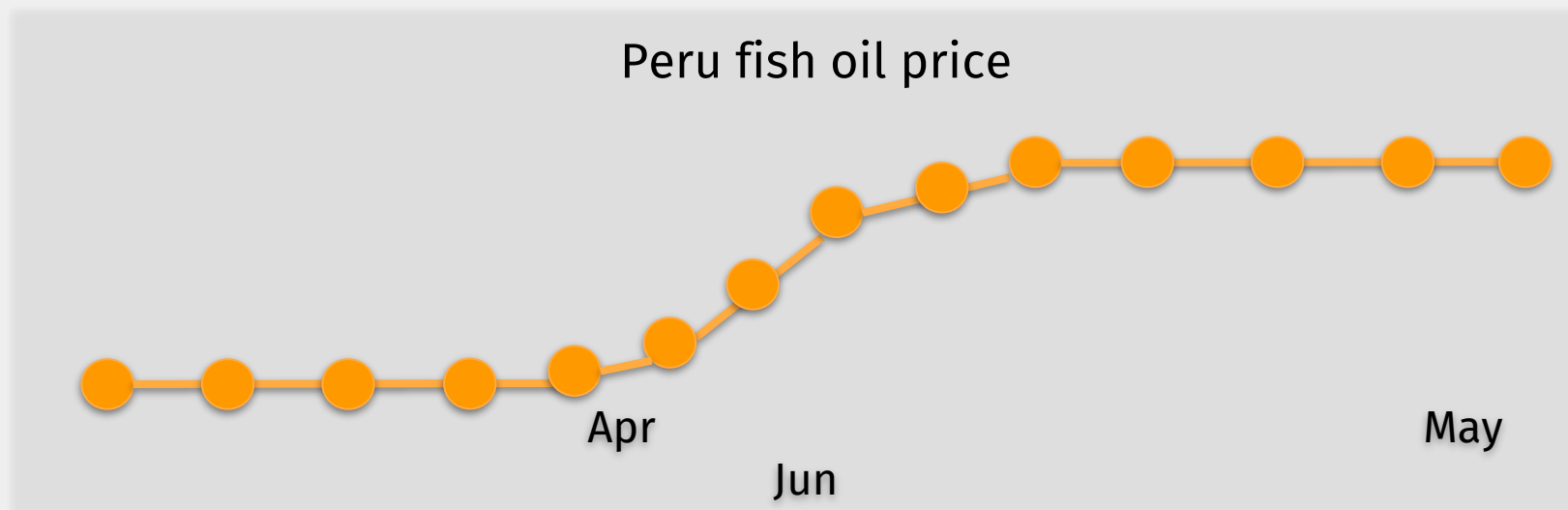
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	date_from	date_to	weekly_fish_landings	fishoil_price_omega3	fishoil_price_aquagrade	fishmeal_price_super_prime	fishoil_production_peru_nc	fishmeal_production_peru_nc	fishoil_production_nc_computed	fishoil_production_south_computed	indicator_temperature_cold	indicator_temperature_low	average_last_week_yield_nc	average_season_yield_nc	average_season_yield_south	epa_lower_bound	epa_upper_bound	dha_lower_bound
2			MT (metric ton)	/MT FOB FCL Per	\$/MT FOB PI	/MT FOB FCL Per	MT(metric tons)	MT(metric tons)	KMT (1000 metric tons)	KMT (1000 metric tons)				%	%		%	
3	2022-04-04	2022-04-10	3000	3600	3300	1810	100	750	0	2,42	0	1	0	0	0,022	13,33333333	12	1
4	2022-04-11	2022-04-17	10000	3600	3300	1810	200	2500	0	2,64	0	1	0	0	0,022	14	16	1
5	2022-04-18	2022-04-24	4500	3600	3300	1810	100	1100	0	2,86	0	1	0	0	0,022	14,66666667	20	1
6	2022-04-25	2022-05-01	5000	3600	3300	1810	100	1200	0	3,124	0	1	0	0	0,022	15,33333333	24	1
7	2022-05-02	2022-05-08	200000	3600	3300	1810	3750	48000	55,84	3,2142	0	1	0,019	0,02	0,022	16	28	1
8	2022-05-09	2022-05-15	268000	3600	3300	1810	2650	64000	41,88	3,4254	0	1	0,015	0,015	0,022	18	20	1
9	2022-05-16	2022-05-22	192000	3600	3300	1750	6250	48200	47,464	3,608	0	1	0,028	0,017	0,022	18	20	1
10	2022-05-23	2022-05-29	265000	3600	3300	1750	9000	63000	64,216	3,6806	0	1	0,0335	0,023	0,022	15	17	1
11	2022-05-30	2022-06-05	313000	3700	3300	1750	12000	73000	69,8	3,8566	0	1	0,039	0,025	0,022	15	17	1
12	2022-06-06	2022-06-12	280000	4200	3700	1750	11500	65000	78,176	4,087125	0	1	0,037	0,028	0,0225	15	17	1
13	2022-06-13	2022-06-19	334000	4200	3700	1780	11000	74000	86,552	4,324	0	1	0,035	0,031	0,023	15	17	1
14	2022-06-20	2022-06-26	107000	4200	3700	1780	3000	25000	86,552	4,6	1	0	0,03	0,031	0,023	15	17	1
15	2022-06-27	2022-07-03	100000	4300	3700	1800	2800	23000	86,552	4,6	1	0	0,03	0,031	0,023	16,5	18,5	1
16	2022-07-04	2022-07-10	145000	4400	3900	1800	5000	35000	86,552	4,6483	1	0	0,03	0,031	0,023	18	20	1



# Data sources provided by DSM

Three months worth of (bi-)weekly non-structured PDF documents containing a situation report of the last two weeks in Peru of the year 2022.

- Extracted features manually
- Change in target variables over the three months was small and increasing only



# Data Collection

# Additional data collection

Identified drivers of the Fish oil price

- ***Supply***
  - Anchovy biomass (influenced by ocean temperatures)
  - Oil yield (typically 3-4%)
  - Oil quality (how much EPA & DHA is contained)
- ***Demand***
- ***Transportation and storage costs***
- ***Prices of substitutable goods***
- ***Fishing rate***



## Features considered

## Data collected

● Fish Oil Price	✓	global & Peru, monthly
● Fish Oil Production	✓	Peru, yearly
○ Anchovy biomass	✗	none
○ Oil yield	✗	none
○ Oil quality	✗	none
● Fish Oil Consumption/Demand	✓	global, yearly
● Climate Factors	✓	sea & continent temperature, Peru, daily
○ temperature	✗	none
○ extreme weather (e.g. El Niño, la Niña)		
● Substitute Product Prices	✓	global, monthly
○ Rapeseed oil	✓	global, monthly
○ Sunflower seed oil	✓	global, monthly
○ Soybean oil	✓	global, monthly
○ Peanut oil	✓	global, monthly
● Transportation Cost	✓	global & Peru, yearly & monthly
● Fishing Rate	✗	none

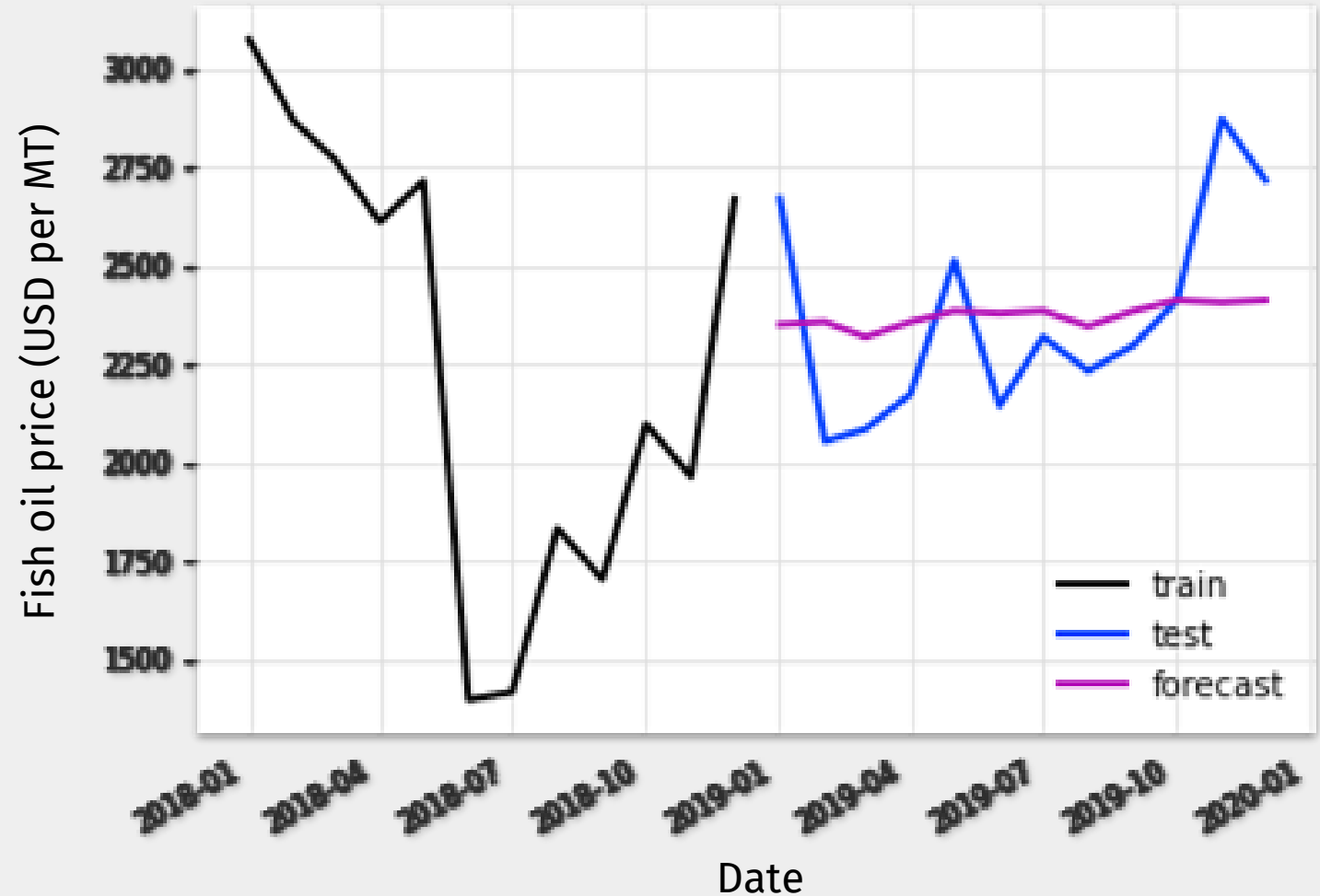
# Solution

# Time Series Forecasting



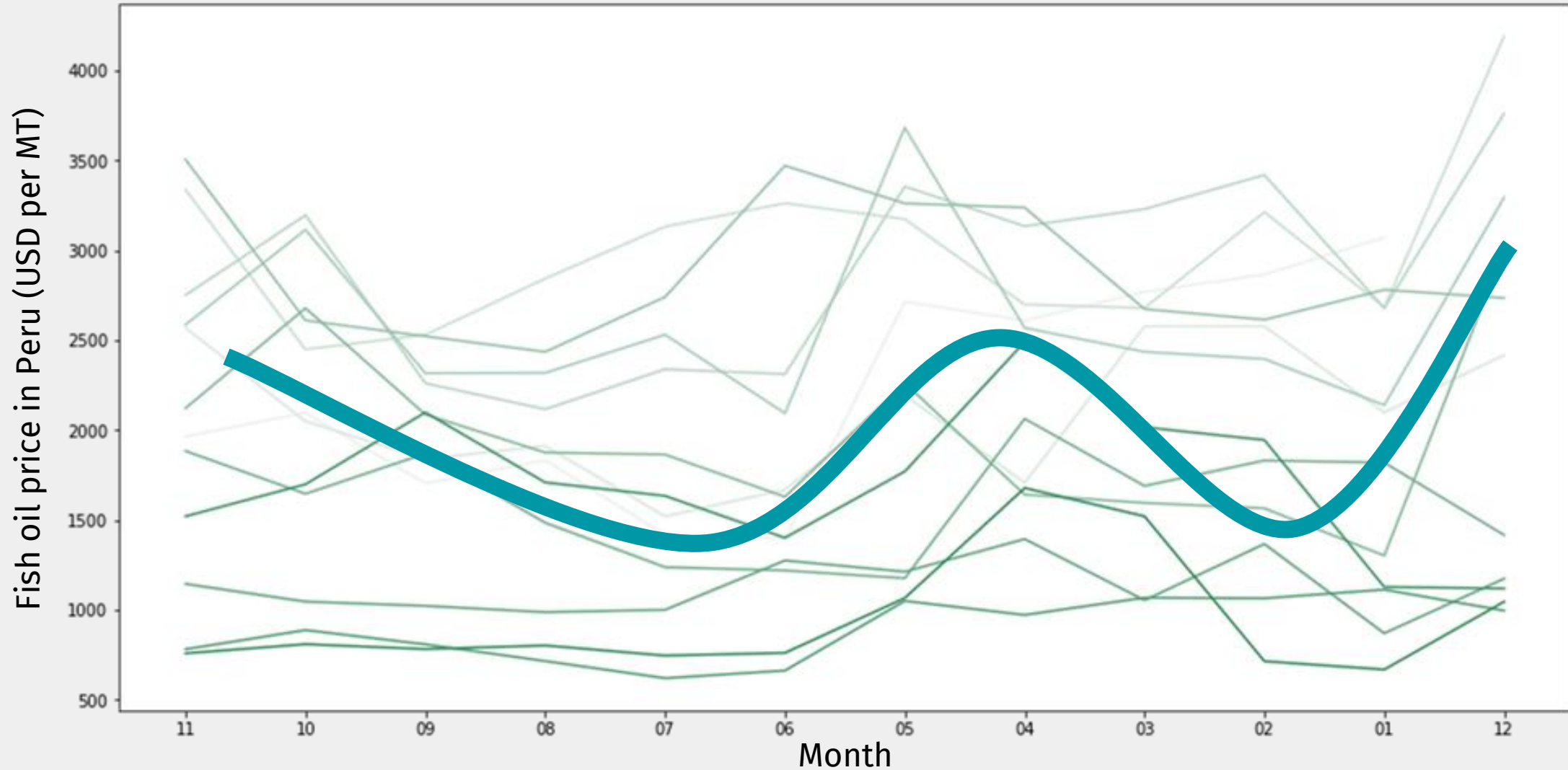
# Time Series Models - Prototyping

- Naive models
- Exponential smoothing model
- TBATS model
- Theta model
- Auto ARIMA model



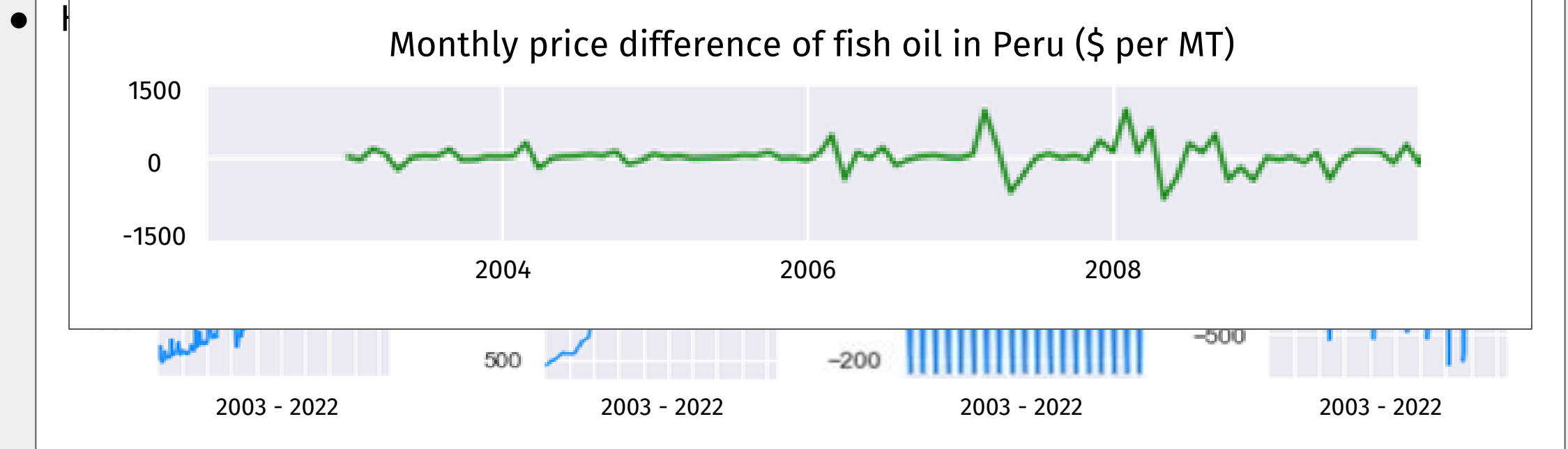
# Time Series Models - ARIMA

Stacked fish oil prices



# Time Series Models - SARIMA

- Series decomposition
- Differencing techniques





# Time Series Models - SARIMA

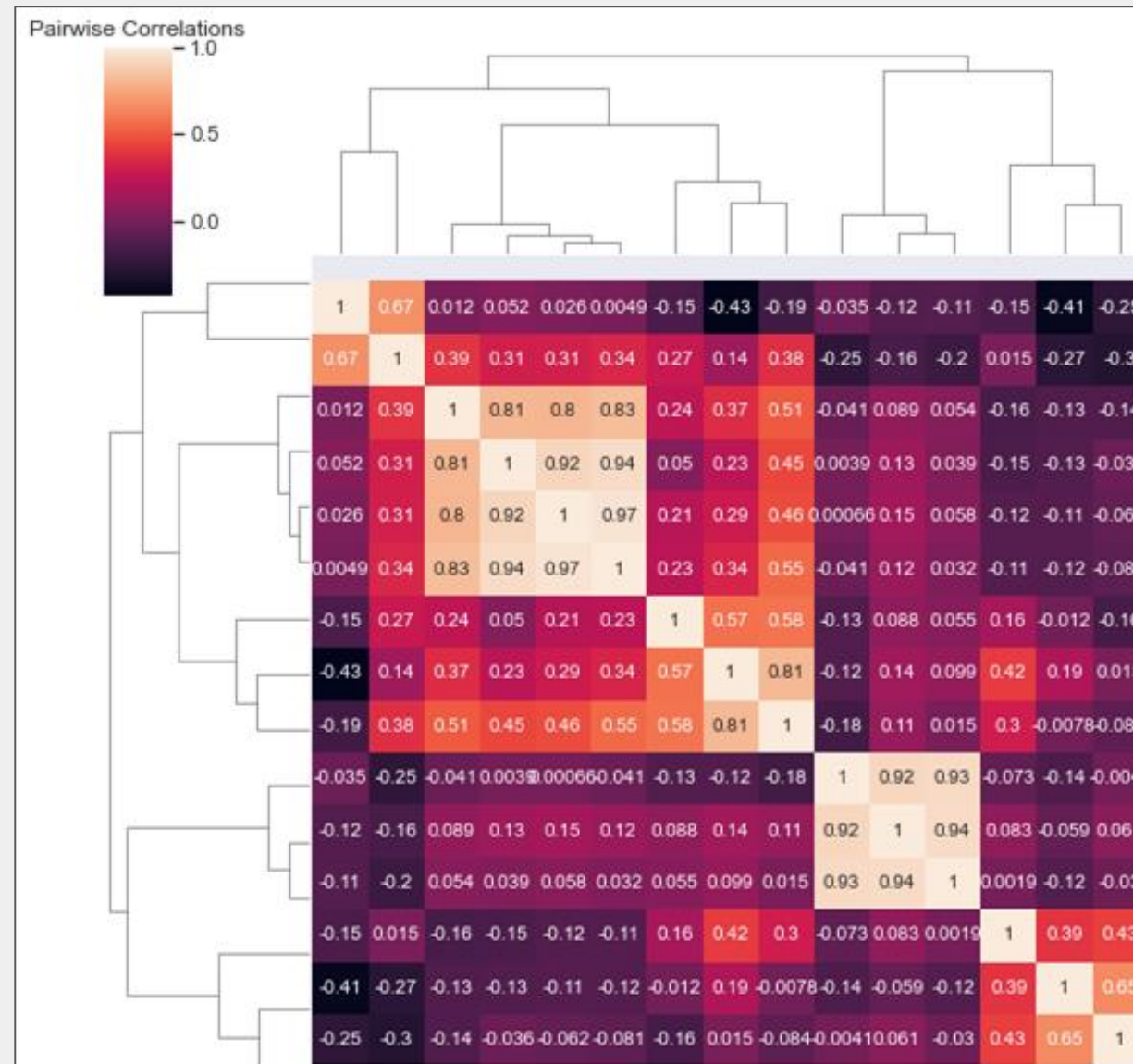
Monthly differences in fish oil prices in Peru compared to SARIMA forecasts



**Accuracy of 71%**

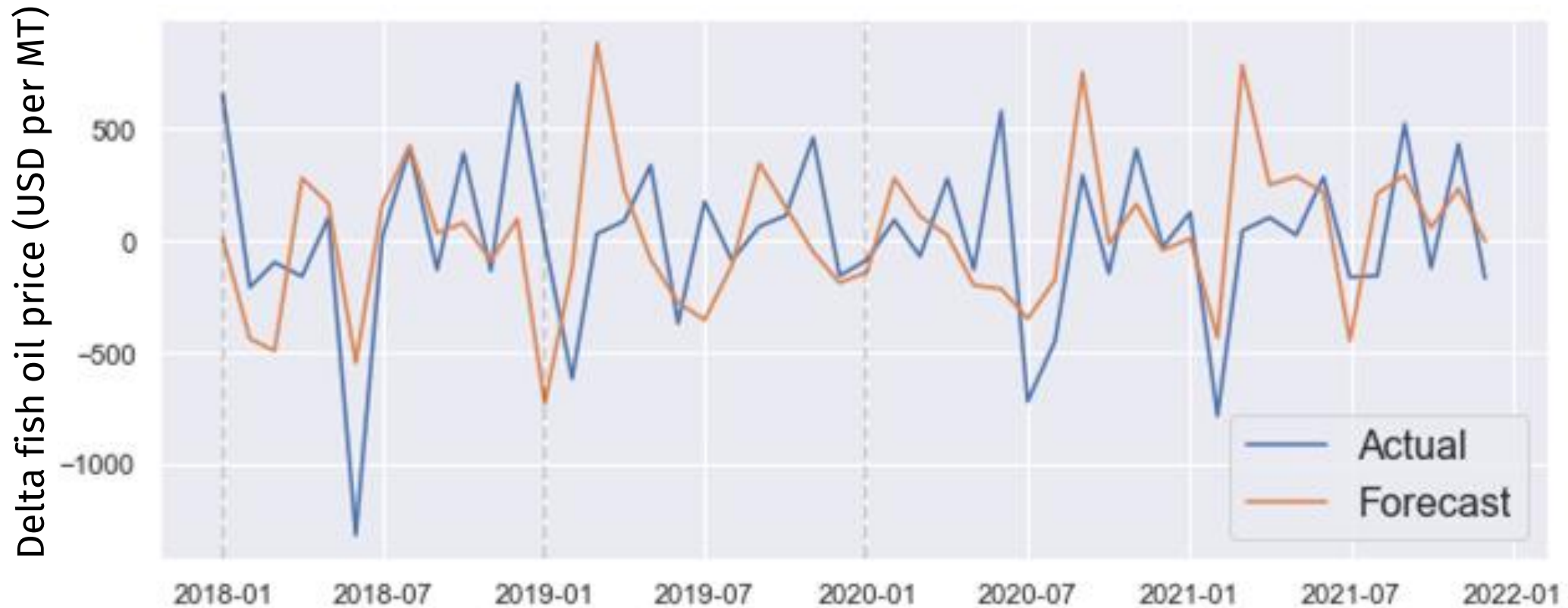
# Time Series Models - VARMA

- Series decomposition
- Differencing techniques
- Hyperparameter
- Correlation and causality testing



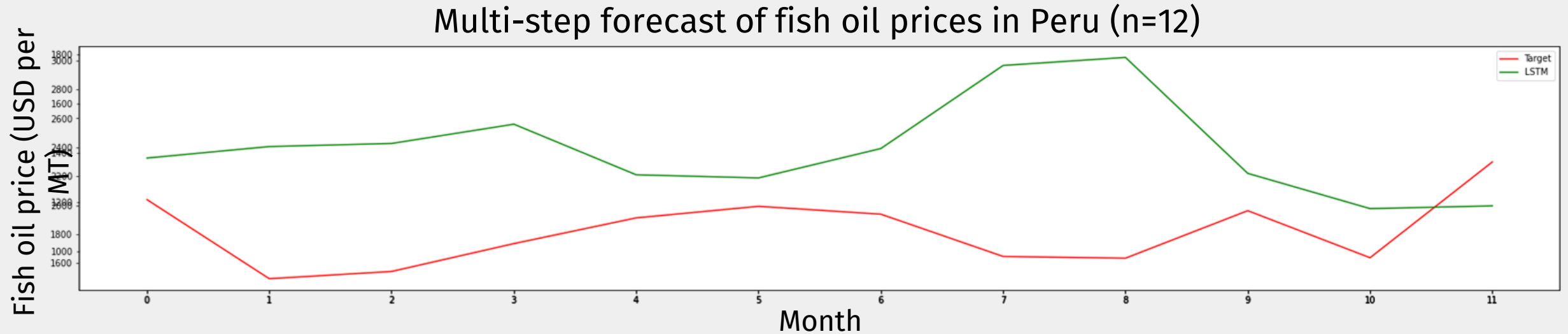
# Time Series Models - VARMA

Monthly differences in fish oil prices in Peru compared to VARMA forecasts



**Accuracy of 79%**

# Time Series Models - Long Short-Term Memory



Accuracy of 68%



A collage of various banknotes, including US dollar bills (100 and 20) and Euro banknotes (100 and 20). The bills are overlapping and slightly faded, creating a textured background. The text "Market value" is centered over the collage in a large, black, sans-serif font.

# Market value



# Market Value - Buying Strategies



## Naive buying strategy

Buy 1/12th of the fish oil every month

## Naive buying strategy with help of VARMA model

Buy 1/12th of the fish oil every month

BUT

If VARMA predicts prices to go down  
postpone the buying until it predicts prices  
to go up

If VARMA predicts prices to go up buy next  
months worth of fish oil in the current  
month

# Market Value - Savings



## Naive buying strategy

Total spend on fish oil per year:  
€60.000.000,-

## Naive buying strategy with help of VARMA model

Total spend on fish oil per year:  
€55.850.000,-

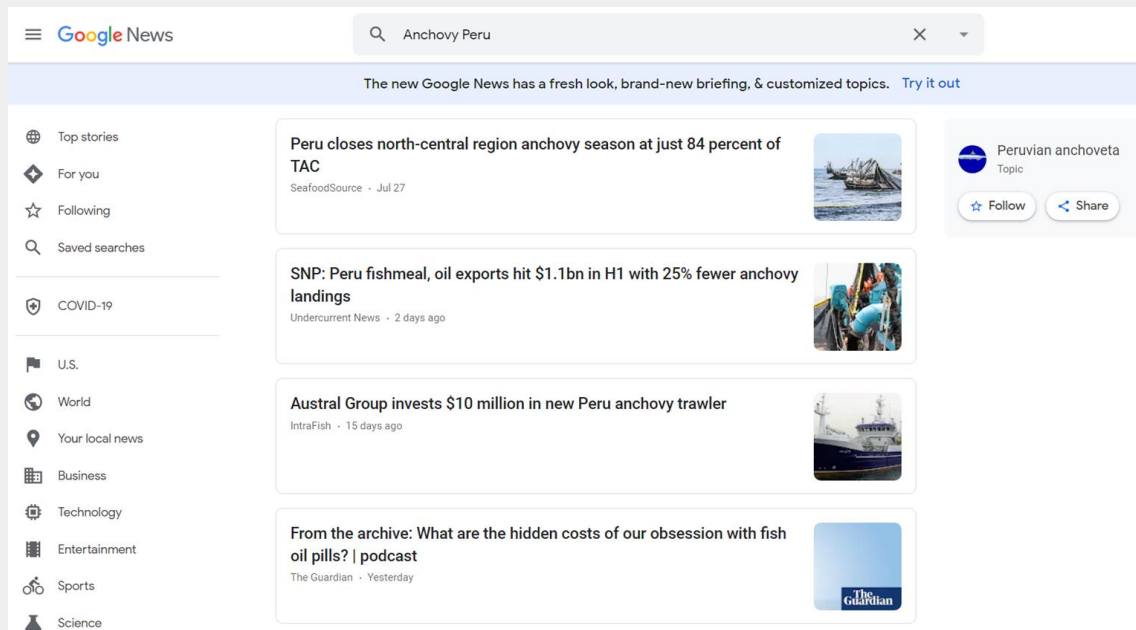
Savings using VARMA per year:  
€4.150.000,-

# Text Mining

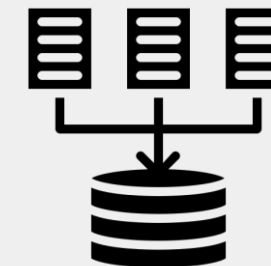
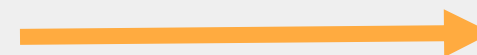




## **Black Swan Events**



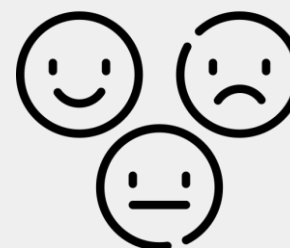
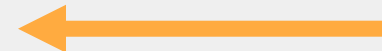
**News portals**



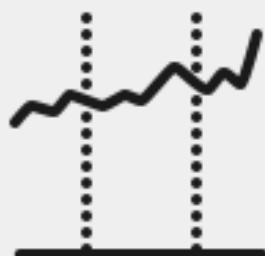
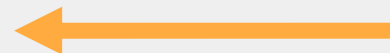
**Web Scraping**



**News data file**



**Sentimental Analysis**

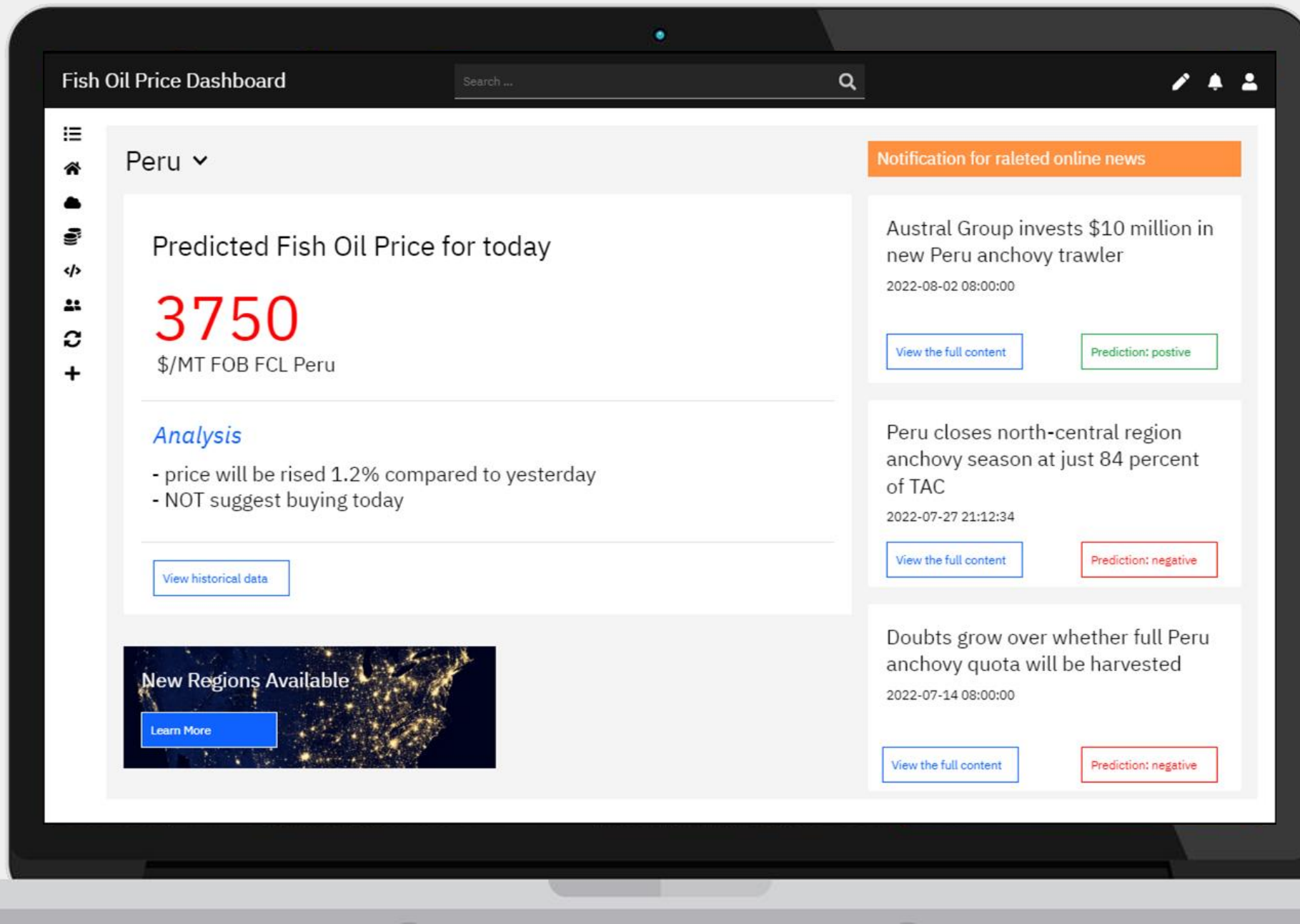


**Price Effect Prediction**

	link	published	title	text	Price Sentiment
0	<a href="https://www.digitaljournal.com/pr/fish-oil-mar...">https://www.digitaljournal.com/pr/fish-oil-mar...</a>	2022-08-15T11:07:03	Fish Oil Market to Witness a Pronounce Growth ...	Fish Oil Market 2022 research provides accurat...	positive
1	<a href="https://www.einnews.com/pr_news/583589445/fish...">https://www.einnews.com/pr_news/583589445/fish...</a>	2022-07-29T11:33:00	Fish Oil Market Size, Share, Growth, Analysis,...	The global fish oil market is expected to exhi...	positive
2	<a href="https://www.seafoodsource.com/news/supply-trad...">https://www.seafoodsource.com/news/supply-trad...</a>	2022-07-27T20:14:07	Peru closes north-central region anchovy seaso...	Peru closes north-central region anchovy seaso...	negative
3	<a href="https://www.intrafish.com/feed/rabobank-fishme...">https://www.intrafish.com/feed/rabobank-fishme...</a>	2022-07-18T08:00:00	Rabobank: Fishmeal market finely balanced amid...	A higher than expected Peruvian anchovy quota ...	negative
4	<a href="https://therevelator.org/farmed-salmon-book/">https://therevelator.org/farmed-salmon-book/</a>	2022-07-18T08:00:00	Salmon Farming's Dirty Business • The Revelator	A new book looks at the "dark underbelly of ou...	negative
5	<a href="https://time.com/6199237/is-farmed-salmon-heal...">https://time.com/6199237/is-farmed-salmon-heal...</a>	2022-07-21T08:00:00	3 Reasons to Avoid Farmed Salmon	Not so long ago, Atlantic salmon was an abunda...	positive
6	<a href="https://www.nature.com/articles/s41597-022-014...">https://www.nature.com/articles/s41597-022-014...</a>	2022-07-20T08:00:00	Energy audit and carbon footprint in trawl fis...	Vessels monitored and on-site investigationsIn...	positive
8	<a href="https://www.intrafish.com/fisheries/a-fantasti...">https://www.intrafish.com/fisheries/a-fantasti...</a>	2022-07-24T08:00:00	'A fantastic result': Peru anchovy fleet wins ...	The harvesting of just over 84 percent of the ...	negative
9	<a href="https://www.intrafish.com/fisheries/austral-gr...">https://www.intrafish.com/fisheries/austral-gr...</a>	2022-08-02T08:00:00	Austral Group invests \$10 million in new Peru ...	South American fishmeal producer Austral Group...	positive
10	<a href="https://www.theguardian.com/science/audio/2022...">https://www.theguardian.com/science/audio/2022...</a>	2022-08-16T05:00:47	From the archive: what are the hidden costs of...	They may be one of the world's favourite suppl...	positive
11	<a href="https://quillandpad.com/2022/08/14/in-praise-o...">https://quillandpad.com/2022/08/14/in-praise-o...</a>	2022-08-14T11:06:06	In Praise Of Anchovies: If You Don't Already L...	A great many years ago, when I was young and i...	positive
13	<a href="https://www.nprillinois.org/illinois/2022-08-1...">https://www.nprillinois.org/illinois/2022-08-1...</a>	2022-08-15T10:00:00	At this northern Illinois party, breath mints ...	They say you can smell it from two blocks away...	positive
14	<a href="https://www.telegraph.co.uk/food-and-drink/col...">https://www.telegraph.co.uk/food-and-drink/col...</a>	2022-08-16T09:00:00	We need to rethink our obsession with salmon	It's the nation's favourite fish. Last year we...	negative

# Future Work





Dashboard Mockup

BRIGHT SCIENCE. BRIGHTER LIVING.™

