"We need to incorporate the contagion of narratives into economic theory. Otherwise, we remain blind to a very real, very palpable, very important mechanism for economic change, as well as a crucial element for economic forecasting. If we do not understand the epidemics of popular narratives, we do not fully understand changes in the economy and in economic behavior."

— Robert J Shiller

NARRATIVE-INVESTING.IO POSITION PAPER

A study on to quantify narratives and take advantage of them using Machine Learning and Alternative Data

Contents

WHY NARRATIVES AND BEHAVIOURAL FINANCE MATTER IN FINANCIAL MARKETS

Did you ever notice that you are more cautious in traffic after there has been a large accident in the news? Then you are aware that sometimes the human brain takes shortcuts that behavioural economists call heuristics. In a nutshell behavioural economics recognizes that humans (and therefore investors) are not always rational, profit maximizing beings.

The fact that you are more cautious when you just witnessed an accident is called availability bias in the school of behavioural finance. It describes the notion that people judge the probability of something happening more likely when an example more easily comes to mind. So for example you probably overestimate the probability of a shark attack when you have just read about in the news. You could argue that the same goes for economic principles. People are more likely to believe inflation is coming when the news is full of it. Or that a recession is coming when everyone is tweeting about it. Or that a stock is going up when its all over Reddit. Point is that news can drive the market, rather than just report or comment on it.

Additionally, scholars (eg Nobel Prize winner Robert Shiller) are increasingly recognizing how narratives can influence markets. Experienced traders also recognise this, many of them explain how their main edge is in recognizing that a certain story/narrative or scenario is unfolding and what implications this has for a stock or investment. Essentially it is not that strange that markets are influence by stories. Human beings are story tellers ever since they ran on the plains chasing mammoths. As children we are taught to appreciate and recognize stories. Religions are build upon stories that are passed through times. And also in capital markets we implicitly also appreciate and fear unfolding stories. Fear of inflation can become a self-fulfilling prophecy, a false rumour of a bank run can create an actual bank run, the examples that narratives matter are endless.

Historically it has been hard to quantify narratives and therefore it always has been a sort of sixth sense experienced investors had by years of reading stories and watching markets. However with the rise of alternative data and Machine Learning Narrative-Investing.IO developed a methodology to quantify financial narratives, which translates into a new toolbox that can help investors navigate financial markets. How or model works and, more importantly, how it can be used in practice will be explained further on in this paper.

QUANTIFYING FINANCIAL NARRATIVES

The rise of alternative data and Machine Learning offers us new way of looking at markets. 20 years ago it was impossible to get real time opinions from thought leaders on their perception of the market, today there are literally thousands opinions voiced on financial markets in a single day. And where it used to be impossible to have someone classify and score these opinions, Machine Learning brings the possibility to have a computer recognize associated topics, emotions, and sentiment the minute an opinion is voiced.

THE ADDED VALUE OF ALTERNATIVE DATA

Traditional finance data is usually nice to work with, it is clean, nicely structured and most data is readily available. Unfortunately that is also it's drawback, since everyone is looking at it, it is hard to gain an edge. Alternative data however usually is instructed and messy, but it is unique. One of the largest alternative data sources is the internet. Terabytes of data are generated every minute and with this indicator we want to take advantage of that.

Therefore at www.Narrative-Investing.io we have a datasets with financial news articles from well know websites, financial tweets and other sources of financial news combined to one large dataset with unstructured alternative data. With this data we can see to what news investors are exposed to. And here is the cool thing, if we think about our behavioural flaws discussed in the first part, we can make a prediction as to where investors' availability bias is headed to. Put differently, is we know if investors are reading more negative or positive news, we can try to predict if their investment decisions will be positive (i.e. long) or if they will be negative (i.e. short). Unfortunately going through all this data and seeing for every news article, tweet etc

whether it's positive or negative is quite undoable. But here is the good news, we can let a computer do that and that is where the AI part comes in.

LEVERAGING AI

The vast amount of (unstructured) data in our dataset is then quantified using AI/Machine Learning. More specifically for each headlines/message/tweet etc we want to what is:

- The (economic) topic
- What is the authors sentiment wrt the topic
- The emotional score

AI/Machine Learning lets us do this in an unbiased way. Moreover it can process thousands of headlines in the time a human can only do ten. Let us take an example, suppose we see the following message:

"I believe the likelihood of a economic recession is rather small"

When we run it through our engine, we get the following score:

Topic: recession, economics

Sentiment towards topic: + 0.4 (positive)

Emotion: Fear (-0.2) → absence of fear

To summarise the first two steps, first we discussed how people are influenced by what they read, second we showed that with alternative data we obtain what they read. The next (and hardest) part is actually reading and classifying. Since we have about 1000 daily news articles we have to let a computer to this, which we do by means of AI/Machine learning. We can use a model that is trained to classify a string of text as either optimistic (scoring it with a max of +1) to pessimistic (scoring it with a minimum of -1). How we do this is quite technical and will be explained in a different post, but the end result is a dataset of more than a million articles classified from +1 (optimistic) to -1 (pessimistic). Now the final step, checking whether the theory we proposed in the first part holds any truth when checking the data.

SUMMARIZING OUR MODEL

So to recap, academic research shows how news can influence investor sentiment, we have alternative (big) data that contains all this news, and we have a computer that can interpret that news faster than any human can. This gives us the ability to transform a narrative in to a quantified timeseries. To give an example we

The dashed line shows the S&P500, the other one our sentiment indicator. The vertical axis shows sentiment (negative to positive) and the horizontal axis is time. You can clearly see how sentiment was already decreasing before the market collapsed under COVID fear. Interestingly you also sentiment improving before the market recovered. So at the least we can see from that this plot that there is a relation between our indicator and S&P stock prices. This shows how new technology and improvement in AI is giving us a new way for looking at the market.

HOW QUANTIFIED NARRATIVES CAN BE USED (WITH CASE STUDIES)

Theory is interesting, but the proof of the pudding is in the eating. In our view quantifying narratives has several use cases within the investment spectrum. We worked out some of these use cases below, namely:

- Using narratives as **a risk indicator** by monitoring emotions in financial narratives, a case study of the **covid crash**
- Using narratives as a tool to enhance **scenario analysis**, a case study on **inflation**
- Using narratives as a tool to enhance **scenario analysis**, a case study on **travel stocks post-covid**

But before we start we case studies we elaborate on one of the key pillars of our model, human experience. Our model is build on the premise that AI and Machine learning are extremely useful, but so is human experience. Therefore, our model is build as such that experienced investors can guide the model in to what narratives it should take in to account.

COMBINING HUMAN INTUITION WITH QUANTIFIED NARRATIVES

AI and Machine Learning can beat humans on various domains, but humans are still superior to computer in understanding how the world works. Our models combine the best of both worlds by having humans point our model to the appropriate narratives. In this way we can leverage investors' experience with Machine Learning and alternative data. To give a concrete example, one of our clients is an experience energy trader. Years of experience have taught him that when the economy is running well, so does the price of oil. There is however one caveat, when there is fear of a supply crunch economic sentiment is irrelevant and the market solely react to (perceived) fear of a supply crunch.

This is where quantified narratives provide additional insight. Having determined which narratives matter, our model can quantify how those narratives are evolving over time. The plot below shows quantified narratives (sentiment adjusted) Economy related chatter and Supply related chatter.
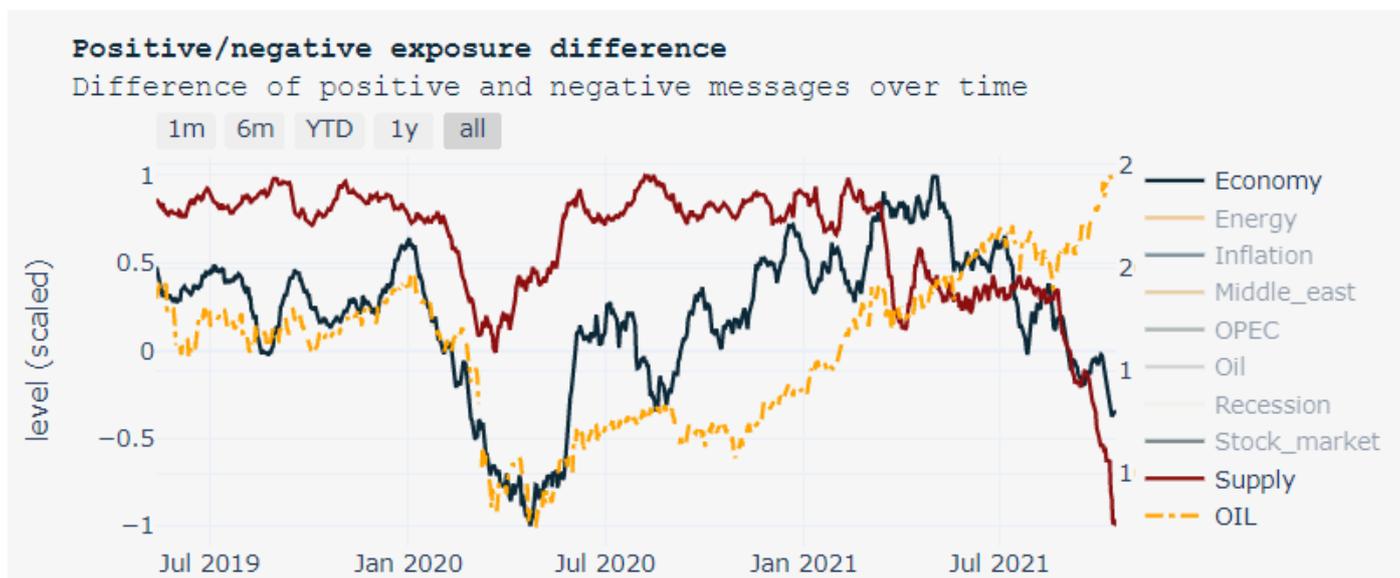

Figure 1 - Investors perception of state of economy and supply lines

Notice that the price of oil generally follows investors sentiment about the economy. However as sentiment towards supply becomes increasingly negative it becomes the dominant narrative for the price of oil. With continuous updates of these narratives our client recognized that increasing fear of a supply crunch would mean an further increase in the price of oil, regardless the decreasing sentiment about the economy.

USING NARRATIVES AS A RISK INDICATOR BY MONITORING EMOTIONS IN FINANCIAL NARRATIVES, A CASE STUDY OF THE COVID CRASH

Fear is a powerful emotion, especially in financial markets. Fear can crash markets and cause irrational behaviour. Recognizing fear after the fact is always an easy exercise, true value comes from monitoring fear before it is priced in. To do this we trained our model to recognize fear and in order to assess whether that is recognized before it is priced in we compare our fear level to the VIX index. The VIX measures the implied volatility in options and can be interpreted as the price one is willing to pay for insurance against the SP500. Insurance is especially high when markets are seeing large shocks, for example during Covid.

In the plot below we show the level of fear present in financial chatter (Tweets, headlines etc). A higher score is more fear (or negative emotion). One can clearly see that fear levels were extremely high pre covid crash and were decreasing extremely fast

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at the level of largest drawdown. It shows how fear can be an extremely useful warning indicator and bellwether for market sentiment
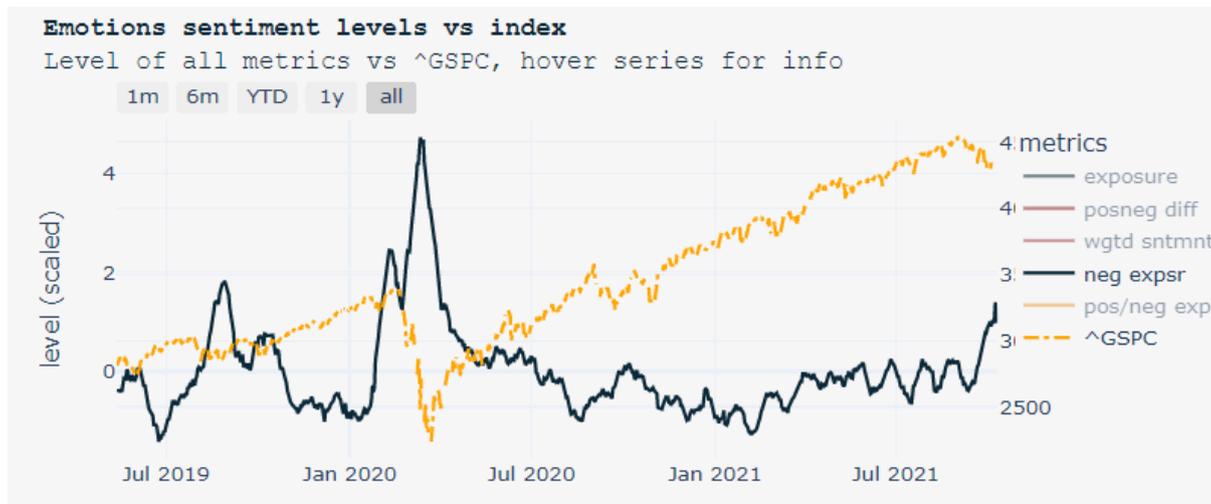

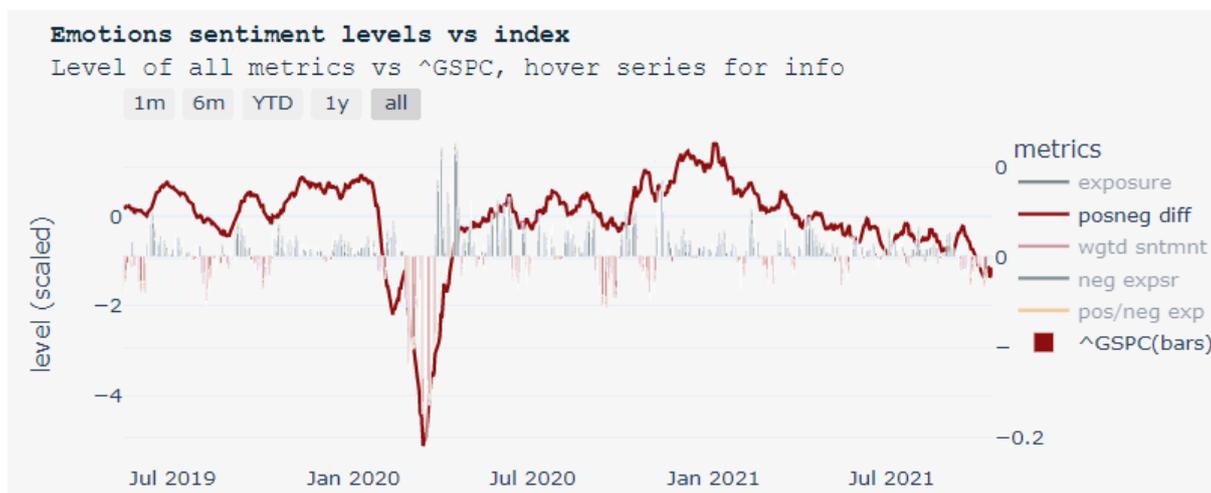**Figure 2 - Fear in financial headlines, tweets, chatter vs SP500**

Figure 3 - Emotions (low more negative emotions, high more positive emotions) vs SP500 returns

USING NARRATIVES AS A TOOL TO ENHANCE SCENARIO ANALYSIS, A CASE STUDY ON INFLATION

We also track certain narratives or stress scenarios over time. Many investors or asset managers do scenario analyses without monitoring which scenario is gaining traction over time. Monitoring narratives can help with that. Take for example inflation. In October 2021 this is becoming an increasingly feared and hot topic. However our model was already picking up fear on the inflation narrative beginning of 2021. While many asset manager have inflation in their standard set of scenarios, monitoring the development of the narrative helps in assessing in when the scenario is starting to become relevant.

As a result of this increase in fear of the inflation narratives we had clients increasing their energy exposure (oil and gas) as they are traditionally seen as a hedge for inflation and tend to do well when inflation is increasing.
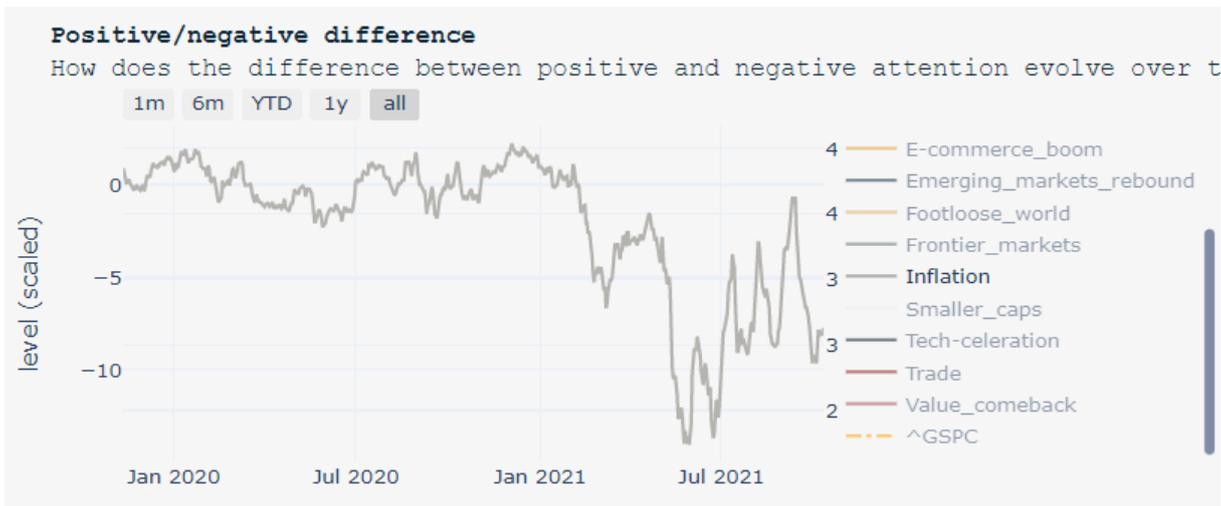
Figure 4 - Financial headlines, chatter etc about inflation

As fear of inflation started to pick so does the price of oil and gas (see also previous chart). This is a prime example how a narrative can signal future price movements and what can be the value of periodically monitor narratives.

USING NARRATIVES AS A TOOL TO ENHANCE SCENARIO ANALYSIS, A CASE STUDY ON TRAVEL STOCKS POST-COVID

One of the scenarios that was especially relevant post covid was whether travel (and travel related sectors) would see recovery or if there would be a regime shift with increasing negative shocks. One of our clients invests in travel related stocks and wanted to get a feeling on whether negativity around the sector had bottomed or was deteriorating. We helped with that with our "Footloose world" narrative/scenario (name taken from the Economist). As you see we didn't see any large negative shocks post covid and as a result our client kept his post covid travel sector positions, which have shown steady results since then.

The plot below shows sentiment towards travel related topics (in financial outings). A lower level means more negative sentiment, higher implies a more positive sentiment. Notice the increase in negative sentiment pre-covid and relative absence of negative sentiment during recovery.
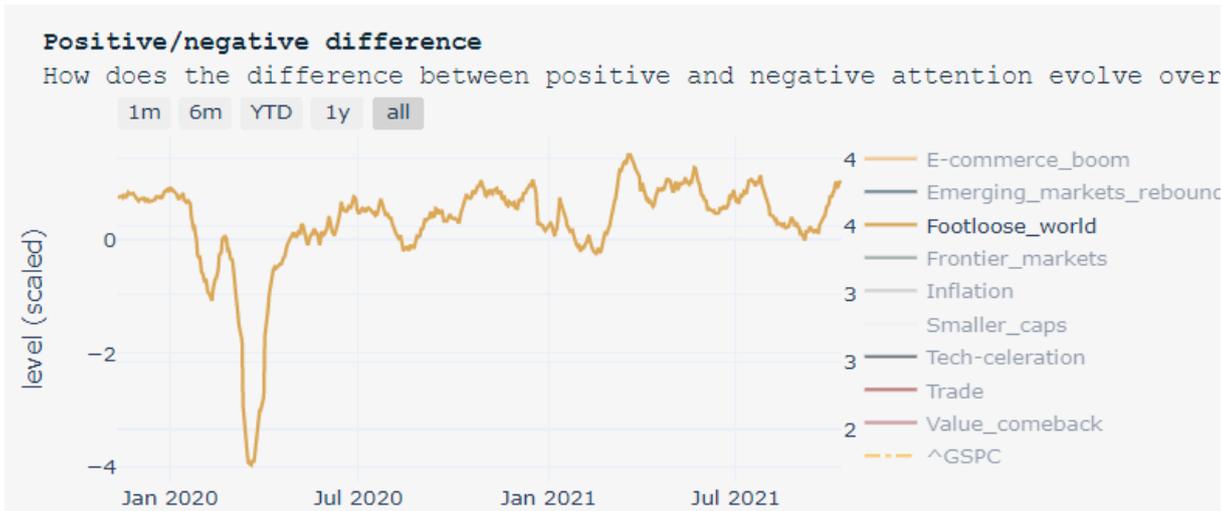

Figure 5 - Financial headlines, chatter etc about travel related domains (sentiment adjusted)

TREND WATCHING

Another interesting use case is in monitoring investing trends. We define these as small niche sectors that haven't really matured yet but where the payoffs can be exponential. Examples of these sectors are Pscychedelic (or shroom) stocks or www.Narrative-Investing.IO – Position paper

Hydrogen stocks. Where fundamental analysis can help you in determining the prospects of a stock, monitoring the narrative can help in assessing on whether it is catching the eye of the investment industry. There is an old saying that says that you can be right but you only start making returns when the market starts agreeing with you. Monitoring the narrative can help investors assess if the market is starting to agree with you.

The plot below shows how our model can distinguish various investing trends and their presence in financial chatter and headlines. Using this we can gauge as to:

- What trend is getting most exposure on an absolute level (put simply, what is the most discussed trend)
- What trend is seeing the largest increase (or decrease) relative to its own historical levels (so is a trend gaining traction)
- Is attention optimistic or pessimistic
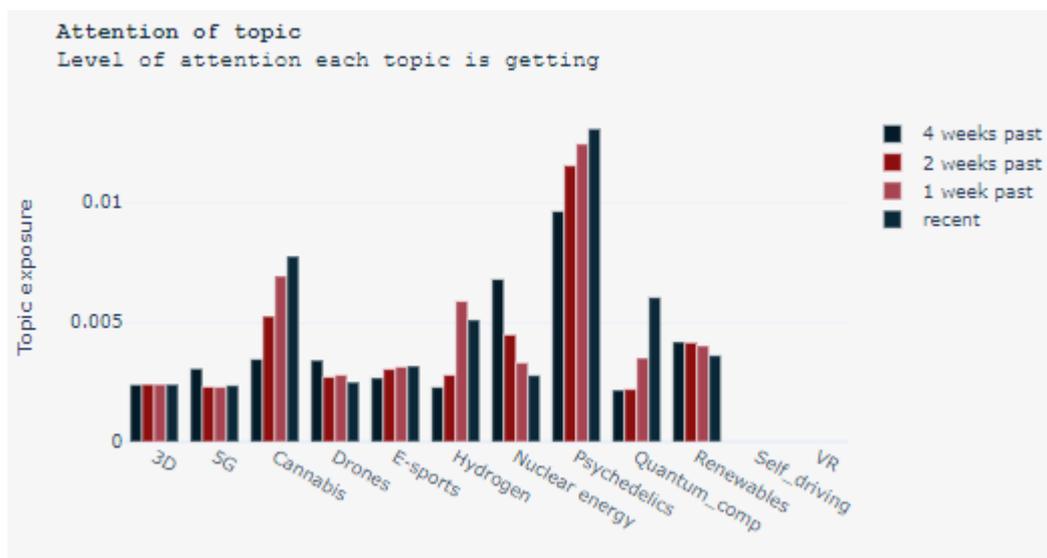- What topics are associated with a trend
- Much more (customized metrics)

Figure 6 - Attention in financial media towards investing trends

Monitoring the narratives of certain trends helps to catch them as they gain momentum. One obvious trend to look at is crypto. In the plot below we show sentiment adjusted attention for Crypto (in mainstream financial website, we also have data on crypto specific media) vs the price of Bitcoin.
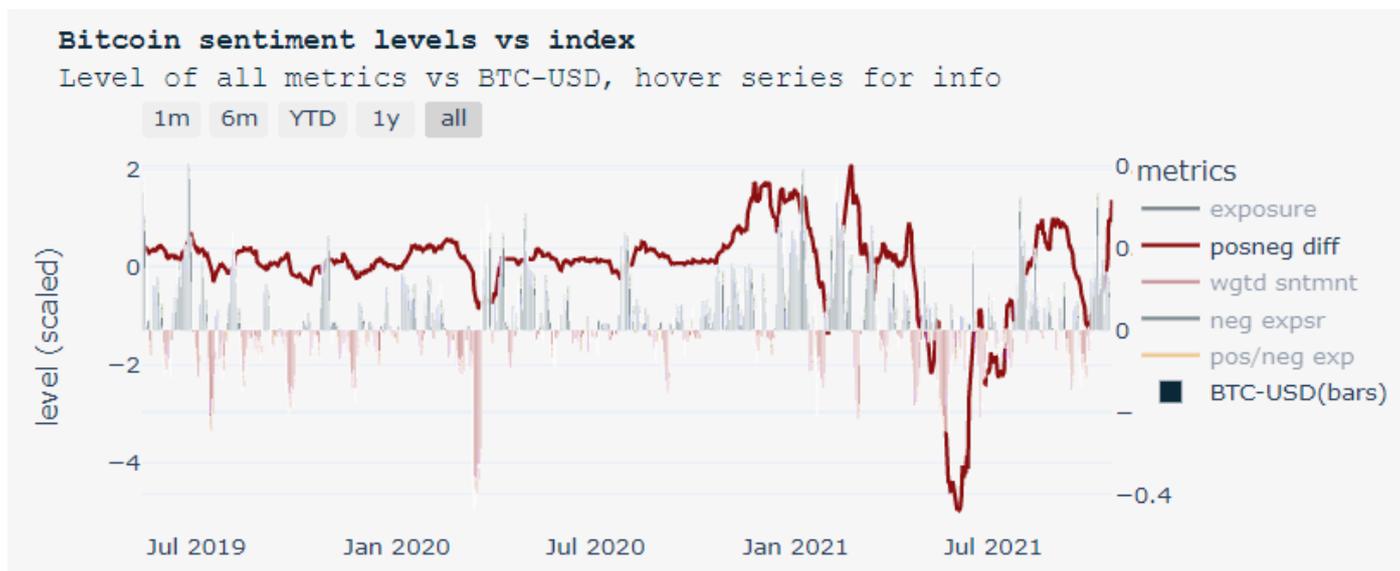

Figure 7 - Mainstream financial media attention towards crypto (sentiment adjusted) vs return of Bitcoin

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One can see that mainstream attention is related to price. It shows how a narrative is related to catching changes in public sentiment early, which is valuable in early stage asset classes or sectors (though crypto arguably is not early stage anymore.

Narrative-Investing.IO was founded in 2020 with the mission of using state of the art developments in Machine Learning, Alternative data, and Investment theory to offer a fresh perspective on financial markets. Where financial institutions still rely on theories developed in the 60's we believe that being first and leveraging developments in computer science can offer an edge. Narrative-Investing.IO offers solutions for smaller investors as well as large scale institutions.

Moreover, we can monitor any desired narrative. In case you're interested in a free demo, want more information or have questions, do not hesitate to reach out.

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