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Do fundamentals still drive relative valuation in a euphoric market ?

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Abstract :

The purpose of this paper is to investigate the relationship between the fundamentals of financial assets in the broad U.S. market and the relative valuation of these same assets over the last four years of stock market euphoria.

At the end of this study, we find first that relative valuation multiples are overwhelmingly negatively related to their value in the previous quarter. The intuition behind this phenomenon is that overvalued (undervalued) relative valuation multiples are likely to face correction by the market and investors, thus decreasing (increasing) their relative value compared to the previous quarter.

Second, we see that there seem to still have a few dynamic links between fundamentals and the relative valuation for the stock market indices, whereas the results for the individual stocks are way less conclusive in this respect.

Nevertheless, in both cases, the relationship between the two dimensions seems to hold mostly for the short term. This is again especially the case for individual stocks where we find very little significant long-term relationship over the studied period.

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Acknowledgments

This thesis was written for my Master degree in Business Engineering with a major in Financial Engineering at the UCLouvain, Belgium. The subject of this thesis is related to the study of the relationship between fundamentals and relative valuation on the U.S. market during the last four years of the stock market rally. Being myself a small-scale investor on the stock market, this research topic is therefore particularly fascinating and one for which I have had a lot of fun in its elaboration.

By this occasion, I would like to thank first of all the members of my family for their unconditional and perpetual support. They are without a doubt my greatest strength in life.

Secondly, I would also like to thank my promotor, Professor Leonardo Iania, for his advice which, although sparing, has proved to be way more than valuable to me.

Finally, it would not be appropriate not to thank Anne-Françoise Woolf, my internship supervisor, as well as Matthieu Becker and Marc Thein, my internship colleagues in private banking, for their true kindness but also for allowing me to access the Bloomberg Terminal, without which the elaboration of this research study would have undoubtedly been much more delicate.

Loris Tedesco

August 2022

Contents

1 Introduction

Beyond the outbreak of the global COVID-19 pandemic, the second decade of the second millennium is the subject of a particularly astonishing phenomenon on the side of the world stock market : following a vertiginous fall, the market recovers suddenly and begins a bullish cycle, to say the least euphoric, that nothing seems to stop. This is particularly the case in the United States where, in the space of no less than two years, many stocks have seen their share price more than double compared to the bottom reached barely a few months earlier.

In this respect, although this bullish recovery is undoubtedly partly due to the few easing measures that followed the strict health rules put in place by governments to stem the pandemic, the question still arises as to the healthy nature of this most impressive twist.

Thus, the objective of this paper will be to pay close attention to the relevance of the fundamentals of equities, supposed to bear witness to the real value of the assets. More specifically, we will focus on their influence and their possible correlation with the intrinsic value of the assets.

Indeed, the analysis of fundamentals is one of the most important subjects that has already received a lot of attention in the financial literature, insofar as fundamentals represent a source of information, both multiple and valuable, available to investors questioning the state in the broad sense of a company : its profitability, its debt, its future prospects, etc. In brief, so much useful information allowing to make or not the decision to invest in this same company.

In this continuity, as demonstrated by some researchers, a special relationship seems to exist between these two dimensions : companies with better fundamentals, that is to say those in "better financial health", generally seem to perform better on the stock market.

Nevertheless, in a context of an equity market in full euphoria, perhaps even bordering on the irrational, one can ask oneself the question as to the persistence of this relevance of the fundamentals in the stock market price of shares.

All this reflection brings us to the following question, subject of this paper :

"Do fundamentals still drive relative valuation in a euphoric market?"

This paper will therefore attempt to answer this question by studying the American market over the short period of the last 4 years, with a viewpoint that is both macro using stock market indices, but also micro through stock picking. In this study, five of the most common relative valuation multiples across the literature are studied : the P/E ratio, the P/B ratio, the Enterprise value/EBITDA ratio, the Enterprise value/Sales ratio and finally the dividend Yield. For the fundamental measures, we consider the gross margin, the operating margin, the Return on Asset (ROA) as well as the Return on Equity (ROE). By choosing 5 measures for relative valuation and 4 for fundamentals, we ensure that we cover a relatively wide range in order to efficiently proxy each of the 2 dimensions as accurately as possible.

With this thesis, we contribute to the existing literature by basing ourselves on the study and methodology of Agudze and Ibhagui (2020) who also questioned the subject, but by trying to bring a new look due to the period of the study subsequent to the original work, as well as to the new dimension studied by also focusing on individual stocks. More precisely, using the autoregressive distributed lags technique (Pesaran et al., 2001), we attempt to assess whether fundamentals do

indeed still have some influence on the relative performance of firms, and if so, how this relationship manifests itself. Finally, because of the significant differences between each asset studied, we also compare these relationships, both across indices, across stocks, and both combined.

After presenting the core literature that led to this research work in the following section, the rest of the paper is established as follows : Section 3 presents a detailed description of the methodology applied, as well as the data considered. All the results are then discussed in Section 4. Finally, Section 5 is responsible for drawing the conclusions of this study.

2 Literature

As already discussed in the introduction, fundamental analysis is a topic that has received a lot of attention within the literature, both theoretical and empirical, especially due to the wealth of valuable information it provides over the state of a company in many aspects, and with the final objective being of leading to an investment decision (Muhammad and Ali, 2018; Sobocińska, 2019).

Despite this, opinions seem to diverge across the multitude of studies on the subject as to the real relationship that fundamentals have with the relative valuation of companies.

Thus, we find as many researchers in favor of an obvious link between these two dimensions. This is for example the case for recognized papers such as that of Fama (1990). Nevertheless, we also find researchers stipulating that no relationship whatsoever can be formally established between the two (Summers, 1986). In this continuity, the fundamentals are considered by many scholars to be particularly important in assessing the performance, and therefore the future earnings, of a firm. In particular, this is once again the subject of numerous early studies documenting strong relationships between fundamentals and future firm revenues (Abardanell and Bushee, 1997; Lev and Thiagarajan, 1993; Luchs et al., 2002).

As is the case with the theoretical literature, the empirical literature is no exception and also contains its share of contradictions on the subject. Boucher (2007), for example, documents through his research that fundamentals have a real long-term predictive power on the relative valuation of stocks, so that possible deviations of both would be justified only by short-term phenomena, destined to regain their normality in the long run. More recently, Velinov and Chen (2015) go in this direction by documenting through their study that stock prices have a strong tendency to align with their fundamentals and that we observe an auto-correction of stock prices towards their fundamentals, especially following the 2008 crisis, an opinion also shared by Goedhart et al (2005). Conversely, other authors such as Becchetti et al (2007) or Manzan et al. (2007) illustrate that stock prices in the equity market tend to move away from fundamentals in the long run.

In the face of this divergence of opinion, Agudze and Ibhagui (2020) have recently contributed to the literature by examining the role of fundamentals on the relative valuation of firms at the aggregate level of the equity market, specifically by taking a closer look at the macro level, whereas most previous work had focused on the micro level. In their study, Agudze and Ibhagui, among other things, detail through their results an effective relationship between fundamentals and relative valuation, as well as significant effects of fundamentals on index valuation. This paper will therefore be based largely on the methodology applied by the latter two authors, with a few devi-

ations, at the end of which we will be able to see whether the conclusions drawn by the authors a little less than 3 years ago are still valid in the light of the surprising bull market we have recently been facing.

3 Methodology and data

3.1 Methodology

In order to determine whether any relationship holds between the fundamentals of an asset and its relative valuation, the whole methodology will consist in implementing some regressions between the two dimensions via a model of the following form :

$$VAL_t = \alpha_0 + \alpha_1 FUND_t + \epsilon_t \tag{1}$$

Where :

- VAL_t represents the relative valuation ratios, that is to say the level an asset is expected by the market and investors to trade in the future. In our case, as already specified, we will use five of them : the P/E ratio, the P/B ratio, the Enterprise value/Sales ratio, the Enterprise value/EBITDA ratio, and finally the Dividend yield).
- $FUND_t$ represents the fundamental indicators, that is to say measures to assess the economic and financial state of a company. In this case, we will use four of them : the gross margin, the operating margin, the return on asset (ROA) and the return on equity (ROE).
- ϵ_t is the white noise term

In order for the different regressions to hold, it is important to ensure that each of the variables considered in our model is stationary, otherwise the results we obtain may be spurious. Nevertheless, it is still possible to perform these same regressions with non-stationary variables, provided that these variables are cointegrated. In other words, we could run the regressions and draw conclusions on consistent results if there exist some stationarity in the linear combination of these same variables, even if the latter are not all individually stationary.

Thus, by performing a unit root test, we could determine the order of integration of all the variables, after which it would be possible to consider a situation of cointegration between the different variables in two precise cases : if all the variables of the model are integrated of order I(1), or if the model contains both integrated variables of order I(0) and I(1).

As we will see in the Unit Root section, the tests carried out do indeed show a mix of variables order, since some of them turn out to be integrated of order I(0) while others are of order I(1). For this same reason, we follow the methodology of Agudze and Ibhagui (2020) and choose to adopt the autoregressive distributed lag (ARDL) model, as established by Pesaran et al. in 2001, for the simple reason that this model allows the study of variables of different orders of integration within the same model, as it is precisely the case here. In addition, this model also allows us to study the temporal nature of the relationship between two variables, which is particularly interesting in the context of this research. Indeed, this specificity will allow us to determine whether, in the case of a relationship between fundamentals and the relative valuation multiples of an asset, this

relationship has a short, long-run or mixed trend.

The final model following Pesaran et al. is therefore defined as follows :

$$\Delta VAL_t = \lambda_0 + \sum_{i=1}^{j} \delta_{1i} \Delta VAL_{t-i} + \sum^{k} \beta_{1i} \Delta FUND_{t-i} + \alpha_1 FUND_{t-1} + \alpha_2 VAL_{t-1} + \epsilon_{1t} \quad (2)$$

Where :

- Δ is the difference operator
- j and k are the optimal lag lengths selected based on the AIC
- δ and β are coefficient estimates of the variables (for *VAL* and *FUND*, respectively)
- ϵ is the white noise term criterion

3.2 Data

a Assets

In what follows, we will present all of the 6 assets selected for this study. As indicated, this study will first of all have a rather macro focus, in the sense that the American market on which this thesis is focused will be represented through three stock market indices, namely the S&P 500 Index, the Nasdaq Composite Index, and finally the Russell 2000 Index. The choice of these three indices stems from a desire to cover and so proxy the entire American market.

Following this, our study will then have a more micro focus, this time by selecting three individual stocks : Amazon.com, Inc., Tesla, Inc., as well as AMC Entertainment Holdings, Inc. Indeed, although the American market is largely covered by the study of the three stock market indices mentioned above, the desire to take a more precise look at three random stocks which literally "exploded" in a rather surprising way during the studied period allows a added value to this thesis.

For each of these 6 selected assets, we will first describe them, their sector, their activity, as well as the relevance of their selection for the study. We will also take a look at their stock market evolution from a purely graphical point of view. Finally, we will summarize the descriptive statistics in tables for information purposes, before illustrating them in the Variables section.

S&P 500 Index :

The S&P 500, or Standard & Poor's 500 Index, is widely regarded as the best single indicator of large-cap U.S. equities, and serves as the foundation for a wide range of investment products. The index includes 500 leading publicly traded companies and captures approximately 80% coverage of available market capitalization. (Kenton, 2022)

Since it is considered by many as the best representation of the American market, its selection within this study is quite relevant.

Moreover, if we consider its price evolution as illustrated on the graph that follows, we realize quite easily that the latter skyrocketed from Q2 2020 (following the bottom reached during the COVID-19 crisis), and this, at a much more frantic pace than it hadn't been for the previous 20 years, which is quite interesting for the subject of our study.

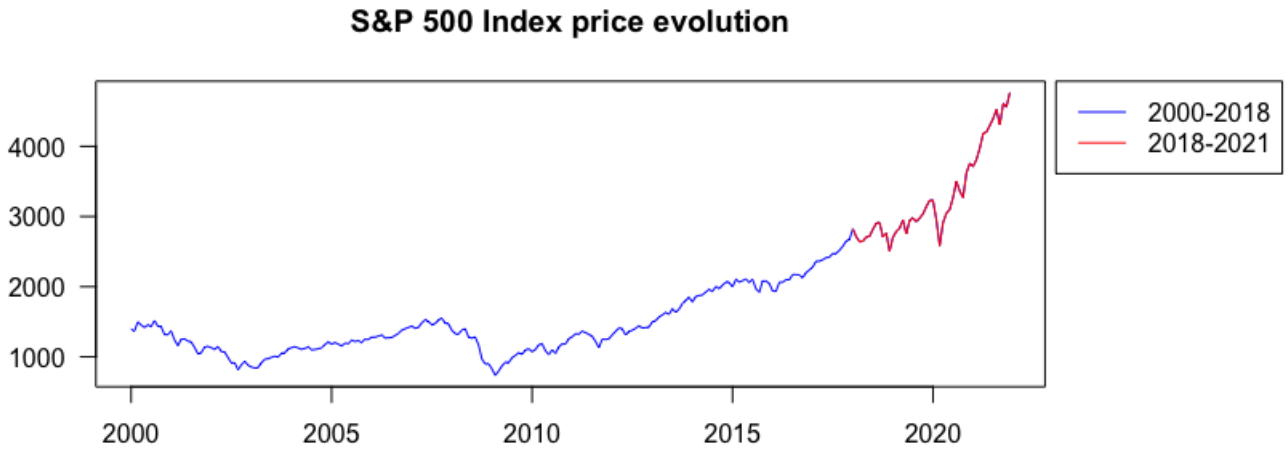

Figure 1: Price evolution of the S&P 500 Index (2000Q1 - 2021Q4)

	PE	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	22.36	3.67	21.77	2.78	1.78	34.04	12.93	3.07	14.99	0.75	1.32	100.16
Maximum	30.67	4.76	32.18	3.4	2.34	35.28	16.16	4.13	20.70	2.34	2.80	103.95
Minimum	16.65	2.92	16.84	2.25	1.27	33.41	9.97	2.11	10.61	-0.54	0.10	87.07
Std. Dev.	4.14	0.57	4.27	0.38	0.29	0.55	1.66	0.55	2.63	0.73	1.11	4.22

Table 1: Descriptive statistics for the S&P 500 Index

Nasdaq Composite Index :

The Nasdaq Composite Index is a broad-based market capitalization-weighted index of more than 3,700 stocks listed on the Nasdaq stock exchange. As a broad index heavily weighted toward the important technology sector, the Nasdaq Composite Index has become a staple of financial markets reports. (Chen, 2022)

For this same reason, the Nasdaq Composite Index is an interesting choice for the purpose of this study in the sense that, although driven by the very popular technology sector composed of some of the largest American companies, this index is also one of those that have exploded the most upwards from 2020, as shown in the graph below. The questioning of a hypothetical link between this increase and the real performance of the companies making up this index is therefore legitimate.

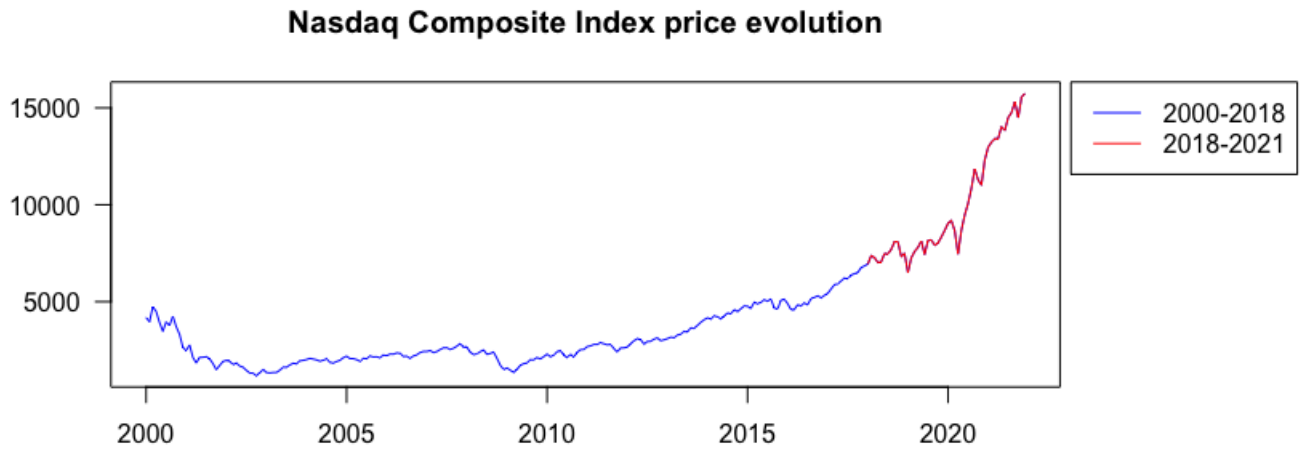

Figure 2: Price evolution of the Nasdaq Composite Index (2000Q1 - 2021Q4)

	PE	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	55.475	5.09	32.99	3.58	0.94	43.7	11.96	3.79	13.81	0.75	1.32	100.16
Maximum	125.46	6.63	45.26	4.65	1.25	61.60	14.71	5.15	17.62	2.34	2.80	103.95
Minimum	22.14	3.87	21.94	2.79	0.62	41.41	9.66	2.66	10.08	-0.54	0.10	87.07
Std. Dev.	30.88	0.89	7.43	0.56	0.20	4.81	1.32	0.71	2.25	0.73	1.11	4.22

Table 2: Descriptive statistics for the Nasdaq Composite Index

Russell 2000 Index :

The Russell 2000 Index refers to a stock market index that measures the performance of the 2,000 smaller companies included in the Russell 3000 Index. The latter is widely regarded as a bellwether of the U.S. economy because of its focus on smaller companies that focus on the U.S. market. (Siew, 2022)

The choice of this index is therefore a complement to the S&P 500 index, thus allowing this study to take a look at both large caps, but also medium and small companies considered within the Russell 2000. Beyond its choice for its scope, this index was also subject to a disproportionate rise during the period studied, following a fall in its stock price more marked than the two previous indices during the COVID-19 crisis. Although its steeper fall than the other two indices makes sense insofar as small businesses were the ones that suffered the most from government containment measures aimed at stemming the pandemic, the question remains as to the justification for the spectacular recovery that followed.

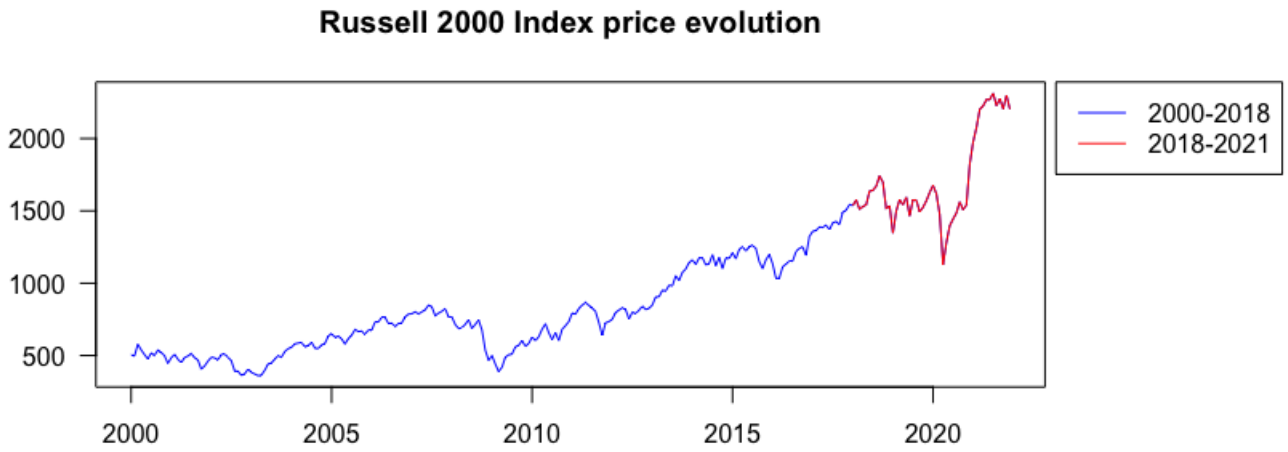

Figure 3: Price evolution of the Russell 2000 index (2000Q1 - 2021Q4)

	PE	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	158.74	2.26	91.03	1.89	1.43	27.84	4.02	0.14	0.35	0.75	1.32	100.16
Maximum	924.23	2.80	416.46	2.34	2.08	29.22	8.88	1.19	5.47	2.34	2.80	103.95
Minimum	35.72	1.61	25.63	1.46	1.00	26.38	-0.06	-1.43	-7.74	-0.54	0.10	87.07
Std. Dev.	243.06	0.35	108.02	0.26	0.29	0.90	2.57	0.89	4.38	0.73	1.11	4.22

Table 3: Descriptive statistics for the Russell 2000 Index

Amazon.com, Inc. :

Amazon.com, Inc. needs no introduction. The company was founded by Jeff Bezos in 1994 and today operates under two major segments: consumer products and subscription retail in North America and around the world. The Company also manufactures and sells electronics and other devices, as well as develops and produces media content, or programs that allow sellers to sell their products on its websites, etc. In short, the company today serves a very wide audience, including consumers, sellers, developers but also businesses and content creators. (Yahoo! Finance, 2022)

Amazon.com, Inc.'s choice is to select a world-famous company that would be an ideal candidate to symbolically represent the American market in a unique way. In addition, the company is ranked among the largest market capitalizations in the world. Finally, although the stock price of Amazon.com, Inc. is constantly growing as shown in the graph below, its evolution began to accelerate from 2018, until it skyrocketed in March 2020 as the three previous indices, benefiting more than strongly from the several global lockdowns around the world.

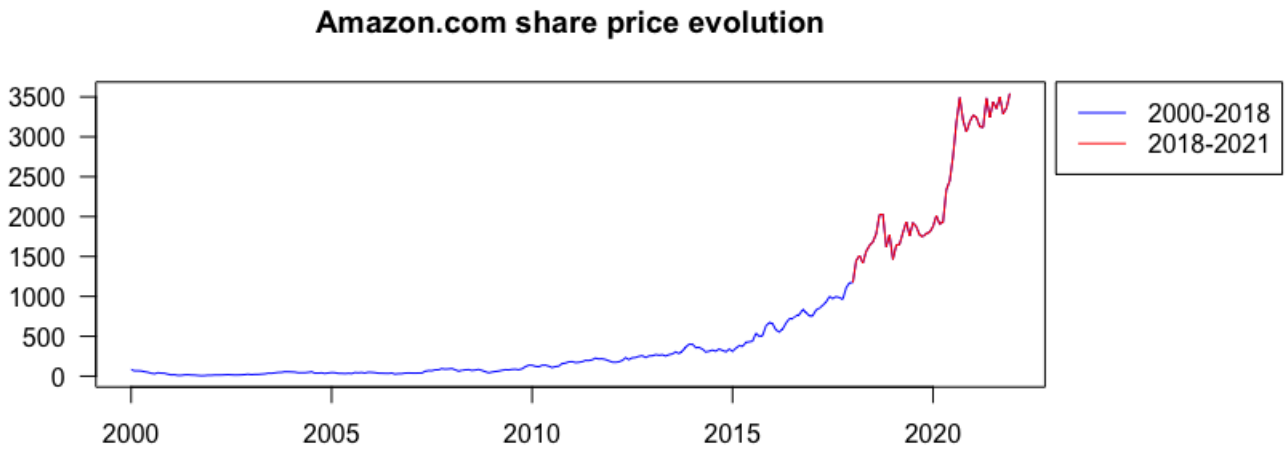

Figure 4: Share price evolution of Amazon.com, Inc. (2000Q1 - 2021Q4)

	PE	PB	EVE	EVS	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	91.79	17.52	74.30	3.85	40.94	5.51	7.09	25.33	0.75	1.32	100.16
Maximum	182.28	25.03	140.82	4.62	43.25	8.17	9.89	31.91	2.34	2.80	103.95
Minimum	58.88	12.28	57.14	3.20	36.85	2.52	3.80	14.82	-0.54	0.10	87.07
Std. Dev.	33.46	3.59	23.34	0.43	1.96	1.45	1.60	4.78	0.73	1.11	4.22

Table 4: Descriptive statistics for Amazon.com, Inc.

Tesla, Inc. :

Tesla, Inc. designs, develops, manufactures, leases, and sells electric vehicles, and energy generation and storage systems in the United States and internationally. The company thus operates in two segments : Automotive, and Energy Generation and Storage. (Yahoo! Finance, 2022)

Investigating a possible relationship between the stock price of Tesla, Inc. through its relative valuation, and its fundamentals is particularly interesting for its more than surprising share price evolution. Indeed, although the company was listed on the stock market in June 2010, its price had a rather steady and slow growth, to say the least, without exuberance whatsoever. It wasn't until 2020 that the market made Tesla, Inc. one of the hottest stocks, multiplying its stock price 10x in the space of just a few months, and making today Tesla, Inc. one of the company with the biggest market capitalization worldwide. For many, Tesla, Inc. is the subject of pure market speculation, going so far as to call it a veritable bubble.

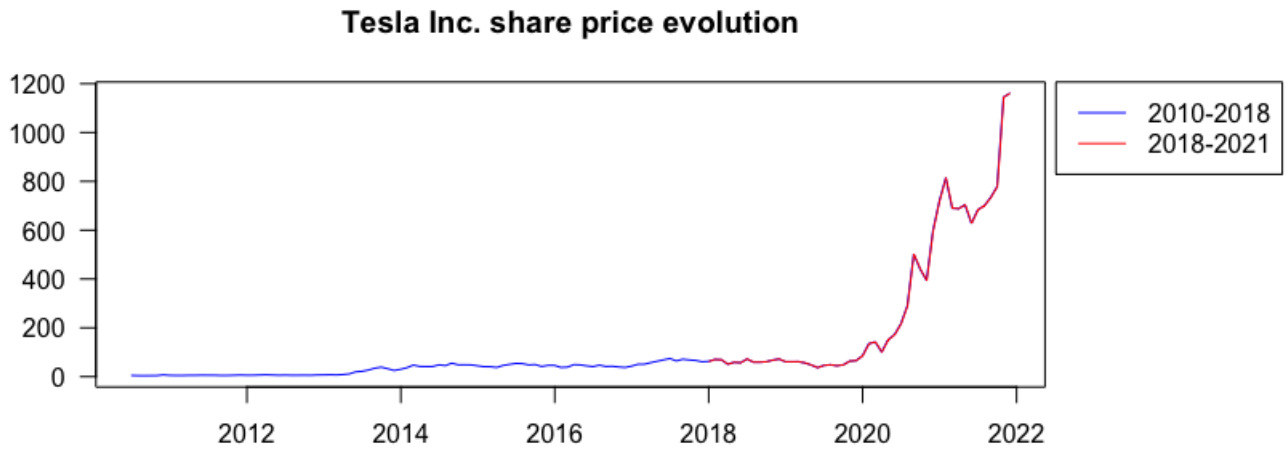

Figure 5: Share price evolution of Tesla, Inc. (2010Q3 - 2021Q4)

	PE	PB	EVE	EVS	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	858.33	17.93	213.24	8.94	19.98	2.77	-0.77	-10.40	0.75	1.32	100.16
Maximum	3314.46	33.61	337.41	21.33	27.35	14.75	9.66	21.06	2.34	2.80	103.95
Minimum	216.48	7.00	143.31	2.04	12.46	-17.51	-10.09	-60.39	-0.54	0.10	87.07
Std. Dev.	1022.74	9.38	63.43	7.09	4.39	9.74	5.33	23.72	0.73	1.11	4.22

Table 5: Descriptive statistics for Tesla, Inc.

AMC Entertainment Holdings, Inc. :

Founded in 1920, AMC Entertainment Holdings, Inc., through its subsidiaries, engages in the theatrical exhibition business. The company owns, operates, or has interests in theatres in the United States and Europe. As of March 1, 2022, it operated approximately 950 theatres and 10,600 screens. (Yahoo! Finance, 2022).

We therefore end with the choice of a stock that is probably even more atypical than the previous one. Indeed, following its introduction in 2014, the company suffered from a slow decline in its share price. Then, in 2021, an astonishing phenomenon occured : taken by storm by a group of online investors determined to revive the entreprise, the latter jumped in the space of a few sessions and saw its price be multiplied by more than 25, before falling again afterwards. In this specific context, it is very unlikely that this evolution was the object of any link with the fundamentals of the company, but rather of the phenomenon of fashion and speculation of which the company was the object. Similarly, as illustrated in the table of descriptive statistics through the Return on Assets (ROA) and Return on Equity (ROE), the company is not profitable, making its rapid development quite difficult to attribute to its financial health through its ratios.

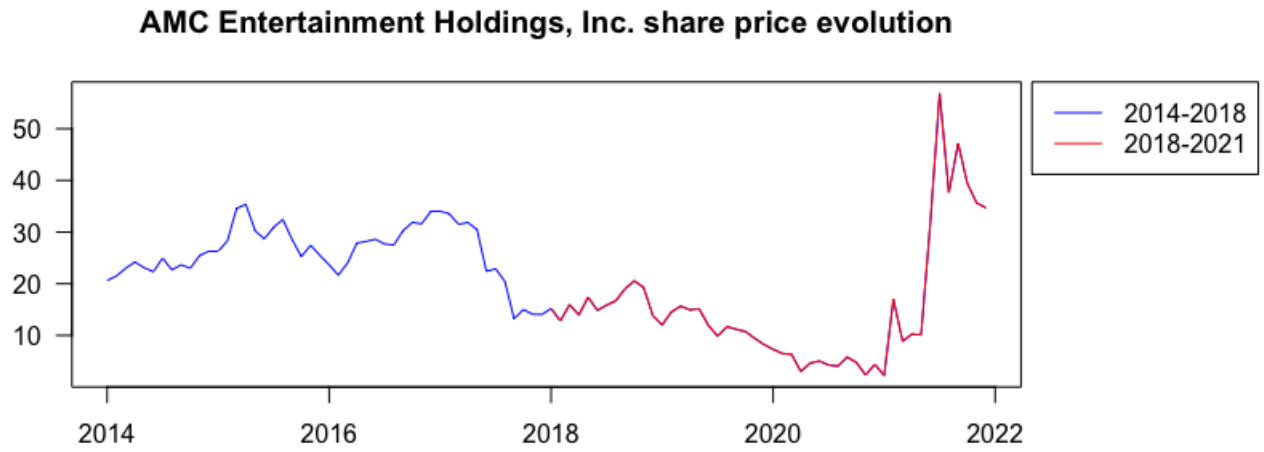

Figure 6: Share price evolution of AMC Entertainment Holdings, Inc. (2014Q1 - 2021Q4)

	PE	PB	EVE	EVS	GRM	OPM	ROA	ROE	INF	INT	IND
Mean	61.06	0.99	25.23	8.57	67.69	-263.76	-12.71	-7.05	0.75	1.32	100.16
Maximum	109.12	1.69	40.99	43.84	78.62	7.94	1.14	6.27	2.34	2.80	103.95
Minimum	9.16	0.62	19.66	1.14	62.32	-2495.24	-38.32	-20.39	-0.54	0.10	87.07
Std. Dev.	44.97	0.33	7.04	12.73	4.89	628.29	12.99	9.96	0.73	1.11	4.22

Table 6: Descriptive statistics for AMC Entertainment Holdings, Inc.

b Variables

As indicated in the methodology, 5 relative valuation ratios were selected for each asset: the Price to Earnings (P/E) ratio, the Price to Book (P/B) ratio, the Enterprise value to EBITDA ratio, the Enterprise value to Sales ratio, and finally the Dividend yield.

Secondly, 4 fundamental indicators were considered: the gross margin, the operating margin, the Return on Assets (ROA) and finally the Return on Equity (ROE).

Finally, 3 additional control variables, which could possibly also have a certain influence on the stock market performance of the considered assets, were added : the inflation rate in the United States in the form of CPI, the short-term interest rate of the period, and finally the growth rate of American industrial production.

For each of these variables listed in the summary table below, the reader will first be provided with a brief description of them, before looking at their evolution during the studied period, both for the indices, but also for the individual stocks.

Variables	Meaning	Source
PE	Price-to-Earnings (P/E) ratio	Bloomberg Terminal
PB	Price-to-Book (P/B) ratio	Bloomberg Terminal
EVE	Entreprise value/EBITDA ratio	Bloomberg Terminal
EVS	Entreprise value/Sales ratio	Bloomberg Terminal
DIV	Dividend yield	Bloomberg Terminal
GRM	Gross margin	Bloomberg Terminal
OPM	Operating margin	Bloomberg Terminal
ROA	Return on Assets	Bloomberg Terminal
ROE	Return on Equity	Bloomberg Terminal
INF	Inflation Rate (CPI)	Federal Reserve Bank of St. Louis
INT	Short-Term interest rate	OECD.org
IND	Growth rate of industrial production	Federal Reserve Bank of St. Louis

Table 7: Variables used and their sources

P/E ratio :

The price-to-earnings ratio is the ratio for valuing a company that measures its current share price relative to its earnings per share. P/E ratios are commonly used by investors and analysts to determine the relative value of a company's shares in an apples-to-apples comparison. (Fernando, 2022)

As for the indices, we can see that the 3 seem for the vast majority of the period quite correlated. The Russell 2000 is, however, the index that stands out the most from the others due to the evolution of its P/E ratio between mid-2019 and mid-2021, even being the subject of some missing values on Bloomberg in the middle of this period, this before returning to a valuation similar to the other two indices. Apart from that, the S&P 500 is, compared to the other two, the index with the lowest ratio during the period studied. Finally, although the Nasdaq Composite was the most valued during two fairly short periods, the Russell 2000 remains overall the most overvalued index over the whole period.

As far as stocks are concerned, the results are much more dispersed. Indeed, Tesla, Inc. has missing values on Bloomberg until 2020, while AMC Entertainment Holdings, Inc. has no data as of 2018 Q4. Only Amazon.com, Inc. has all of its data, where its P/E ratio evolves in a relatively stable manner, mostly between 60 and 100, which remains quite high, however.

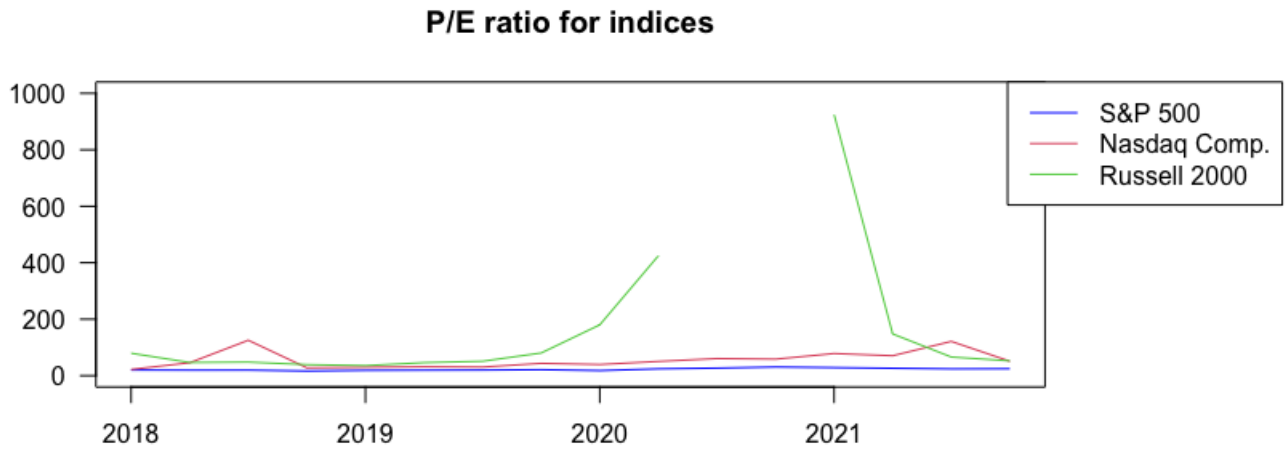

Figure 7: Evolution of the P/E ratio for the 3 indices (2018Q1 - 2021Q4)

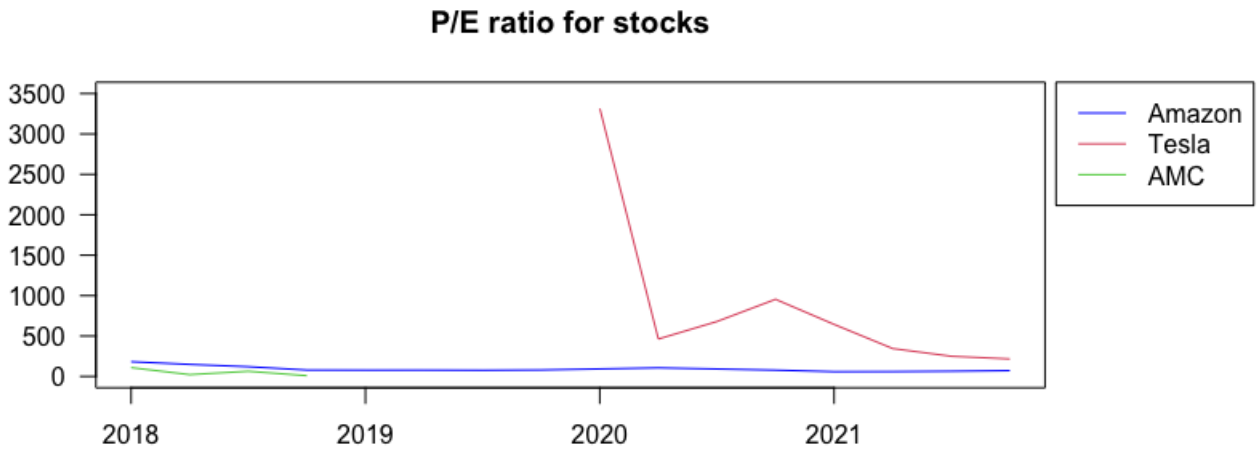

Figure 8: Evolution of the P/E ratio for the 3 stocks (2018Q1 - 2021Q4)

P/B ratio :

The Price to Books (P/B) ratio is used to compare a firm's market capitalization to its book value, that is to say its carrying value on the balance sheet. It is calculated by dividing the company's stock price per share by its book value per share. (Fernando, 2022)

For the indices, the results are much more illustrative than for the P/E ratio. Indeed, the 3 indices see their P/B ratio evolve in a relatively steady and "healthy" way, in a level between 2 and 7. Here, the Russell 2000 is the index with the lowest level on the entire period, while the highest is the Nasdaq Composite.

Now looking at the stocks, we first see that, although having the highest ratio at the start of 2018, Amazon.com, Inc. is gradually seeing its ratio decrease over the period. Tesla, Inc., on the other hand, is in second position at first and is experiencing sustained growth over the period, more particularly from 2020, until reaching a ratio close to 35 at the end of 2021. Finally, AMC Entertainment Holdings, Inc. is once again subject to a missing data issue on Bloomberg, this time after 2019 Q4. Until then, its ratio evolved very little and steadily around 1.

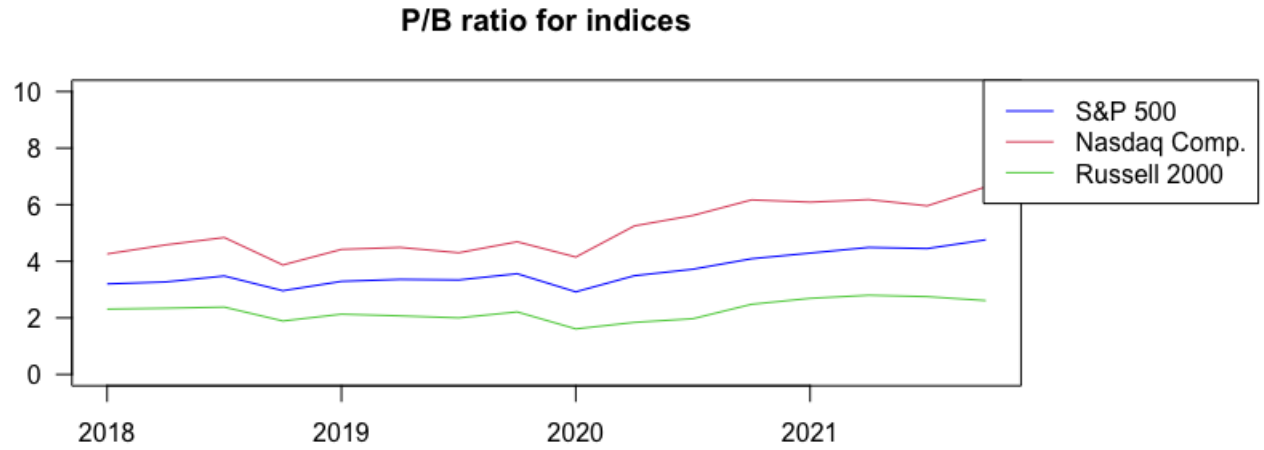

Figure 9: Evolution of the P/B ratio for the 3 stocks (2018Q1 - 2021Q4)

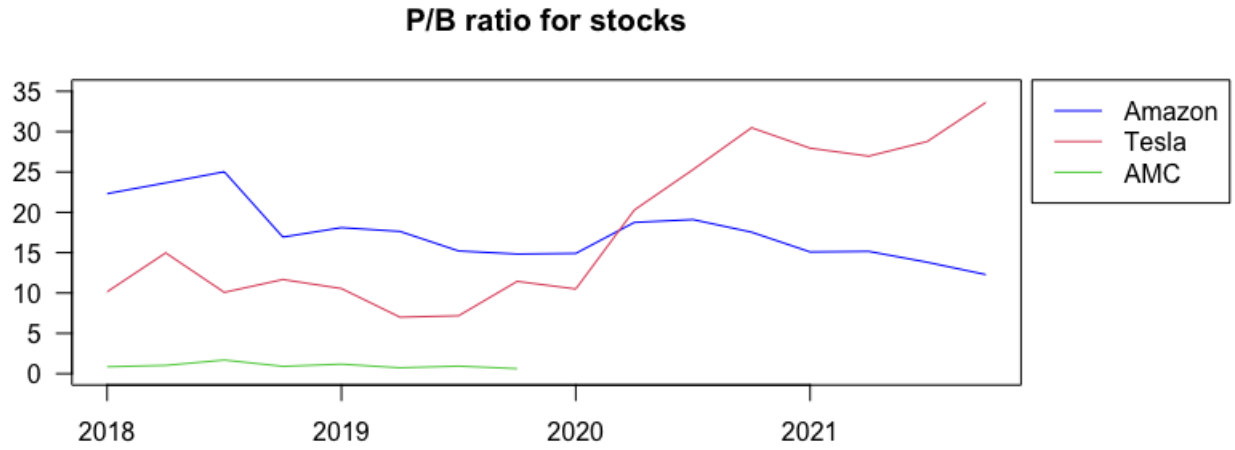

Figure 10: Evolution of the P/B ratio for the 3 stocks (2018Q1 - 2021Q4)

Enterprise value/EBITDA ratio :

The enterprise-value-to-EBITDA ratio is calculated, as its name suggests, by dividing the enterprise value (EV) by EBITDA, or earnings before interest, taxes, depreciation, and amortization.

(Maverick, 2022)

For indices as for stocks, the results and patterns are generally quite similar to those of the P/E ratio above. We therefore find the S&P 500 and Nasdaq Composite indices as the most stable over the whole period, while the Russell 2000 behaved much more surprisingly, posting very high levels at some points before slowly regaining a level similar to the other two indices. As far as stocks are concerned, the characteristics are exactly the same as those established for the P/E ratio, with, however, particularly high levels.

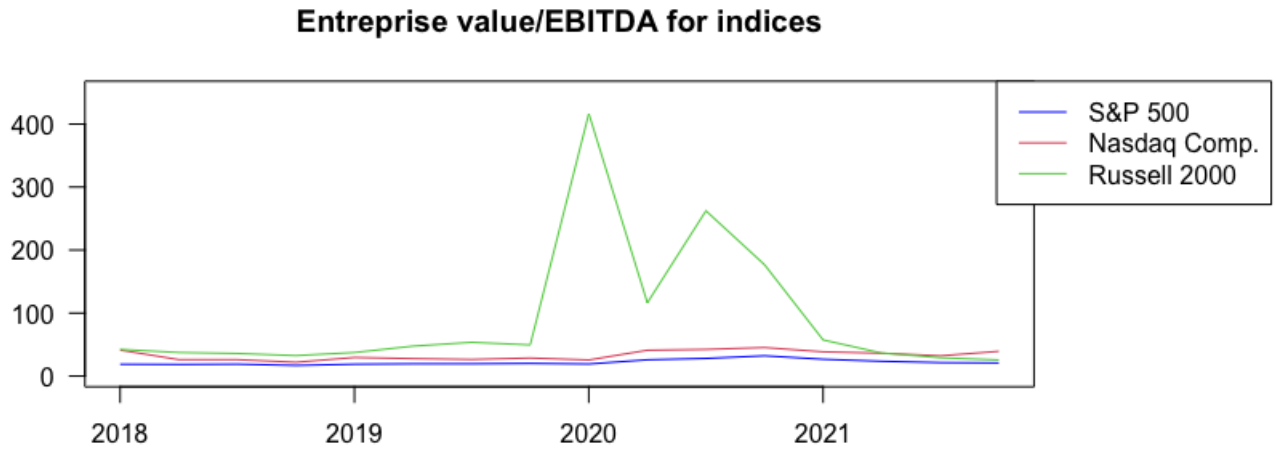

Figure 11: Evolution of the EV/EBITDA for the 3 indices (2018Q1 - 2021Q4)

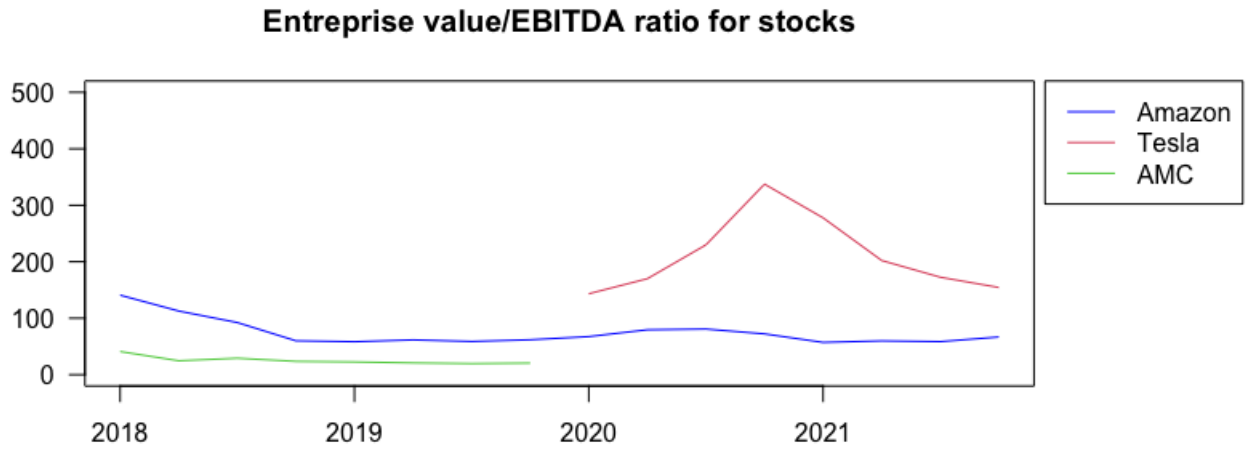

Figure 12: Evolution of the ET/EBITDA for the 3 stocks (2018Q1 - 2021Q4)

Enterprise value/Sales ratio :

Enterprise value-to-sales (EV/Sales) is a financial valuation measure that compares the enterprise value (EV) of a company to its annual sales. The EV/sales multiple gives investors a quantifiable metric of how to value a company based on its sales while taking account of both the company's equity and debt. The ratio is most commonly used to compare companies in the same industry. Finally, one should note that a high EV/EBITDA means that there is a potential the company is overvalued. (Hayes, 2022)

In terms of indices, the results this time are rather similar to those illustrated with the P/B ratios. The Nasdaq Composite therefore appears to be the most overvalued index of the three, while the Russell 2000 stands out as the least overvalued. The three evolutions here are once again stable with a slight healthy growth trend on paper.

For equities, the results are once again quite surprising. Amazon.com, Inc. maintains its role as the most stable value of the three selected entities, evolving at a level of around 5. Tesla, Inc. also follows a fairly stable evolution until 2020, before undergoing very strong growth like this was the case for its share price. Finally, AMC Entertainment Holdings, Inc. also evolves in a stable way at a lower level than the two other companies until mid-2020, before literally exploding upwards until reaching a top value of 43. In this specific case, this disproportionate rise can again witness an overvalued company whose stock market value has nothing more to do with its real intrinsic value. Note however that, although all 3 are American companies, they operate in different industries from each other, so that comparing their ratios in this specific case might not be the most appropriate comparison methodology. However, the fact remains that their evolution and the levels reached by some in such a short time period raise questions as to the healthy nature of these increases.

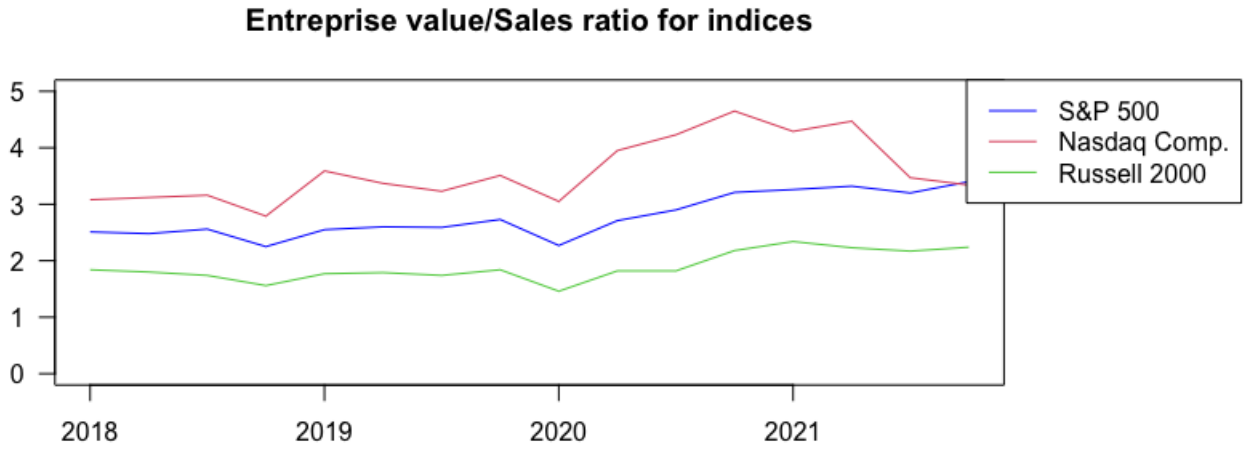

Figure 13: Evolution of the EV/Sales for the 3 indices (2018Q1 - 2021Q4)

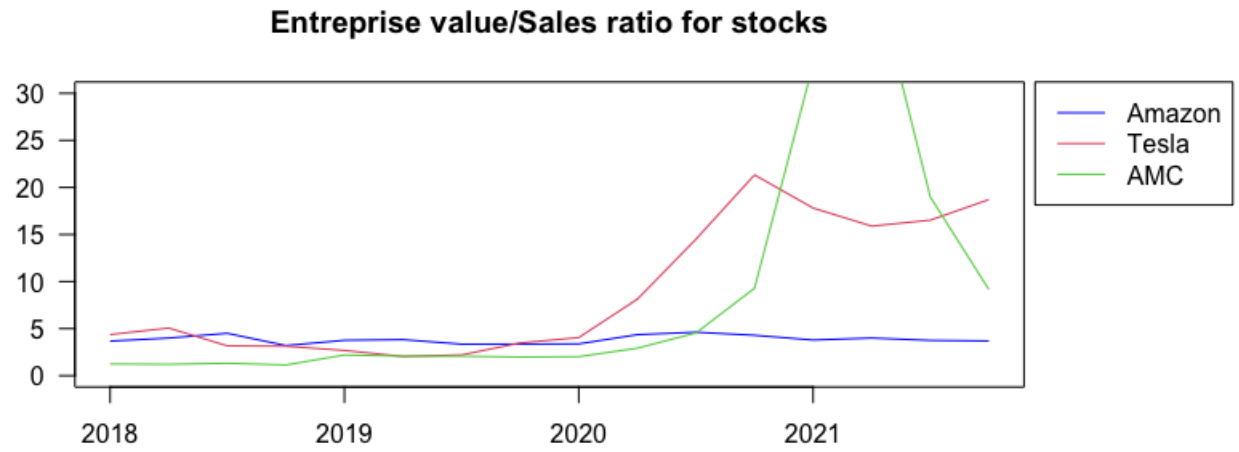

Figure 14: Evolution of the EV/Sales for the 3 stocks (2018Q1 - 2021Q4)

Dividend yield :

The dividend yield, expressed as a percentage, is a financial ratio (dividend/price) that shows how much a company pays out in dividends each year relative to its stock price.

We therefore end with this last relative valuation for which only data for the indices are available, for the simple reason that none of the 3 enterprises selected pay dividends to shareholders. Here, the S&P 500 is the index with the highest dividend yield, followed closely by the Russell 2000 and finally the Nasdaq Composite. Note, however, a slight downward trend for these 3 ratios with a more pronounced drop from 2020, corresponding precisely to the COVID-19 crisis where, inevitably facing numerous disruptions (or even total cessation) of their activities, a large number of companies have chosen to reduce/stop paying a dividend to their shareholders.

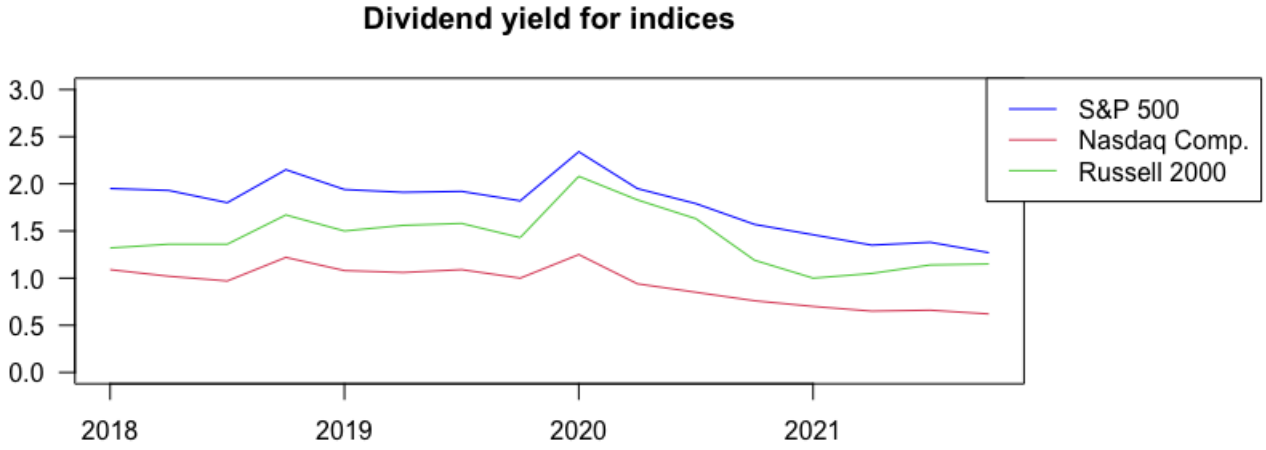

Figure 15: Evolution of the Dividend yield for the 3 indices (2018Q1 - 2021Q4)

Gross margin :

Gross margin is net sales less the cost of goods sold. In other words, it is the amount of money remaining after a company incurred the direct costs associated with producing the goods it sells and the services it provides. The higher the gross margin, the more capital a company retains. (Bloomenthal, 2022)

For indices as well as stocks, we are facing here 6 relatively stable patterns without exuberance. In terms of indices, the Nasdaq Composite is again in the lead, while the Russell 2000 is in third place. At the stock level, gross margins are also relatively stable, with AMC Entertainment Holdings, Inc. having the highest one, while Tesla, Inc. has the lowest. Whether at the level of indices or stocks, these seem highly correlated to each other.

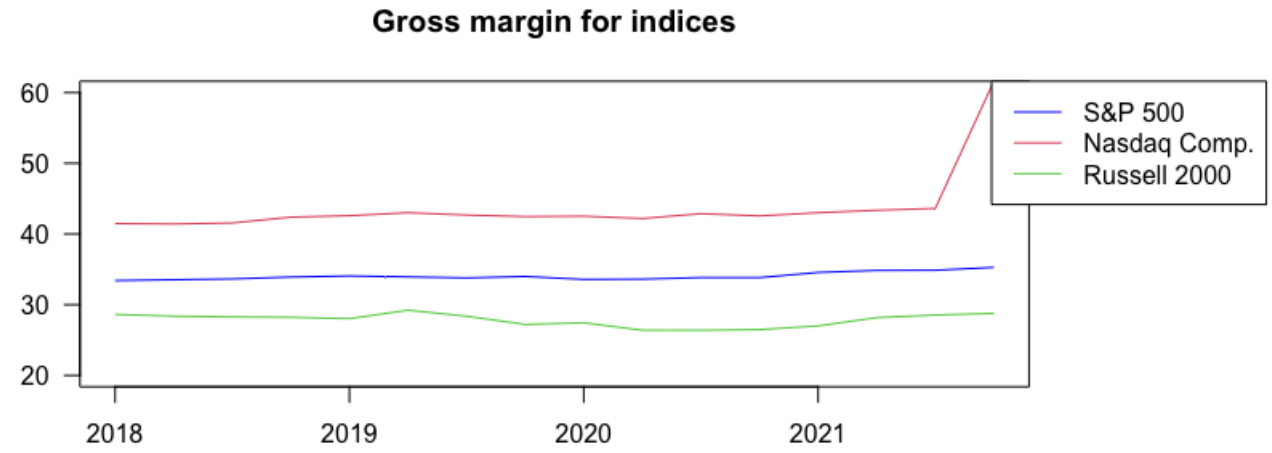

Figure 16: Evolution of the Gross margin for the 3 indices (2018Q1 - 2021Q4)

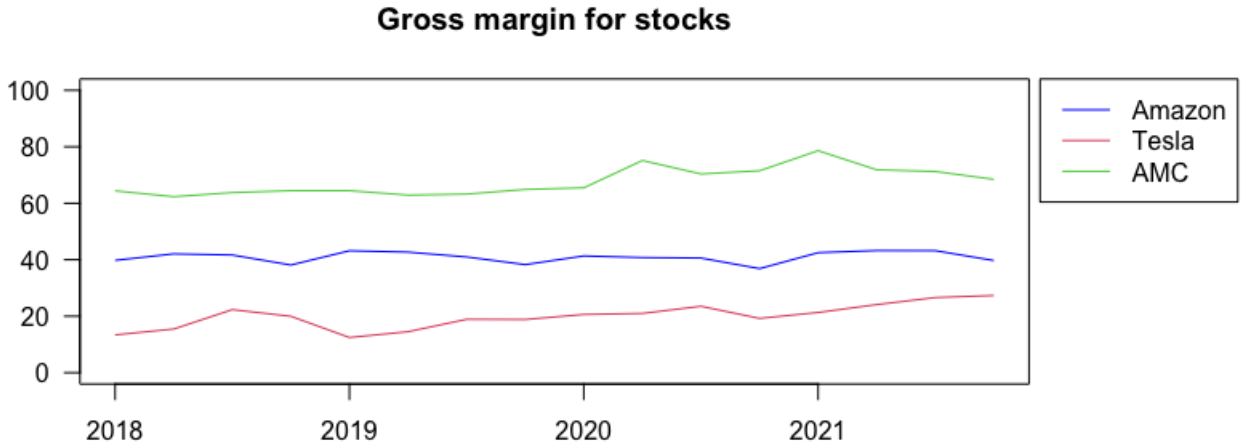

Figure 17: Evolution of the Gross margin for the 3 stocks (2018Q1 - 2021Q4)

Operating margin :

The operating margin measures how much profit a company makes on a dollar of sales after paying for variable costs of production, such as wages and raw materials, but before paying interest or tax. It is calculated by dividing a company's operating income by its net sales. Higher ratios are generally better, illustrating efficiency from the company to operate and turn sales into profits. (Hayes, 2022)

In terms of operating margin, the S&P 500 Index ranks first alongside the Nasdaq Composite Index, which follows very closely before slightly falling at the end of 2021. In any case, both show levels well above that of the Russell 2000, which makes sense insofar as this index includes small companies that cannot generally operate as efficiently as large companies and must reinject their revenues in order to grow.

When it comes to stocks, Amazon.com, Inc. is once again the most stable one. Its operating margin is stable and still slightly positive. Tesla, Inc. is quite negative at the start of 2018, but ends up reaching the level of Amazon.com, Inc. in mid-2019 and even ends up surpassing it during the year 2021. Finally, AMC Entertainment Holdings, Inc. is again illustrated with a graph that is dissident to say the least. Its evolution is much more volatile than the other two stocks and drops steeply in Q4 2019 until it reaches a level of -2495, before finally rising sharply, but still ending below the level of 0.

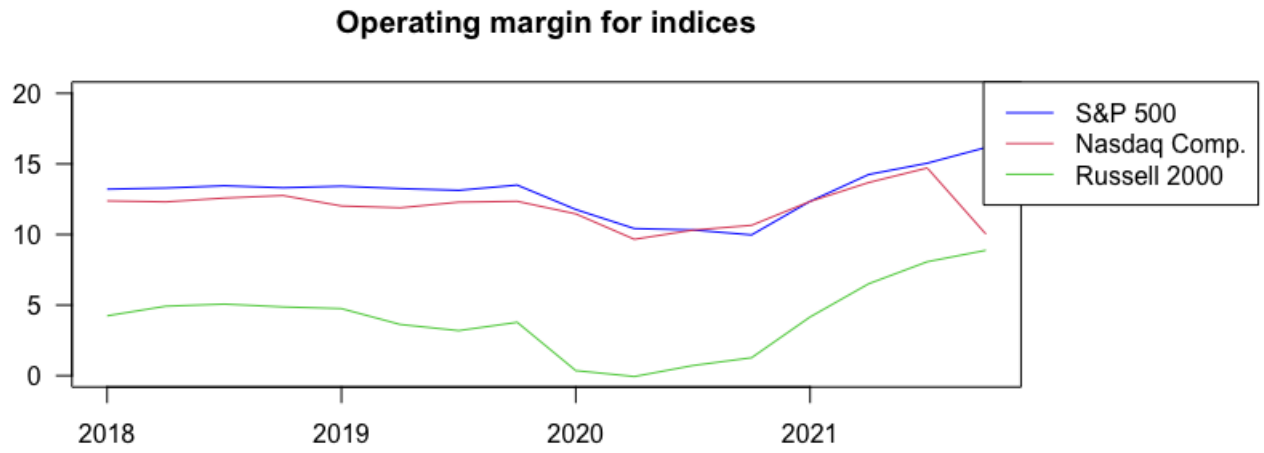

Figure 18: Evolution of the Operating margin for the 3 indices (2018Q1 - 2021Q4)

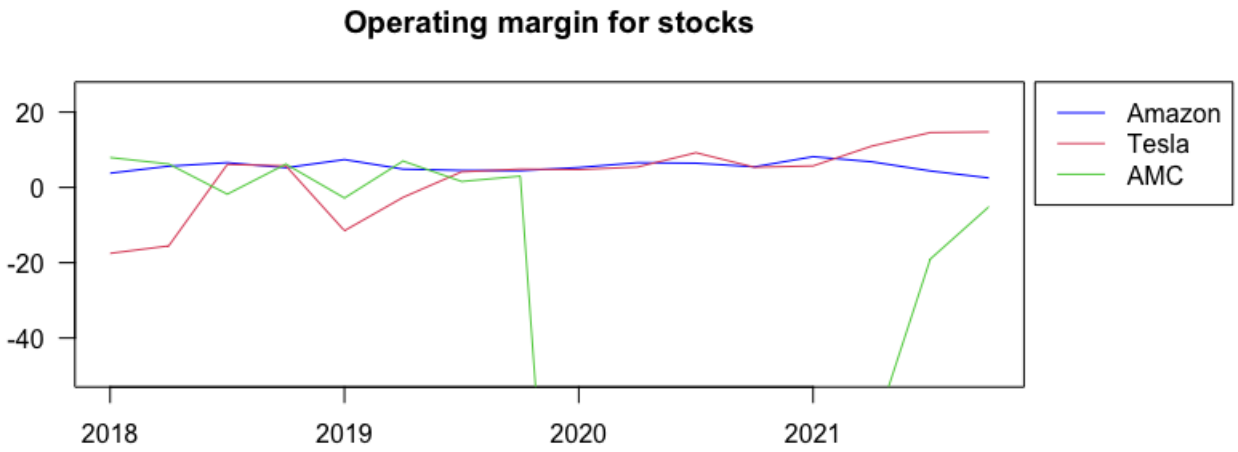

Figure 19: Evolution of the Operating margin for the 3 stocks (2018Q1 - 2021Q4)

Return on Assets :

The return on assets (ROA) is a ratio that indicates how profitable a company is in relation to its total assets. Corporate management, analysts, and investors can use ROA to determine how efficiently a company uses its assets to generate a profit. A higher ROA thus means a company is more efficient and productive at managing its balance sheet to generate profits while a lower ROA indicates there is room for improvement. (Hargrave, 2022)

In this respect, the S&P 500 Index and the Nasdaq Composite Index once again follow each other very closely, the latter this time being the one with the highest ratio over the whole period. The Russell 2000 is once again trading at a lower level than the other two indices, which makes sense considering that small and medium-sized businesses naturally have room for improvement in their profit generation. Despite this, the three indices are clearly correlated with each other.

At the stock level, Amazon.com, Inc., due to its greater experience as a company, occupies the first place with a level remaining almost the same during the period. Second, although Tesla, Inc. starts 2018 with a level of -10, the company is slowly evolving until it reaches at the end of 2021 a level equivalent to that of Amazon.com, Inc. Finally, despite a higher level than Tesla, Inc. at the beginning of 2018 and a relatively stable evolution until Q4 2019, AMC Entertainment Holdings, Inc. ends up crashing until Q3 2020, before rising significantly but unfortunately not enough to reach the level of the other two stocks, and therefore ending with negative ROA.

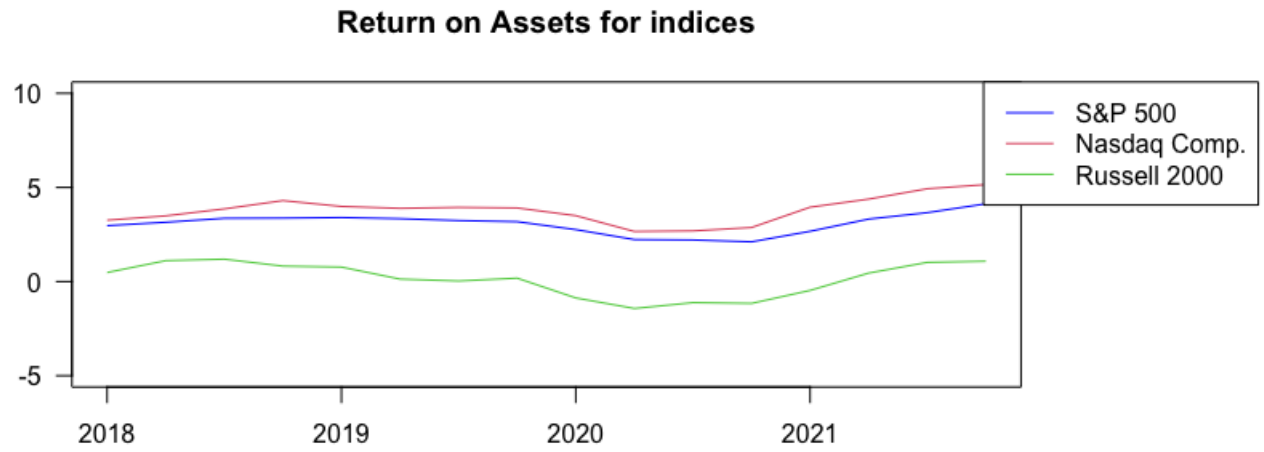

Figure 20: Evolution of the Return on Assets for the 3 indices (2018Q1 - 2021Q4)

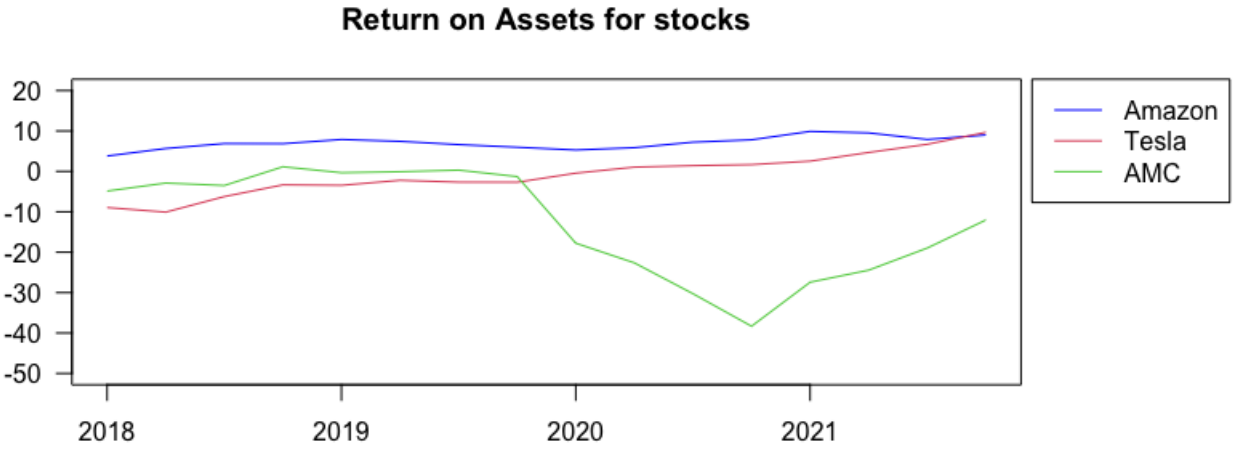

Figure 21: Evolution of the Return on Assets for the 3 stocks (2018Q1 - 2021Q4)

Return on Equity :

Return on equity (ROE) is a measure of financial performance calculated by dividing net income by shareholders' equity. As for the ROA, the ROE is considered a gauge of a corporation's profitability and how efficient it is in generating profits. In this way, the higher the ROE, the more efficient a company is at generating income and growth from its equity financing. (Fernando, 2022)

The conclusions drawn for the ROA of the indices apply again here, the only difference being that, this time, the S&P 500 Index is above the Nasdaq Composite Index. Once again, we find a strong correlation between the three indices.

The same goes for stocks for which the comparison with ROA makes sense, the difference here being a lack of data for AMC Entertainment Holdings, Inc. from Q4 2019. Nevertheless, given the strong evident correlation between the ratios ROA and ROE, we can hypothesize that AMC's ROE must have followed a similar evolution as illustrated for its ROA, namely a dizzying fall followed by a probable rise in Q4 2020.

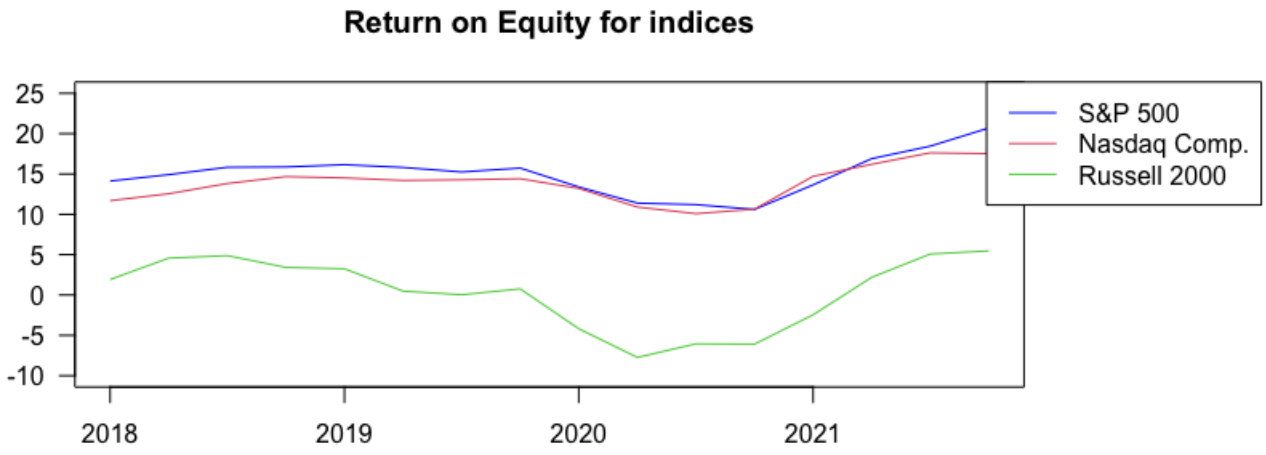

Figure 22: Evolution of the Return on Equity for the 3 indices (2018Q1 - 2021Q4)

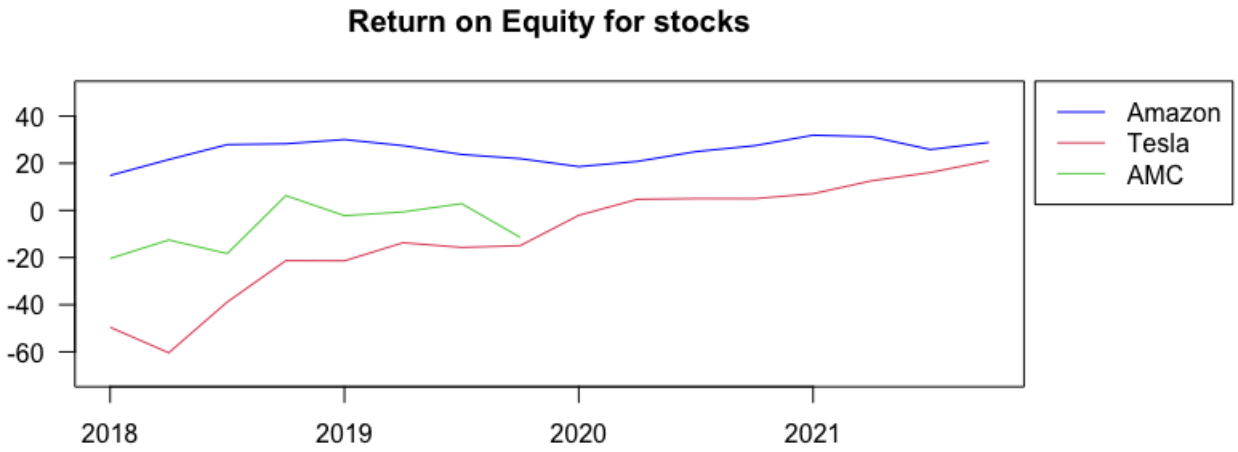

Figure 23: Evolution of the Return on Equity for the 3 stocks (2018Q1 - 2021Q4)

Inflation Rate (CPI) :

The first control variable that will be added to our model is the average growth rate of the American consumer price index, or in other words, inflation in America over the period. Indeed, considering that the level of inflation naturally has a real influence on the global economy, adding it to our model and observing its behavior makes sense. As illustrated in the graph below, the

latter evolves globally in a stable manner and is subject to periods of rise and fall. Note, however, a more significant increase from Q2 2020, following the bottom reached on the stock market.

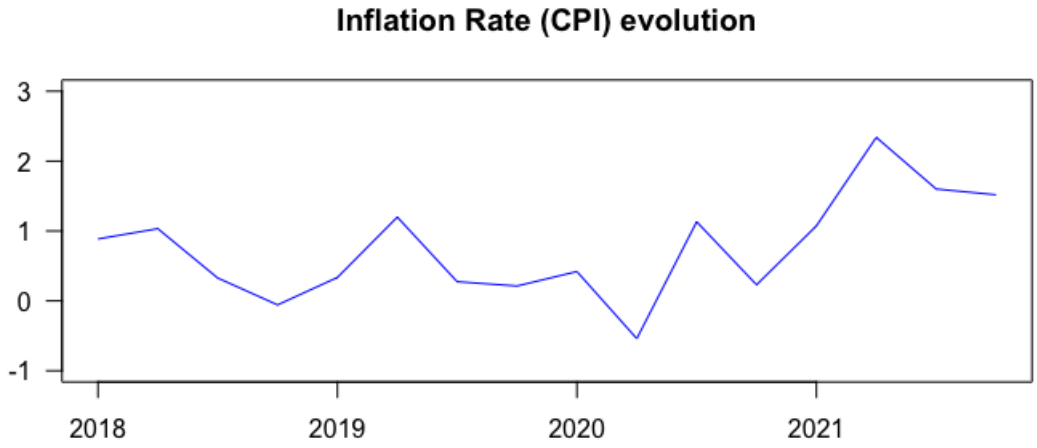

Figure 24: Evolution of the Inflation Rate (CPI) (2018Q1 - 2021Q4)

Short-term Interest Rate :

The second control variable added to our model is the short-term interest rate in America. As illustrated, this was up over the period 2018 Q1 to 2019 Q4, before literally collapsing until Q2 2020, after which it remained stable in the periods that followed. This phenomenon once again echoes the COVID-19 crisis period. In a very summarized way, a low interest rate makes it possible to stimulate the economy, which American society badly needed during the crisis.

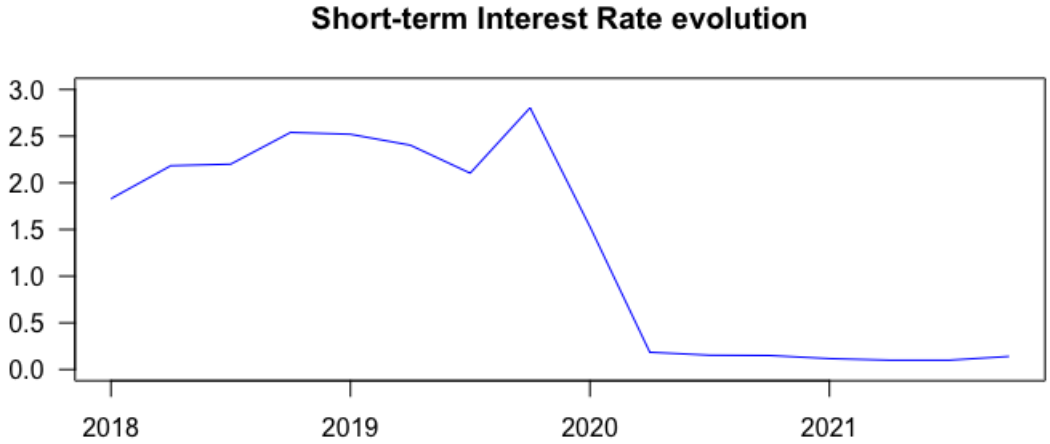

Figure 25: Evolution of the Short-term Interest Rate (2018Q1 - 2021Q4)

Industrial Production :

To finish up this section, the last control variable considered in our methodology is the average growth rate of industrial American production. This latter basically and naturally fell sharply at the beginning of 2020 due to the COVID-19 crisis and the severe lockdown measures, before the major upward trend change that followed, finally reaching at the end of 2021 a level of production almost equivalent to that prior to the sanitary crisis.

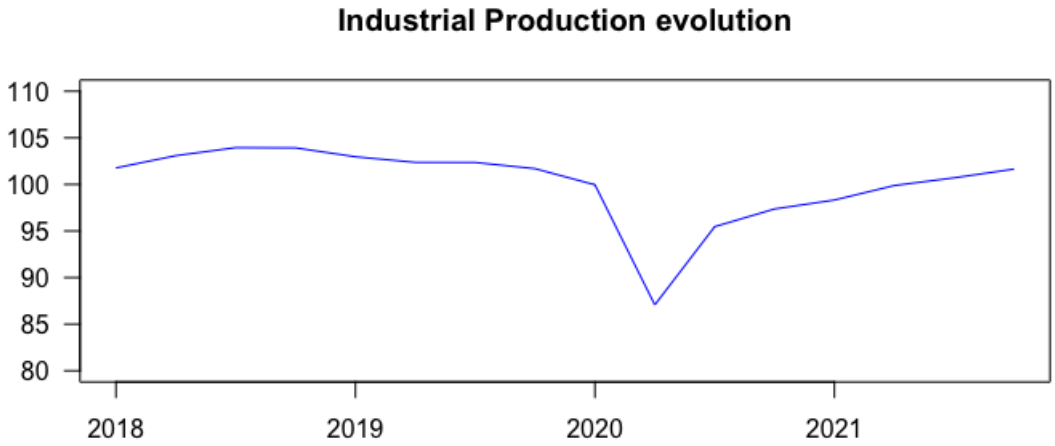

Figure 26: Evolution of the Industrial Production (2018Q1 - 2021Q4)

4 Results and discussions

4.1 Unit root test

First, we perform a Unit Root test based on the Augment Dickey Fuller test on all the variables and for each asset. The objective of this operation here is to determine the most appropriate technique for carrying out our comparative study. According to this, the results obtained testify some divergences within the models : some of them are I(0), while others are I(1). For this same exact reason, the autoregressive distributed lag (ARDL) technique will be used to estimate the different relationships, insofar as it allows a mixture of variables orders, which would not be the case for example for a model employing the classic regression method of OLS (ordinary least squares).

4.2 Correlation matrix

The tables below present the preliminary results of correlation matrices for each of the 6 assets studied. For all the cases, overall, we first notice a strong correlation between the relative valuation variables. This fact could in this specific case be an indicator of a global phenomenon pulling all the relative valuation variables in the same direction.

Secondly, with regard to the fundamental variables, the results illustrate that some are particularly correlated with each other. This is particularly the case for the ROA and the ROE between them as already discussed previously with descriptive statistics, but also the ROA and the ROE with the gross margin and the operating margin. This strong correlation between these variables

therefore forces us to consider different models to carry out our study. Indeed, including all of these variables within the same model could potentially lead to a problem of multicollinearity, as a result of which we would have spurious results. For this same reason, we will establish three different cases for each model: the first one (1) studying the impact of the gross margin and the operating margin on the relative valuation variables; the second one (2) studying the impact of the ROA on the relative valuation variables; and the last one (3) studying this time the impact of the ROE on the relative valuation variables.

Note, however, that some assets have been subject to a voluntary size reduction in terms of the number of variables considered for their study. This is firstly and naturally the case, for example, for the three stocks which do not pay dividends to shareholders and therefore do not have a Dividend yield variable.

In addition to that, some variables of some assets were subject to several missing values during their data collection. In order not to further reduce the already relatively small sample size for our study given the short period studied (2018Q1 to 2021Q4), we have therefore chosen to delete and not consider these variables within the study.

In this way, the P/E ratio of the Russell 2000 index will not be studied through this paper.

This is also the case for the P/E ratio and the Enterprise value/Sales of Tesla, Inc.

Finally, only the Enterprise value/Sales will be studied at the level of the relative valuation variable for AMC Entertainment Holdings, Inc., just as the ROE of the share will not be considered for again reasons of missing values, and therefore a sample too small for the study.

a S&P 500 Index

	PE	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
PE	1											
PB	0.773	1										
EVE	0.929	0.508	1									
EVS	0.864	0.982	0.636	1								
DIV	-0.732	-0.978	-0.449	-0.959	1							
GRM	0.431	0.866	0.133	0.797	-0.831	1						
OPM	-0.321	0.335	-0.634	0.186	-0.392	0.623	1					
ROA	-0.448	0.206	-0.711	0.053	-0.262	0.542	0.972	1				
ROE	-0.301	0.365	-0.596	0.214	-0.403	0.678	0.983	0.982	1			
INF	0.315	0.639	0.040	0.592	-0.656	0.660	0.523	0.403	0.490	1		
INT	-0.856	-0.766	-0.762	-0.801	0.668	-0.528	0.184	0.308	0.148	-0.406	1	
IND	-0.551	-0.170	-0.691	-0.262	0.064	0.085	0.651	0.707	0.609	0.250	0.635	1

Table 8: Correlation matrix for the S&P 500 Index

b Nasdaq Composite Index

	PE	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
PE	1											
PB	0.524	1										
EVE	0.086	0.697	1									
EVS	0.247	0.721	0.728	1								
DIV	-0.583	-0.975	-0.631	-0.671	1							
GRM	-0.008	0.520	0.241	-0.051	-0.470	1						
OPM	0.365	-0.147	-0.469	-0.223	-0.026	-0.354	1					
ROA	0.248	0.210	-0.367	-0.311	-0.309	0.550	0.537	1				
ROE	0.288	0.243	-0.353	-0.233	-0.343	0.497	0.560	0.983	1			
INF	0.296	0.533	0.196	0.239	-0.613	0.339	0.398	0.492	0.503	1		
INT	-0.427	-0.873	-0.772	-0.704	0.808	-0.340	0.236	0.039	-0.010	-0.406	1	
IND	-0.051	-0.369	-0.640	-0.581	0.268	0.0750	0.570	0.586	0.498	0.250	0.635	1

Table 9: Correlation matrix for the Nasdaq Composite Index

c Russell 2000 Index

	PB	EVE	EVS	DIV	GRM	OPM	ROA	ROE	INF	INT	IND
PB	1										
EVE	-0.552	1									
EVS	0.887	-0.359	1								
DIV	-0.976	0.610	-0.877	1							
GRM	0.226	-0.548	-0.071	-0.206	1						
OPM	0.711	-0.709	0.464	-0.674	0.710	1					
ROA	0.420	-0.695	0.033	-0.404	0.820	0.868	1				
ROE	0.440	-0.685	0.064	-0.419	0.835	0.892	0.996	1			
INF	0.680	-0.193	0.588	-0.615	0.416	0.607	0.350	0.389	1		
INT	-0.453	-0.218	-0.714	0.377	0.425	-0.015	0.417	0.392	-0.406	1	
IND	0.187	-0.373	-0.175	-0.228	0.744	0.584	0.792	0.800	0.250	0.635	1

Table 10: Correlation matrix for the Russell 2000 Index

d Amazon.com, Inc.

	PE	PB	EVE	EVS	GRM	OPM	ROA	ROE	INF	INT	IND
PE	1										
PB	0.797	1									
EVE	0.970	0.767	1								
EVS	0.175	0.514	0.281	1							
GRM	-0.117	0.037	-0.130	0.128	1						
OPM	-0.173	0.264	-0.179	0.437	0.409	1					
ROA	-0.793	-0.503	-0.668	0.151	0.298	0.329	1				
ROE	-0.730	-0.305	-0.653	0.145	0.250	0.413	0.929	1			
INF	-0.197	-0.249	-0.038	0.079	0.497	-0.107	0.505	0.327	1 0		
INT	0.325	0.355	0.143	-0.466	-0.070	-0.130	-0.509	-0.240	-0.406	1	
IND	0.061	0.074	0.022	-0.505	0.087	-0.303	0.004	0.167	0.251	0.635	1

Table 11: Correlation matrix for Amazon.com, Inc.

e Tesla, Inc

	PB	EVS	GRM	OPM	ROA	ROE	INF	INT	IND
PB	1								
EVS	0.978	1							
GRM	0.700	0.645	1						
OPM	0.579	0.559	0.912	1					
ROA	0.792	0.767	0.787	0.826	1				
ROE	0.717	0.713	0.714	0.826	0.966	1			
INF	0.466	0.481	0.357	0.190	0.416	0.285	1		
INT	-0.907	-0.906	-0.686	-0.575	-0.772	-0.755	-0.406	1	
IND	-0.410	-0.372	-0.248	-0.266	-0.348	-0.471	0.250	0.635	1

Table 12: Correlation matrix for Tesla, Inc.

f AMC Entertainment Holdings, Inc.

	EVS	GRM	OPM	ROA	INF	INT	IND
EVS	1						
GRM	0.677	1					
OPM	0.062	-0.553	1 6				
ROA	-0.532	-0.828	0.462	1			
INF	0.670	0.169	0.460	-0.213	1		
INT	-0.622	-0.862	0.439	0.889	-0.406	1	
IND	-0.126	-0.711	0.946	0.669	0.251	0.635	1

Table 13: Correlation matrix for AMC Entertainment Holdings, Inc.

4.3 Granger causality test

This step now consists in carrying out a Granger causality test, in order to identify on the one hand the direction of causality between the relative valuation variables and the fundamental ones, and on the other hand the possible problems of reversed causalities between these same variables. Put differently, this procedure will give us a first insight on which variables might have a future predictive power over the others. For each of the tests carried out, the criterion chosen for the selection of the optimal lag length was the Akaike information criterion, for the reason that beyond being one of the most commonly used criterion to judge the quality of a statistical model, the latter could also be considered as the most efficient one for small sample (Khim-Sen Liew, 2004).

Tables 14 to 18 present the results of the Granger causality tests between the fundamental variables and the relative valuation ones for the S&P 500 Index.

The results globally illustrate an absence of Granger causality relationship between the variables, which can testify in the case of the fundamental variables that the latter do not affect the relative valuation variables in an individual way if such is the case, but potentially in addition of other control variables. However, we note three cases of unidirectional causal relationship: the P/B ratio towards the Return on Assets (ROA), the Enterprise value/Equity (EVE) towards the Return on Assets (ROA) and finally the dividend yield (DIV) towards the Return on Assets (ROA). Indeed, for each of these 3 cases, we reject at the 5% level of significance the null hypothesis that the relative valuation variables do not Granger cause this single and same fundamental variable.

As for the Nasdaq Composite Index, the results detect a unidirectional causal relationship, since we reject at the 5% level of significance the null hypothesis that the dividend yield (DIV) does not Granger cause, again , the Return on Assets (ROA). This case is the only one for the Nasdaq Composite Index, which could mean, as for the S&P 500 Index, that the fundamentals that have a real impact on the relative valuation have this same impact in combination with other control variables.

For the last index, the Russell 2000, several cases of unidirectional causal relationships are detected: the gross margin (GRM) to the P/B ratio; the gross margin (GRM) to the Enterprise value/EBITDA (EVE); the Enterprise value/EBITDA (EVE) to the operating margin (OPM); and finally the Enterprise value/EBITDA (EVE) to the Return on Assets (ROA), given that we always reject the null hypothesis at the 5% level of significance.

Regarding the stocks, the results of the first case with Amazon.com, Inc. detect 5 different cases of unidirectional causal relationships: the P/E ratio to the gross margin (GRM); the Return on Assets (ROA) to the P/B ratio; the Return on Equity (ROE) to the P/B ratio, again; the Enterprise/Sales to Return on Equity (ROE); and finally the P/B ratio on the gross margin (GRM). In the case of the first four unidirectional causal relationships, we reject the null hypothesis at the 5% level of significance, while we reject it at the 1% level in the case of the P/B ratio to the gross margin (GRM).

Tesla, Inc. is the only of the six assets presenting no causal relationship case whatsoever. Again, however, the absence of Granger causality relationship between the variables can testify in the case of the fundamental variables that the latter do not affect the two relative valuation variables of Tesla, Inc. in an individual way, if such is the case, but potentially in combination with one or several of the three other control variables considered.

Finally, for AMC Entertainment Holdings, Inc., results of the Granger causality test for the relationship between ROA and Enterprise value/Sales (EVS) presented in Table 9 is the only case detected of a bidirectional causal relationship since the null hypothesis of the absence of Granger causality between the variables was rejected at least at the 5% level of significance for both (5% level of significance for ROA to EVS and 1% level of significance for EVS to ROA). As a result, this indicates the presence of reverse causality between the two variables. In addition to that, we also find a unidirectional causal relationship running from the gross margin (GRM) to the only relative valuation variable considered (here, the Enterprise value/Sales) with the null hypothesis of no Granger causality between the two being rejected at the 5% level of significance, which is the same case with the operating margin (OPM), but this time at the 1% level of significance.

In addition to those results, one should note however that it might be the case for some of the variables for which the results present no evidence of Granger causality that the latter are not be cointegrated, which could thus leads to spurious results.

It is for this same reason that adding the three control variables within our models makes sense, since its allows all the variables to be correctly cointegrated. Indeed, by doing so, we ensure that the three variables added either Granger-cause or are Granger-caused by at least one of the variables of the entire model considered.

Notes: For all the results shown below, **, * and . indicate 1%, 5% and 10% significant levels, respectively.

a S&P 500 Index

	H_0: Fundamentals do not Granger cause the Price-to-Earnings ratio				H_0: The Price-to-Earnings ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PE	2.4887	0.2399	2	PE to GRM	4.2144	0.1335
2	OPM to PE	3.1404	0.1871	2	PE to OPM	1.6318	0.3583
2	ROA to PE	1.9478	0.3053	2	PE to ROA	5.5907	0.09448 .
2	ROE to PE	3.2971	0.1773	2	PE to ROE	3.0259	0.1949

Table 14: Granger causality test for the Price-to-Earnings ratio (S&P 500 Index)

	H_0: Fundamentals do not Granger cause the Price-to-Book ratio				H_0: The Price-to-Book ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PB	0.7543	0.6168	2	PB to GRM	6.9098	0.0721 .
2	OPM to PB	1.1992	0.4589	2	PB to OPM	1.7938	0.3294
2	ROA to PB	1.1299	0.4792	2	PB to ROA	16.067	0.02291 *
2	ROE to PB	1.563	0.3718	2	PB to ROE	6.1566	0.08363 .

Table 15: Granger causality test for the Price-to-Book ratio (S&P 500 Index)

	H_0: Fundamentals do not Granger cause the EV/EBITDA ratio				H_0: The EV/EBITDA ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVE	3.3055	0.1768	2	EVE to GRM	3.3528	0.174
2	OPM to EVE	6.9527	0.07152 .	2	EVE to OPM	3.3829	0.1722
2	ROA to EVE	2.9777	0.1984	2	EVE to ROA	5.075	0.1066
2	ROE to EVE	4.4692	0.1244	2	EVE to ROE	3.5315	0.164

Table 16: Granger causality test for the EV/EBITDA ratio (S&P 500 Index)

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVE	0.7872	0.6026	2	EVE to GRM	4.4347	0.1256
2	OPM to EVE	1.3864	0.4105	2	EVE to OPM	3.1502	0.1865
2	ROA to EVE	1.3022	0.4312	2	EVE to ROA	13.461	0.02935 *
2	ROE to EVE	1.7162	0.3428	2	EVE to ROE	7.8853	0.06066 .

Table 17: Granger causality test for the EV/Sales ratio (S&P 500 Index)

	H_0: Fundamentals do not Granger cause the Dividend yield				H_0: The Dividend yield do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to DIV	0.3702	0.8194	2	DIV to GRM	3.437	0.1692
2	OPM to DIV	1.5254	0.3795	2	DIV to OPM	2.5651	0.2325
2	ROA to DIV	1.3877	0.4102	2	DIV to ROA	11.67	0.03576 *
2	ROE to DIV	1.8341	0.3228	2	DIV to ROE	6.3096	0.08105 .

Table 18: Granger causality test for the Dividend yield (S&P 500 Index)

b Nasdaq Composite Index

	H_0: Fundamentals do not Granger cause the Price-to-Earnings ratio				H_0: The Price-to-Earnings ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PE	1.0292	0.5112	2	PE to GRM	3.2626	0.08599 .
2	OPM to PE	0.9909	0.5242	2	PE to OPM	1.676	0.35
2	ROA to PE	4.0041	0.1418	2	PE to ROA	2.3114	0.2586
2	ROE to PE	13.734	0.02854 *	2	PE to ROE	0.5512	0.7157

Table 19: Granger causality test for the Price-to-Earnings ratio (Nasdaq Composite Index)

	H_0: Fundamentals do not Granger cause the Price-to-Book ratio				H_0: The Price-to-Book ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PB	0.344	0.7179	2	PB to GRM	0.3407	0.7201
2	OPM to PB	3.5299	0.07384 .	2	PB to OPM	0.6552	0.6627
2	ROA to PB	4.0196	0.05657 .	2	PB to ROA	5.1931	0.1036
2	ROE to PB	3.1656	0.09099 .	2	PB to ROE	2.1041	0.2837

Table 20: Granger causality test for the Price-to-Book ratio (Nasdaq Composite Index)

	H_0: Fundamentals do not Granger cause the EV/EBITDA ratio				H_0: The EV/EBITDA ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVE	0.1703	0.9126	2	EVE to GRM	0.2687	0.7703
2	OPM to EVE	2.1238	0.1985	2	EVE to OPM	0.5188	0.7332
2	ROA to EVE	0.6127	0.6313	2	EVE to ROA	1.7921	0.3297
2	ROE to EVE	0.9154	0.4878	2	EVE to ROE	0.6624	0.6592

Table 21: Granger causality test for the EV/EBITDA ratio (Nasdaq Composite Index)

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVS	0.8426	0.5796	2	EVS to GRM	1.6361	0.2477
2	OPM to EVS	2.5687	0.2322	2	EVS to OPM	1.8387	0.3221
2	ROA to EVS	5.0177	0.1081	2	EVS to ROA	3.0734	0.1916
2	ROE to EVS	3.0579	0.1927	2	EVS to ROE	2.3685	0.2523

Table 22: Granger causality test for the EV/Sales ratio (Nasdaq Composite Index)

	H_0: Fundamentals do not Granger cause the Dividend yield				H_0: The Dividend yield do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to DIV	0.3546	0.7108	2	DIV to GRM	0.6547	0.5427
2	OPM to DIV	3.5231	0.07411 .	2	DIV to OPM	0.9794	0.5282
2	ROA to DIV	2.5636	0.1315	2	DIV to ROA	12.064	0.03416 *
2	ROE to DIV	1.6953	0.2372	2	DIV to ROE	4.3018	0.1303

Table 23: Granger causality test for the Dividend yield (Nasdaq Composite Index)

c Russell 2000 Index

	H_0: Fundamentals do not Granger cause the Price-to-Book ratio				H_0: The Price-to-Book ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PB	7.8024	0.01709 *	2	PB to GRM	1.2089	0.4562
2	OPM to PB	1.1778	0.3938	2	PB to OPM	0.1399	0.9562
2	ROA to PB	1.3808	0.3361	2	PB to ROA	0.5089	0.7387
2	ROE to PB	1.603	0.2847	2	PB to ROE	0.4404	0.7776

Table 24: Granger causality test for the Price-to-Book ratio (Russell 2000 Index)

	H_0: Fundamentals do not Granger cause the EV/EBITDA ratio				H_0: The EV/EBITDA ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVE	11.533	0.03634 *	2	EVE to GRM	2.5095	0.2378
2	OPM to EVE	6.8021	0.07358 .	2	EVE to OPM	10.672	0.04041 *
2	ROA to EVE	3.6352	0.1587	2	EVE to ROA	6.8071	0.07351 .
2	ROE to EVE	4.8673	0.1122	2	EVE to ROE	15.719	0.02363 *

Table 25: Granger causality test for the EV/EBITDA ratio (Russell 2000 Index)

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVS	1.2864	0.2789	2	EVS to GRM	0.6592	0.6607
2	OPM to EVS	1.8818	0.1952	2	EVS to OPM	0.2725	0.8793
2	ROA to EVS	3.3546	0.09194 .	2	EVS to ROA	1.074	0.4966
2	ROE to EVS	3.1581	0.1009	2	EVS to ROE	0.9021	0.5564

Table 26: Granger causality test for the EV/Sales ratio (Russell 2000 Index)

	H_0: Fundamentals do not Granger cause the Dividend yield				H_0: The Dividend yield do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to DIV	9.0201	0.05072 .	2	DIV to GRM	2.9626	0.1995
2	OPM to DIV	1.0103	0.5175	2	DIV to OPM	0.32	0.8501
2	ROA to DIV	0.53	0.7271	2	DIV to ROA	0.4902	0.7491
2	ROE to DIV	0.4599	0.7663	2	DIV to ROE	0.4819	0.7538

Table 27: Granger causality test for the Dividend yield (Russell 2000 Index)

d Amazon.com, Inc.

	H_0: Fundamentals do not Granger cause the Price-to-Earnings ratio				H_0: The Price-to-Earnings ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PE	0.2889	0.7558	2	PE to GRM	12.184	0.03369 *
2	OPM to PE	3.1664	0.09095 .	2	PE to OPM	1.0825	0.3186
2	ROA to PE	2.4393	0.1424	2	PE to ROA	0.8084	0.5937
2	ROE to PE	3.6427	0.06934 .	2	PE to ROE	2.5379	0.2351

Table 28: Granger causality test for the Price-to-Earnings ratio (Amazon.com, Inc.)

	H_0: Fundamentals do not Granger cause the Price-to-Book ratio				H_0: The Price-to-Book ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PB	0.2152	0.651	2	PB to GRM	48.143	0.004706 **
2	OPM to PB	0.522	0.4839	2	PB to OPM	0.5559	0.4703
2	ROA to PB	7.4444	0.01832 *	2	PB to ROA	1.7414	0.3383
2	ROE to PB	8.293	0.01384 *	2	PB to ROE	2.3116	0.2586

Table 29: Granger causality test for the Price-to-Book ratio (Amazon.com, Inc.)

	H_0: Fundamentals do not Granger cause the EV/EBITDA ratio				H_0: The EV/EBITDA ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVE	0.7106	0.5802	2	EVE to GRM	7.713	0.06245 .
2	OPM to EVE	1.2149	0.3823	2	EVE to OPM	0.9382	0.3519
2	ROA to EVE	2.2568	0.1822	2	EVE to ROA	1.7327	0.3399
2	ROE to EVE	2.8646	0.1262	2	EVE to ROE	3.1195	0.1885

Table 30: Granger causality test for the EV/EBITDA ratio (Amazon.com, Inc.)

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVS	1.687	0.2387	2	EVS to GRM	5.3973	0.09874 .
2	OPM to EVS	0.9027	0.4392	2	EVS to OPM	0.0168	0.8991
2	ROA to EVS	1.0665	0.384	2	EVS to ROA	6.5141	0.0778 .
2	ROE to EVS	1.7511	0.2279	2	EVS to ROE	13.796	0.02836 *

Table 31: Granger causality test for the EV/Sales ratio (Amazon.com, Inc.)

e Tesla, Inc.

	H_0: Fundamentals do not Granger cause the Price-to-Book ratio				H_0: The Price-to-Book ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to PB	0.9142	0.5518	2	PB to GRM	2.8081	0.1196
2	OPM to PB	0.5956	0.6924	2	PB to OPM	1.9846	0.1843
2	ROA to PB	2.5604	0.233	2	PB to ROA	1.7327	0.3399
2	ROE to PB	2.6323	0.2263	2	PB to ROE	0.7289	0.6281

Table 32: Granger causality test for the Price-to-Book ratio (Tesla, Inc.)

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVS	4.4325	0.057 .	2	EVS to GRM	2.3433	0.1518
2	OPM to EVS	2.5583	0.1357	2	EVS to OPM	1.5162	0.2418
2	ROA to EVS	3.7001	0.07845 .	2	EVS to ROA	0.5109	0.7376
2	ROE to EVS	4.6296	0.05249 .	2	EVS to ROE	0.1321	0.9601

Table 33: Granger causality test for the EV/Sales ratio (Tesla, Inc.)

f AMC Entertainment Holdings, Inc.

	H_0: Fundamentals do not Granger cause the EV/Sales ratio				H_0: The EV/Sales ratio do not Granger cause fundamentals		
Lag		F	Pr(>F)	Lag		F	Pr(>F)
2	GRM to EVS	21.476	0.01518 *	2	EVS to GRM	0.6943	0.644
2	OPM to EVS	714.48	8.484e-05 ***	2	EVS to OPM	0.4707	0.7602
2	ROA to EVS	9.6496	0.04632 *	2	EVS to ROA	29.919	0.00942 **

Table 34: Granger causality test for the EV/Sales ratio (AMC)

4.4 Overall results of the effect of fundamentals on relative valuation

The correlation step allowed us to observe that certain fundamental variables were highly correlated with each other, both at the level of the indices and at the level of individual stocks. This is notably the case for the Return on Asset (ROA) and the Return on Equity (ROE) which are globally the most correlated variables across all models. Among the cases of strong correlations, we also note the ROA with the gross margin and the operating margin, as well as the ROE with these same two variables.

For this reason, in order to avoid obtaining spurious results due to these strong correlations, we choose to include these 3 groups of variables individually within our ARDL models as follows :

- (1) denotes ARDL models where only the variables gross margin (GRM) and the operating margin (OPM) are considered as fundamental variables
- (2) denotes ARDL models where only the variable Return on Asset (ROA) is considered as fundamental variable
- (3) denotes ARDL models where only the variable Return on Equity (ROE) is considered as fundamental variable

We therefore follow Agudze and Ibhagui's methodology once again, as well as we add within each model the three macroeconomic control variables, which also have the role of encouraging cases of cointegration between variables.

The overall results are presented in the tables below.

Let us begin with Tables 35 to 39 which reveal the empirical results for each of the 5 relative valuation models for the S&P 500 index. Our first finding is that, for all the models except the case of the Return on Asset (ROA) ratio over the P/B ratio, each of the lagged values of the relative valuation variables are statistically significant at the 5% level at their first lag. In addition, our results also reveal that, considering the exact same exception as stated above, all relative valuation measures have a negative short-run relationship with its value in previous quarter. In an intuitive way, this could be explained by considering that assets with relative valuation measures considered by the investors as overvalued may latter suffer from disinterest or even fear, and thus, experience correction which would lower their value. The opposite scenario could also held in the case of equities seen as undervalued and which would later face more interest from the investors, thus seeing their relative valuation be higher than in the past.

Regarding the effect of fundamentals on relative valuation, the results seem to show that they do have an impact, mostly significant at the 5% level, but at different lag levels. The three macroeconomic control variables also exert some effect within the models, but mostly for those in cases 1 and 2, i.e. less so for the models where only the Return on Equity (ROE) is considered.

Finally, it is also very important to note that these same results described hold almost exclusively for the short term. Indeed, at the 5% level of significance, we fail to reject the null hypothesis of absence of long-run relationship as the estimated test statistic (F-calc.) is below the lower bound of the F-critical value, in 14 out of the 15 cases. In this particular case, we can therefore conclude that the fundamentals variables are only useful in predicting relative asset valuations over a very short time horizon, which is therefore consistent with Gupta's (2018) finding

that the two dimensions are only related in the short-run. Thus, the only case where we reject the hypothesis of no long-run relationship occurs for the Dividend yield (DIV) based model, this, for the 3 different cases (GRM + OPM; ROA; ROE). A potential explanation for this phenomenon would be to consider that the decision to pay a dividend to shareholders, as well as the amount of the dividend, is a long-term strategic choice that is not very versatile for companies.

Let us now turn to the interpretation of the results for the other two indices, namely the Nasdaq Composite Index (Tables 36-44) and the Russell 2000 (Tables 45-48). In summary, the results seem to be largely in line with those of the S&P 500 index, with a few differences. Thus, we again find the relative valuation measures that have a negative short-run relationship with its value in previous quarter, but this time, without the slightest exception as was the case for the S&P 500 Index.

We also find the overall significant effect at different levels of lags of the fundamentals on the different relative valuation measures. On the other hand, for these two indices, we count many more cases where we reject the null hypothesis of no long-term effect than in the case of the S&P 500 Index, where this was the case only for the Dividend yield. In other words, the results surprisingly seem to show both a short-run and a long-run relationship between the two dimensions over the period studied. In the case of the Nasdaq Composite Index, this occurs 5 times: for the P/E, EV/EBITDA and EV/EVS ratios (case 1 only); and for the P/B and Dividend yield ratios (cases 2 and 3). For the Russell 2000 Index, this occurs 4 times out of 12 possible cases: for the P/B ratio (cases 1, 2 and 3); for the EV/EBITDA ratio (case 1 only); for the EV/Sales ratio (cases 2 and 3); and finally for the Dividend yield (cases 1, 2 and 3).

In total, therefore, at the index level, only 10 cases out of 42 (i.e. about 24%) show a significant long-term relationship between fundamentals and relative valuation for the period studied.

Finally, the results are less convincing in this regard for individual stocks. Indeed, although Amazon.com, Inc. and Tesla, Inc. show some significant relationships at the 5% level between their fundamentals and relative valuations measures, these same relationships are once again mostly of the short-term rather than the long-term order. We find 3 cases out of 12 where the null hypothesis is rejected for Amazon.com, Inc., 1 case out of 6 for Tesla, Inc., and finally no case for AMC Entertainment Holdings, Inc. for which very few additional and relevant conclusions can be drawn, notably because of the few variables considered in the model given the missing data. In total, therefore, we have 4 cases out of 20 where we can consider that the relationship between fundamentals and the relative valuation of companies is both a short and a long term phenomenon, which reduces the probability to 20%, even less than in the case of the indices. These results are actually not surprising insofar as, with a much larger number of stocks in their respective baskets, the indices naturally include more stocks that have probably not exploded as much as the 3 individual stocks selected for this purpose, making the whole "way healthier" and thus the relationship between the two dimensions less short-termed inclined.

Notes: For all the results shown below, **, * and . indicate 1%, 5% and 10% significant levels, respectively.

a S&P 500 Index

	(1)	(2)	(3)
C	838.295	53.3743	85.51684
lag (-1)	-4.786 *	-0.3627 *	-0.27275 *
GRM	-132.201		
GRM (-1)	27.009 *		
GRM (-2)	61.966 .		
OPM	22.475		
OPM (-1)	-4.278		
OPM (-2)	-17.328		
ROA		0.3673	
ROA (-1)		-11.9330	
ROA (-2)		5.4811 *	
ROA (-3)		3.2924 .	
ROE			0.05628
ROE (-1)			-1.96559
ROE (-2)			0.84744 **
ROE (-3)			0.72570 *
INT	-23.470	2.1741	2.26364
INT (-1)	-41.575 **	-2.2430	-0.91286
INT (-2)		-3.6287 *	-4.40926 *
INF	-8.600	1.8432	1.89718
INF (-1)	-39.757	2.2762	2.27055
IND	4.038 **	-0.4115	-0.56474
IND (-1)	4.822 *	0.3046 .	0.07462
Long-run results :			
C	144.8912502	39.168900	67.1907913
GRM	-7.4712307		
OPM	0.1501034		
ROA		-2.049081	
ROE			-0.2641304
INT	-11.2424184	-2.713439	-2.4030534
INF	-8.3581123	3.023046	3.2745946
IND	1.5314175	-0.07843575	-0.3850890
R^2	1	1	1
Bound test (F-Stat calc.)	1.943888	3.2742549	3.2742549
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 35: Results for the S&P 500 Index (P/E model)

	(1)	(2)	(3)
C	6.1917 *	36.98569	12.16289
lag (-1)	-3.6049 *	0.35337	-0.18705 *
GRM	-4.2382		
GRM (-1)	-3.2550		
GRM (-2)	6.1702 .		
OPM	0.3259		
OPM (-1)	1.5908		
OPM (-2)	-1.7602		
ROA		2.28297 *	
ROA (-1)		-1.88015	
ROA (-2)		0.91390 .	
ROA (-3)			
ROE			0.16230 .
ROE (-1)			-0.21136
ROE (-2)			0.10588
ROE (-3)			0.08056
INT	-1.5712 **	0.63771	0.29194
INT (-1)	-2.4327 *	0.44185	–0.03491
INT (-2)		-0.59449 *	-0.57181 *
INF	0.2389	0.05341	0.24552
INF (-1)	-1.9356	0.27194	0.31823
INF (-2)		-0.10409 .	
IND	0.3424 .	-0.22343	-0.09201
IND (-1)	0.2669	-0.09802	-0.00427
IND (-2)		-0.07154	
Long-run results :			
C	1.34458278	57.1976051	10.24630582
GRM	-0.28731484		
OPM	0.03399428		
ROA		2.0362851	
ROE			0.11572908
INT	-0.86948548	0.7501490	-0.26518267
INF	-0.36845616	0.3421628	0.47491391
IND	0.13231188	-0.6077464	-0.08110479
R^2	1	1	1
Bound test (F-Stat calc.)	1.8732537	3.5192276	3.704963
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 36: Results for the S&P 500 Index (P/B model)

	(1)	(2)	(3)
C	175.423	12.2638	201.7125
lag (-1)	-3.241 *	-0.4330	-0.2748
GRM	-61.805		
GRM (-1)	12.784 .		
GRM (-2)	35.768		
OPM	7.771		
OPM (-1)	-7.553		
OPM (-2)	-7.187		
ROA		-4.6552	
ROA (-1)		-10.1635	
ROA (-2)		9.3337 .	
ROE			0.6008
ROE (-1)			-1.7109
ROE (-2)			1.4415 .
ROE (-3)			-0.6747
INT	-11.202 *	0.2600	-0.1731
INT (-1)	-21.957 *	-4.0426 *	1.4717
INT (-2)		-0.6649	1.0053
INF	-2.167 *	1.6776	1.6467
INF (-1)	-19.103 *	0.6575	
INF (-2)		-1.0837 *	
IND	2.478 *	-0.1642	-0.2825
IND (-1)	2.771	0.5045 .	-0.4295
IND (-2)		-0.2485	-1.0186
Long-run results :			
C	41.368361	8.558164	158.2348786
GRM	-3.125192		
OPM	-1.643393		
ROA		-3.8276568	
ROE			-0.2692448
INT	-7.819656	-3.1036687	1.8072574
INF	-5.015920	0.8733279	1.2917911
IND	1.237811	0.2932115	-1.3575922
R^2	1	1	1
Bound test (F-Stat calc.)	2.0214604	2.5053379	2.808689
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 37: Results for the S&P 500 Index (EV/EBITDA model)

	(1)	(2)	(3)
C	18.20584 *	11.296896 *	9.739055
lag (-1)	-4.67636 *	-0.276656 *	-0.309215 *
GRM	-7.04988		
GRM (-1)	-1.02894		
GRM (-2)	6.41054 .		
OPM	0.93902 **		
OPM (-1)	0.80359 .		
OPM (-2)	-1.71804		
ROA		0.689507 **	
ROA (-1)		-1.214275	
ROA (-2)		0.554446 *	
ROA (-3)		0.346470	
ROE			0.101330
ROE (-1)			-0.199182
ROE (-2)			0.094590 *
ROE (-3)			0.069747 *
INT	-1.52698 *	0.347175	0.245424
INT (-1)	-2.57439 *	-0.024812 .	0.021859
INT (-2)		-0.507741	-0.467632 *
INF	-0.01054	0.202900	0.231558
INF (-1)	-2.40925	0.299770	0.282615
IND	0.32335 .	-0.090282	-0.067763
IND (-1)	0.29830 .	0.002111 .	-0.002273
Long-run results :			
C	3.207309224	8.84881582	7.43884909
GRM	-0.293900343		
OPM	0.004328174		
ROA		0.29463575	
ROE			0.05078251
INT	-0.722534863	-0.14520591	-0.15303010
INF	-0.426290906	0.39373904	0.39273369
IND	0.109516840	-0.06906458	-0.05349400
R^2	1	1	1
Bound test (F-Stat calc.)	1.6647114	2.5302509	2.5134271
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 38: Results for the S&P 500 Index (EV/Sales model)

	(1)	(2)	(3)
C	10.2045 *	-8.030587	85.51684
lag (-1)	-2.7406 **	-0.163703 *	-0.27275 **
GRM	1.4211		
GRM (-1)	1.8252 *		
GRM (-2)	-2.5854		
OPM	-0.0505		
OPM (-1)	-0.6687		
OPM (-2)	0.7196 *		
ROA		-0.878193	
ROA (-1)		1.004248 **	
ROA (-2)		-0.522221	
ROA (-3)			
ROE			0.05628 *
ROE (-1)			-1.96559
ROE (-2)			0.84744 *
ROE (-3)			0.72570 *
INT	0.5092	-0.305870 .	2.26364
INT (-1)	1.0336	0.008324	-0.91286
INT (-2)		0.237542	-4.40926 *
INF	-0.2784 .	-0.118297	1.89718
INF (-1)	0.6251	-0.209331 .	2.27055
INF (-2)		0.029315	
IND	-0.1669	0.075278 .	-0.56474
IND (-1)	-0.1191	0.017553 .	0.07462 .
IND (-2)		0.022594	
Long-run results :			
C	2.728017 *	-6.90089245	67.1907913
GRM	0.1766703 .		
OPM	8.845101e-05		
ROA		-0.34043575	
ROE			-0.2641304
INT	0.4124451	-0.05156296	-2.4030534 *
INF	0.09266031	-0.25634804	3.2745946
IND	-0.07645347	0.09918849 *	-0.3850890
R^2	1	1	1
Bound test (F-Stat calc.)	4.5550772	8.4118015	9.3132416
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 39: Results for the S&P 500 Index (Dividend yield model)

b Nasdaq Composite Index

	(1)	(2)	(3)
C	1789.2676	-19.2648	-1464.326
lag (-1)	-0.7776 **	-0.2402 .	-1.397 **
GRM	-2.5285		
GRM (-1)	-74.7356		
GRM (-2)	25.5910 .		
OPM	-4.9982		
OPM (-1)	15.8798 *		
OPM (-2)	2.3806		
ROA		-93.0186	
ROA (-1)		6.9621 *	
ROA (-2)		19.9941	
ROA (-3)		-69.6937	
ROE			-108.860
ROE (-1)			13.358 .
ROE (-2)			-6.385 *
ROE (-3)			-43.367 *
INT	-15.7600 *	0.3456	-26.337 *
INT (-1)	-28.9662 **		
INF	-0.5379 .	14.7658	90.828
INF (-1)	27.0754 .	46.1378 .	92.555 .
INF (-2)		42.9543	158.042
IND	3.2145	4.1338	11.666
IND (-1)	0.8180 *	-0.4899	17.082 *
IND (-2)		1.6445	5.407 *
Long-run results :			
C	-7.97224977	7.73118858	-610.86241
GRM	0.04418522 **		
OPM	-0.21991266		
ROA		-0.14407406	
ROE			-60.5945
INT	-0.96919125 **	-0.37898837 *	-10.98695 *
INF	0.23420856	0.72550335	142.42961
IND	0.15062007 .	-0.02110807	14.24830
R^2	1	1	1
Bound test (F-Stat calc.)	14.021752	2.4567456	2.2596131
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 40: Results for the Nasdaq Composite Index (P/E model)

	(1)	(2)	(3)
C	-17.29830	16.81348	18.74010
lag (-1)	-1.16981 *	-1.17476 .	-1.09485 .
GRM	-0.10268		
GRM (-1)	-0.58586 *		
GRM (-2)	0.78442 .		
OPM	-0.44487		
OPM (-1)	0.06145 *		
OPM (-2)	-0.09376		
ROA		-0.03665	
ROA (-1)		-0.32541 .	
ROA (-2)		0.04873 *	
ROA (-3)			
ROE			-0.01926
ROE (-1)			-0.09028
ROE (-2)			0.01016 *
ROE (-3)			0.72570 **
INT	0.75726	-0.68201 *	-0.61896 *
INT (-1)	-1.34571	-0.44504	-0.39857
INT (-2)		0.30284	0.30047
INF	0.37649 **	0.85242 *	0.88760 **
INF (-1)	0.13170	0.04336	0.08374
INF (-2)		0.68201 *	0.69131 *
IND	0.17345	0.04029	0.02419
IND (-1)	0.15337	0.07500	0.06476
IND (-2)		-0.16120	-0.15823
Long-run results :			
C	-7.97224977	7.73118858	8.94579356
GRM	0.04418522		
OPM	-0.21991266		
ROA		-0.14407406	
ROE			-0.04743997
INT	-0.96919125 *	-0.37898837	-0.34229804
INF	0.23420856 .	0.72550335 *	0.79368213 .
IND	0.15062007	-0.02110807	-0.03307303
R^2	1	1	1
Bound test (F-Stat calc.)	2.6161930	4.1727541	4.0663576
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 41: Results for the Nasdaq Composite Index (P/B model)

	(1)	(2)	(3)
C	-317.7749	459.1942	147.0785
lag (-1)	-0.9663 .	-5.7609 *	-1.6628 .
GRM	-2.2835 *		
GRM (-1)	2.5073 *		
GRM (-2)	4.2478		
OPM	-8.1150		
OPM (-1)	-2.0170		
OPM (-2)	1.7093		
ROA		14.6202 *	
ROA (-1)		-71.4067 .	
ROA (-2)		16.0893 .	
ROA (-3)		14.4489	
ROE			-0.2023 .
ROE (-1)			-5.9835
ROE (-2)			1.3644
ROE (-3)			1.9930 .
INT	-5.0901 *	3.0249	-0.3230
INT (-1)	-13.7713 **	1.3879	-4.9432 *
INT (-2)		-31.1208 *	-6.4656
INF	2.2491	22.1878	9.3333
INF (-1)	-1.9754	0.8376	0.6882
IND	1.8117	-2.4319	-0.7862
IND (-1)	1.3965 .	1.2820	0.6854
IND (-2)		0.022594	
Long-run results :			
C	-161.6083392	67.9191596	55.23490233
GRM	2.2741124		
OPM	-4.2834394		
ROA		-3.8823659	
ROE			-1.06222399
INT	-9.5921957	-3.9503638	-4.40584321
INF	0.1392067	3.4056667	3.76354044
IND	1.6315508	-0.1700753	-0.03786505
R^2	1	1	1
Bound test (F-Stat calc.)	9.7086907	3.8156369	2.0836031
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 42: Results for the Nasdaq Composite Index (EV/EBITDA model)

	(1)	(2)	(3)
C	-28.05726	679.462	58.72417 .
lag (-1)	-0.99123 .	-12.714 *	-1.34190 *
GRM	-0.22083		
GRM (-1)	0.31137		
GRM (-2)	0.34964 *		
OPM	-0.53119		
OPM (-1)	-0.11284		
OPM (-2)	-0.04152		
ROA		27.194	
ROA (-1)		-14.824	
ROA (-2)		3.592 .	
ROE			0.66322
ROE (-1)			-0.35511
ROE (-2)			0.07063
ROE (-3)			0.72570 *
INT	-0.35459 *	7.357	0.25561
INT (-1)	-0.97844	14.062	0.44779
INT (-2)		-7.418 *	0.22278
INF	0.46166	4.610	0.63330
INF (-1)	-0.20276 .	1.900	-0.08146
INF (-2)		-2.827 *	-0.29078
IND	0.12499	-3.397	-0.17837
IND (-1)	0.14223	-2.364	-0.17299
IND (-2)		-1.367	-0.21964
Long-run results :			
C	-14.0904502	49.5462317	25.0754319
GRM	0.2210615		
OPM	-0.3442833		
ROA		1.1640320	
ROE			0.1617272
INT	-0.6694538	1.0209685	0.3954835
INF	0.1300211	0.2685832	0.1114741
IND	0.1341984	-0.5197298	-0.2438158
R^2	1	1	1
Bound test (F-Stat calc.)	11.213144	3.7378330	2.280534
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 43: Results for the Nasdaq Composite Index (EV/Sales model)

	(1)	(2)	(3)
C	7.91823	-0.101360	-0.497954
lag (-1)	-1.38919 **	-1.156578 *	-1.091989 **
GRM	0.01126		
GRM (-1)	0.17158 *		
GRM (-2)	-0.19746		
OPM	0.05325		
OPM (-1)	-0.02318		
OPM (-2)	0.02940		
ROA		-0.010977 .	
ROA (-1)		0.063697 .	
ROA (-2)		0.011545 .	
ROE			-0.002119
ROE (-1)			0.017421
ROE (-2)			0.003963 .
INT	0.11538 *	0.022807	0.016758
INT (-1)	0.31152	0.105063	0.102621
INT (-2)		0.008432	0.003259 *
INF	-0.11569	-0.218944	-0.219043
INF (-1)	-0.09126	-0.100929	-0.105883
INF (-2)		-0.152770	-0.152949
IND	-0.03711	0.003011	0.004678
IND (-1)	-0.02531	-0.006093	-0.004212
IND (-2)		0.023238	0.023030
Long-run results :			
C	3.314196839 .	-0.04700029	-0.238028914
GRM	-0.006119244		
OPM	0.024894316		
ROA		0.02979933	
ROE			0.009209301
INT	0.178680212	0.06320307	0.058622687
INF	-0.086618296 *	-0.21916324 **	-0.228430922 *
IND	-0.026124197	0.00934641	0.011231510
R^2	1	1	1
Bound test (F-Stat calc.)	3.7723464	7.5359589	7.8662201
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 44: Results for the Nasdaq Composite Index (Dividend yield model)

c Russell 2000 Index

	(1)	(2)	(3)
C	-3.91196	14.101101	8.114831
lag (-1)	-0.62828 .	-0.235107 *	-0.436096 *
GRM	0.03167 *		
GRM (-1)	0.42131 *		
GRM (-2)	0.25811		
OPM	0.25259		
OPM (-1)	-0.31838 *		
OPM (-2)	0.07829 *		
ROA		-0.024214	
ROA (-1)		-0.361484 .	
ROA (-2)		0.564462 *	
ROA (-3)		-0.272049	
ROE			-0.002787
ROE (-1)			-0.062121
ROE (-2)			0.088515 *
ROE (-3)			-0.054906 .
INT	-0.30170 *	0.825195	0.623436
INT (-1)	0.12754	-0.085630 .	-0.172966 *
INT (-2)		-0.690296	-0.516855 *
INF	0.16430 *	0.411279 *	0.365968 *
INF (-1)	0.39052 *	0.240259 *	0.196990 *
IND	0.06485	-0.108527	-0.068555
IND (-1)	0.04440	-0.008414	0.017635 .
IND (-2)			
Long-run results :			
C	-2.402503814	11.41690593	5.65061767
GRM	-0.080777883		
OPM	0.007678753 *		
ROA		-0.07552728	
ROE			-0.02179452
INT	-0.106958104	0.52751577 *	-0.04622619
INF	0.340739058 *	0.03989085 *	0.39200592 *
IND	0.067097334	-0.09468035	-0.03545739
R^2	1	1	1
Bound test (F-Stat calc.)	4.4596348	5.6280448	5.92996
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 45: Results for the Russell 2000 Index (P/B model)

	(1)	(2)	(3)
C	2617.555	6437.973	2474.8245
lag (-1)	-1.115 *	-1.965 *	-1.6612 **
GRM	-54.967		
GRM (-1)	-69.605		
GRM (-2)	21.175 *		
OPM	-63.083		
OPM (-1)	23.066		
OPM (-2)	15.545		
ROA		-77.747	
ROA (-1)		95.688	
ROA (-2)		-66.537	
ROE			-28.8643
ROE (-1)			26.7642
ROE (-2)			-27.7929
ROE (-3)			9.3882
INT	-79.131 *	-105.023 **	-102.0022 *
INT (-1)	-5.240 *	137.152	76.1124 *
INT (-2)		8.486	-45.7835
INF	-12.203	-71.271	-108.7158
INF (-1)	30.790 *	-45.519	-35.3423
INF (-2)		22.923 *	
IND	-1.383	-33.626	-20.0002
IND (-1)	8.006 .	-5.426	-0.2913
IND (-2)		-22.498	
Long-run results :			
C	1237.661837	2171.62203	929.981070
GRM	-48.889528		
OPM	-11.571500		
ROA		-16.39208	
ROE			-7.705206
INT	-39.893269 *	13.69993	-26.933143
INF	8.788221 *	-31.66282	-54.133679
IND	3.131300	-20.76154	-7.625060
R^2	1	1	1
Bound test (F-Stat calc.)	39.132642	3.2118279	3.6658011
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 46: Results for the Russell 2000 Index (EV/EBITDA model)

	(1)	(2)	(3)
C	-3.49275	-8.760895	-9.180899
lag (-1)	-0.72761 *	-1.308615 *	-1.454512
GRM	-0.23144		
GRM (-1)	-0.23794		
GRM (-2)	0.08342 *		
OPM	0.01812		
OPM (-1)	-0.31469		
OPM (-2)	0.26394		
ROA		-0.124318	
ROA (-1)		-0.256473	
ROA (-2)		-0.002906 *	
ROE			-0.028037
ROE (-1)			-0.060098
ROE (-2)			-0.004202
ROE (-3)			
INT	-0.17345 .	-0.101839	-0.114591
INT (-1)	-0.27451	-0.344142 *	-0.308030 .
INF	0.52958 *	0.323670	0.374625
INF (-1)	0.24361	0.014941	0.055953 **
INF (-2)		0.102210	0.149444 *
INF (-3)		-0.067199 *	-0.055751
IND	0.09417 .	0.050738 .	0.052405
IND (-1)	0.08300	0.083878	0.087553
Long-run results :			
C	-2.02172625	-3.79487053	-3.74041692
GRM	-0.22341035		
OPM	-0.01888936		
ROA		-0.16620169	
ROE			-0.03761948
INT	-0.25929635 *	-0.19318123 *	-0.17218137 *
INF	0.44754762	0.16183763	0.21359520
IND	0.10254710	0.05830996	0.05702090
R^2	1	1	1
Bound test (F-Stat calc.)	2.917160	6.9528375	6.4936862
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 47: Results for the Russell 2000 Index (EV/Sales model)

	(1)	(2)	(3)
C	17.75512	25.39648	31.77324
lag (-1)	-0.83038 *	-0.88786 **	-1.23314 **
lag (-2)		-1.15299 *	-1.25184 *
GRM	-0.04282		
GRM (-1)	0.27097 *		
GRM (-2)	-0.19655		
OPM	-0.16787		
OPM (-1)	0.30789		
OPM (-2)	-0.06885		
ROA		-0.57596 .	
ROA (-1)		0.25345	
ROA (-2)		0.30244 **	
ROE			-0.13883
ROE (-1)			0.03526 .
ROE (-2)			0.10924 .
ROE (-3)			
INT	0.26793	0.47200	0.72136
INT (-1)	0.07906	0.30786	0.34982
INT (-2)		-0.25184 .	-0.49273 .
INF	-0.18417	-0.05230	-0.01792
INF (-1)	-0.21843	0.05484 *	0.10845
INF (-2)		-0.03217	-0.07205
IND	-0.09172	-0.07332	-0.10818
IND (-1)	-0.07212	-0.14248	-0.16514
Long-run results :			
C	9.70021051 *	8.351776121	9.117196895
GRM	0.01727102		
OPM	0.03888615 .		
ROA		-0.006599689	
ROE			0.001625484 .
INT	0.18957355	0.173641237	0.165984370 *
INF	-0.21995307	-0.009741354	0.005304546
IND	-0.08951040	-0.070966579	-0.078427886
R^2	1	1	1
Bound test (F-Stat calc.)	5.3955000	6.9349469	7.952754
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 48: Results for the Russell 2000 Index (Dividend yield model)

d Amazon.com, Inc.

	(1)	(2)	(3)
C	-2608.855	1233.740	252.2673
lag (-1)	-1.948 *	-1.743 *	1.2577 *
GRM	26.890 *		
GRM (-1)	16.263 *		
GRM (-2)	-2.702		
OPM	-9.524		
OPM (-1)	5.905		
OPM (-2)	-40.236		
ROA		2.762 *	
ROA (-1)		-42.597	
ROA (-2)		-24.055	
ROA (-3)		-18.246	
ROE			-1.5653
ROE (-1)			-10.7219
ROE (-2)			9.6112 .
ROE (-3)			-4.6835
INT	-55.572 *	27.163	-13.6246 .
INT (-1)	-39.176 .	6.765	12.6819 .
INF	-182.814	55.705 *	46.5428 *
INF (-1)	-32.710	65.671 *	0.8988
INF (-2)		22.898	
IND	23.576 .	-4.567	-2.1599
IND (-1)	-6.266	-1.119	2.6885
IND (-2)			-1.8367
Long-run results :			
C	-884.838469	449.73608	-978.902407
GRM	13.719849 *		
OPM	-14.874162		
ROA		-29.94110	
ROE			28.557884 **
INT	-32.135392 *	12.36770	-49.211161 *
INF	-73.098925	52.59226 *	-131.223946
IND	5.870811 *	-2.07256	5.076084 *
R^2	1	1	1
Bound test (F-Stat calc.)	2.9092933	18.137075	15.416262
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 49: Results for Amazon.com, Inc. (P/E model)

	(1)	(2)	(3)
C	-181.0275	161.872807	218.6643
lag (-1)	-0.7247 *	-0.483300 *	0.9747
GRM	2.5307		
GRM (-1)	1.2230		
GRM (-2)	-1.5272		
OPM	-0.9647		
OPM (-1)	0.6481		
OPM (-2)	-1.6361		
ROA		1.402404	
ROA (-1)		-5.599418	
ROA (-2)		-0.181490	
ROA (-3)		-3.029195	
ROE			0.7577
ROE (-1)			1.1236
ROE (-2)			0.3918
INT	-2.6343	5.675645	9.9281
INT (-1)	-5.1481	-0.094075	6.2597
INT (-2)			-11.7416
INF	-16.8616	8.954609	2.5448
INF (-1)	-3.0463	6.743808	5.1299
INF (-2)		0.029315	-2.6995
IND	2.2370	-0.877395	-2.2261
IND (-1)	-0.6880	-0.004079	-0.9750
IND (-2)		-0.152170	0.9308
Long-run results :			
C	-104.9635158	109.1301604	8650.49826
GRM	1.2909989		
OPM	-1.1322368		
ROA		-4.9940654	
ROE			1.02506
INT	-4.5123706	3.7629400	175.89730
INF	-11.5430117	10.5834375	196.82023
IND	0.8981183	-0.6968543	-89.81332
R^2	1	1	1
Bound test (F-Stat calc.)	0.5018443	1.9077482	3.2280866
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 50: Results for Amazon.com, Inc. (P/B model)

	(1)	(2)	(3)
C	-957.2513	119.73362	-195.2563
lag (-1)	-1.0689 *	-0.11243 *	2.2220 *
GRM	12.0770		
GRM (-1)	5.8382		
GRM (-2)	-3.9365		
OPM	-5.3611		
OPM (-1)	0.6821		
OPM (-2)	-17.9071		
ROA		-0.07227	
ROA (-1)		-12.07746	
ROA (-2)		-4.85688	
ROE			-0.6522
ROE (-1)			-11.8060
ROE (-2)			9.7433 *
ROE (-3)			-2.9244
INT	-24.3229 *	3.98618	14.6952
INT (-1)	-25.0150	-8.69498	-14.3009
INT (-2)		0.20849	
INF	-83.5650	11.57318 *	43.3031 *
INF (-1)	-7.7712	11.78428	-4.6665
INF (-2)		-3.63320	-26.3635
IND	11.4876 *	-0.41731	-1.2937
IND (-1)	-3.6256	0.61582 *	3.7631
IND (-2)		0.48707 *	
Long-run results :			
C	-462.677168	107.6327395	159.7881386
GRM	6.756456 *		
OPM	-10.916769		
ROA		-15.2878339	
ROE			4.6148852 *
INT	-23.846941 *	-4.0454901 *	-0.3227189 *
INF	-44.146356	17.7308289 .	-10.0436566
IND	3.799990 .	0.6162969 .	-2.0208575
R^2	1	1	1
Bound test (F-Stat calc.)	1.8953237	14.98850	21.957836
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 51: Results for Amazon.com, Inc. (EV/EBITDA model)

	(1)	(2)	(3)
C	1.82445	15.32296	77.9640
lag (-1)	-0.73195 *	-0.05795 *	0.9308
GRM	0.34205 *		
GRM (-1)	0.05884		
GRM (-2)	-0.37644		
OPM	-0.35514		
OPM (-1)	-0.02423		
OPM (-2)	-0.03525		
ROA		0.16629 *	
ROA (-1)		-0.96930 *	
ROA (-2)		0.18531 *	
ROA (-3)		-0.23846	
ROE			0.1951 *
ROE (-1)			-0.5682 **
ROE (-2)			0.3063 *
ROE (-3)			-0.2648
INT	-0.17392 *	0.69771	2.5412
INT (-1)	-0.98353 **	-0.61266 **	1.9417
INT (-2)			-1.5744 *
INF	-2.10316	1.25730 .	2.6456
INF (-1)	-0.26323	0.63119	1.7656 *
INF (-2)		-0.51801 *	
IND	0.25332	-0.11199	-0.5397
IND (-1)	-0.15896	0.04944 *	-0.2205
Long-run results :			
C	1.05340584	14.48369153	1127.019491
GRM	0.01411407 .		
OPM	-0.23939475		
ROA		-0.80927268	
ROE			-4.793767
INT	-0.66828871 .	0.08039410	42.044228
INF	-1.36630903	1.29542029 *	63.766421 **
IND	0.05448341	-0.05912021	-10.988590
R^2	1	1	1
Bound test (F-Stat calc.)	1.0396156	3.4210822	7.8412831
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 52: Results for Amazon.com, Inc. (EV/Sales model)

e Tesla, Inc.

	(1)	(2)	(3)
C	-125.84161	32.10432	399.6900
lag (-1)	-0.37342 **	0.26390	0.3281
GRM	0.01457 *		
GRM (-1)	0.92957 *		
GRM (-2)	-0.51402		
OPM	0.04083		
OPM (-1)	-0.35817		
OPM (-2)	0.46521 *		
ROA		-0.25315	
ROA (-1)		-1.63535	
ROA (-2)		1.93425	
ROA (-3)		-1.11172	
ROE			-3.0132 *
ROE (-1)			3.5729 *
ROE (-2)			2.5826 *
ROE (-3)			-1.3298
ROE (-4)			0.2941 *
INT	-6.78768 *	-4.13900 *	-3.0428 *
INT (-1)	-8.10515 **	-5.65965 .	44.1337
INT (-2)			-16.0080 *
INF	-3.82800	-2.74008	11.9223
INF (-1)	-2.60640	2.42075	
INF (-2)		3.23151	
IND	1.10822 *	-0.08625	-4.0780
IND (-1)	0.55691		
Long-run results :			
C	-91.6262940	43.613974	67.1907913
GRM	0.3131685		
OPM	0.1076698 *		
ROA		-1.448134	
ROE			-0.2641304
INT	-10.8435885 *	-13.311549 *	-2.4030534 *
INF	-4.6849389	8.650368	3.2745946 *
IND	1.2123955 *	-0.117175	-0.3850890
R^2	1	1	1
Bound test (F-Stat calc.)	5.0986750	17.603839	6.7069660
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 53: Results for Tesla, Inc. (P/B model)

	(1)	(2)	(3)
C	-58.35142	-297.3430	-118.20851
lag (-1)	0.09818	0.1285	-0.23429 *
GRM	-0.80855		
GRM (-1)	0.61708 *		
GRM (-2)	-0.60320		
OPM	0.37603		
OPM (-1)	-0.25447		
OPM (-2)	0.38891		
ROA		1.9743 *	
ROA (-1)		-2.5513	
ROA (-2)		2.2161	
ROE			0.16046 *
ROE (-1)			-0.16295
ROE (-2)			0.20108
ROE (-3)			-0.06111
INT	-5.41118 *	-1.5855 *	-4.51254 **
INT (-1)	-3.45049	-12.1797 *	-6.93911
INT (-2)		-1.6048 *	
INF	-3.49101	-11.7907	-4.00111
INF (-1)	-0.98556	-3.5912	-2.49579
INF (-2)		-8.7194	-1.75223
IND	0.94490 **	1.4702 **	0.96522 **
IND (-1)	0.01508 *	0.4834	0.54933 **
IND (-2)		1.4929	
Long-run results :			
C	-64.7037919	-341.180018	-95.7700645
GRM	-0.8811798		
OPM	0.5660450 *		
ROA		1.880777 *	
ROE			0.1113847 *
INT	-9.8263924 *	-17.636045 *	-9.2778842 *
INF	-4.9639033	-27.654465	-6.6832704
IND	1.0644897 .	3.954629 *	1.2270546 .
R^2	1	1	1
Bound test (F-Stat calc.)	3.0423883	3.6853947	3.7193104
Bound test (F-Stat: Upper & lower at 5%)	2.578 and 3.858	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes	Yes

Table 54: Results for Tesla, Inc. (EV/Sales model)

f AMC Entertainment Holdings, Inc.

	(1)	(2)
C	-684.1	491.8691
lag (-1)	-0.7525 *	0.4473
GRM	4.731	
GRM (-1)	5.592	
GRM (-2)	0.5838	
OPM	-0.01990	
OPM (-1)	0.02688	
OPM (-2)	0.007787	
ROA		0.7184
ROA (-1)		-0.6677
ROA (-2)		-2.2959
INT	17.76	-2.5649
INT (-1)	15.09	28.3115
INT (-2)		18.1612
INF	2.453	7.5602
INF (-1)	14.99	-2.4546
INF (-2)		10.9159
IND	4.292	-1.0756
IND (-1)	-5.202	-0.9147
IND (-2)		-3.8774
Long-run results :		
C	-390.37180603	889.894778
GRM	6.22348384	
OPM	0.00842528	
ROA		-4.062049
ROE		
INT	18.74838335	79.438500
INF	9.95405791	28.986223
IND	-0.51896466	-10.616081
R^2	1	1
Bound test (F-Stat calc.)	3.1132869	3.1132869
Bound test (F-Stat: Upper & lower at 5%)	2.752 and 3.994	2.752 and 3.994
VIF test	Yes	Yes

Table 55: Results for AMC Entertainment Holdings, Inc. (EV/Sales model)

5 Conclusions

This paper investigates the relationship and effects of fundamentals on the relative valuation of assets in the U.S. equity market between 2018 and 2021, both at the macro and micro level.

Although the results differ from case to case, we still manage to find overall evidence of a relationship that appears to exist between fundamentals and relative valuation, more specifically in the case of the indices than the individual stocks studied. Nevertheless, the results seem to suggest that this relationship is mostly of a short-term nature and no longer holds over the long term.

With these results, we do not question the conclusions of previous authors that fundamentals are particularly important for the long-term assessment of the future performance of relative valuations of assets in the stock market, but simply that during the period studied, the relationship between the two, when it was the case, seemed rather brief and transient.

As already mentioned several times, the research study voluntarily chose to consider a relatively short period of 4 years of observations for the data. Although this choice was entirely appropriate in view of the research question, it must be noted that the regression results obtained must obviously be put into perspective in view of the small number of observations provided to the model. Of course, there is no doubt that the sample sizes of each asset considered do not represent the general state of the markets as they really are in the long term, but only a very short-term dimension of them. In the same way, although the American market is relatively well approximated with the help of the 3 stock market indices, the same cannot be said for the 3 stocks selected expressly for the "explosive" character of their performance on the stock market in recent years. In this continuity, for two of these same stocks (Tesla, Inc. and AMC Entertainement Holdings, Inc.), we were forced to reduce the dimension of the variables studied due to the lack of available data. All these facts represent in this case limitations of this paper that must be considered.

As a result, one notable source of improvement to these limitations would be to first consider a larger sample size for the data studied, i.e., by conducting a study that would begin before 2018. By doing so, we would then provide our models with more information needed for the different regressions performed. As a consequence of a longer-term study and therefore probably much more faithful to the true state of the markets, the results of our conclusions would then be susceptible to change. Still in this continuity, the paper would naturally gain in quality if the study carried out on individual stocks were to take place with a much larger number of companies than just 3 randomly selected, so as to attempt to cover the US market more widely at the micro level.

Finally, the whole methodology applied could also be tested with a broader scope than the study of the US market alone, so as to be able to analyze and compare the reactions of the different markets in recent years.

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