

Chapter 2

Modeling Financial Opinions



In this chapter we lay out the primary background of a financial opinion and the relation between opinions and financial instruments. Together, these constitute an overall picture of opinion-based market interaction. Following this discussion we propose several research issues. First, in Sect. 2.1, we discuss the components in a financial opinion one by one, as well as potential research directions; we also explain why we need to extract components and estimate their quality (or influence). After recognizing the components in an opinion, in Sect. 2.2 we identify the relationship between components based on the notions of argument mining. Then, in Sect. 2.3, we present how argumentation structures between financial opinions are formed by linking each opinion structure. We close the chapter in Sect. 2.4 with the interaction between the financial market and opinions.

2.1 Opinion Components

2.1.1 Target Entity

As mentioned in Chap. 1, there are 12 components in a financial opinion, that is, an opinion related to a financial instrument. The first important component is the subject of discussion: the target entity. By definition, any monetary contract, including debt, equity, foreign exchange, and derivatives, can be the financial instrument. Because stock is the most common case, we mainly use stocks' examples in this book. The same concepts can be employed for other financial instruments.

In financial narratives, investors tend to tag the target entity with a unique ticker symbol. For example, investors use 6758 to represent the stock of Sony Corporation in Japan. The equity of a given company may be listed on multiple stock

J.P.Morgan

Sony (6758)

PS5 Pricing Announced; Digital Version Reassuring

Sony streamed its PlayStation 5 Showcase presentation from 5 a.m. on September 17 Japan time. Much-anticipated pricing was announced at \$499.99 for the base model and \$399.99 for a disc-free Digital Edition, broadly in line with expectations but nonetheless reassuring in our view given advance speculation that the digital version might cost \$449. Sony also announced an addition to its PS Plus service targeted at PS5 users but made no clear mention of a price hike or other pricing changes. We came away from the event sensing few real surprises, but given the PlayStation's advantage over the Xbox in terms of launch titles and installed base for the previous generation, we think the fact that the event came off smoothly sets the stage for rising expectations heading into the year-end holiday season.

Asia Pacific Equity Research
17 September 2020

Overweight

6758.T, 6758 JP

Price: ¥8,210

16 Sep 2020

Price Target: ¥9,400

PT End Date: 31 Dec 2020

Japan Equity Research
Consumer/Industrial Electronics

Fig. 2.1 A professional analyst report about the target entity Sony with the ticker symbol 6758 JP



Fig. 2.2 A post by a financial social media user showing their opinion on the target entity Sony with the ticker symbol SNE

exchanges, for instance the Tokyo Stock Exchange, New York Stock Exchange, and the London Stock Exchange. The ticker symbols of the equity of Sony Corporation in these exchanges are 6758, SNE, and SON, respectively. In this case, in some financial documents identifying the target entity is straightforward. Figures 2.1 and 2.2 show documents written by a professional analyst and a financial social media user, respectively. Use of ticker symbols (6758 JP in Fig. 2.1 and SNE in Fig. 2.2) for the mentioned target entity reflects investor consensus.

2.1.2 Market Sentiment

In the general domain, sentiment can be positive, neutral, or negative, whereas in the financial domain, market sentiments are bullish, neutral, or bearish. On most financial social media platforms, writers can provide a market sentiment label—either bullish or bearish—before posting their opinions. Figure 2.2 depicts an example with a bullish label. Note that bullish (bearish) market sentiment means the writer thinks the price of the target entity will rise (fall).

In some cases, including analyst reports, the definition of market sentiment is slightly different. It can differ, for instance, across various institutions, as shown in Fig. 2.1, where market sentiment is overweight, neutral, or underweight. Such a

rating is given based on a comparison with other stocks. For instance, according to the definition of J.P. Morgan, the meanings of these market sentiment labels are as follows:

- **Overweight:** The target entity will outperform the average return of the stocks that have been analyzed by this analyst or this team in the next six to twelve months.
- **Neutral:** The target entity will perform according to the average return of the stocks that have been analyzed by this analyst or this team in the next six to twelve months.
- **Underweight:** The target entity will underperform the average return of the stocks that have been analyzed by this analyst or this team in the next six to twelve months.

In this case, an overweight rating does not mean the price will rise. It simply means that the target stock may outperform other stocks, either by rising more or by falling less.

Simple market sentiment is used in the reports of other analysts, who use buy, hold, and sell to represent their market sentiments. This kind of definition is based on the expected return of the target entity. If the return is expected to go up (down), they recommend that their customers buy (sell) the target stock. A more complex setting is also common, in which analysts set a threshold for going up and down. For example, they assign a “buy” (“reduce”) label to the stock if and only if the expected return is higher (lower) than 10% (−10%). For expected returns between 10% and −10%, they assign a “hold” rating.

In summary, market sentiment can be represented in various ways; its definition is typically provided within the reports or platforms themselves.

2.1.3 Opinion Holder

The same opinion held by different people may have different influences on the market. For example, the opinions in Figs. 2.1 and 2.2 are bullish opinions about the equity of Sony, but the opinion holders are different. The opinion in Fig. 2.1 is likely to be read by far more people than that in Fig. 2.2, which indicates the importance of recognizing and analyzing the opinion holder. Indeed, one important research topic is determining whether a given opinion is coming from a trustworthy opinion holder. The opinion holder’s wider network may also influence the trustworthiness of an opinion.

We classify the opinion holders into the following groups:

- **By opinion source:** managers, professionals, social media users, and journalists.
- **By expertise:** professional investors and amateur investors.
- **By historical performance:** accurate investors and inaccurate investors.

In Chap. 3, we further discuss opinions from different sources.

2.1.4 Publishing Time and Validity Period

With financial opinions, temporal information is much more important than in opinions from other domains. For instance, while opinions about the PlayStation 5 Console from 2020 may still be useful for those who want to buy the PlayStation 5 Console two years later, in 2022, bullish opinions on the equity of Sony in 2020 will most likely be worthless in 2022. This explains the need to note the publishing time and estimate the validity period of financial opinions.

In most cases, the publishing time is easily obtained from the title of the document (for analyst reports) or from the platform metadata (social media posts). The publishing time helps us arrange opinions in order and can be used to link opinions with market data. For example, the price target of an investor and the close price of the target entity are paired to evaluate the degree of investor sentiment. Note that the price target is the price level that investors think the price of a financial instrument will be at.

The validity period is also an important concept in financial opinions. In the report depicted in Fig. 2.1, the publishing time is 17 Sep 2020, and the analyst has set the “PT End Date” to 31 Dec 2020. However, most financial opinions do not provide an exact validity period, which complicates the estimation of the validity period of financial opinions; this remains an open problem. When all opinions are viewed on a timeline, temporal information plays a crucial role. More details are provided in Sect. 2.4.

2.1.5 Market Information

Investors analyze financial instruments based on the information available prior to the publishing time of their opinion. In many cases, especially with social media posts, market information is known to investors and is not included in their posts. For example, they only state “\$SNE Target 150 March 2021” and do not provide a sentiment label. Understanding that “150” is the price target of \$SNE, we must ascertain the close price of \$SNE in order to infer the investor’s sentiment. That is, if the close price of \$SNE is higher (lower) than 150, this investor possesses a bearish (bullish) sentiment about \$SNE. This not only shows the importance of recording the market information before the publishing time, but also indicates that the numerals in financial narratives are crucial for understanding financial opinions. Indeed, Chap. 5 is devoted entirely to research on this topic.

2.1.6 Aspect

Basically, investors analyze the financial instruments from two aspects: fundamental and technical. Based on financial or economic factors such as financial statements, fundamental analysis is used to evaluate the value of the target financial instrument.

Table 2.1 Taxonomies of aspects proposed in FiQA-2018 [3] and NumAttach [1]

FiQA-2018 [3]			NumAttach [1]
Level 1	Level 2		
Corporate	Price action	Strategy	Asset
Stock	Technical analysis	Strategy	Liability
Economy	Coverage	Legal	Equity
Market	Risks	Fundamentals	Income
	Financial	Market	Economics
	Sales	Volatility	Indicator
	Signal	Insider activity	Pattern
	Dividend policy	Reputation	
	Options	Conditions	
	M&A	Regulatory	
	Rumors		

Technical analysis, in turn, uses historical data such as price or trading volume to predict price movement.

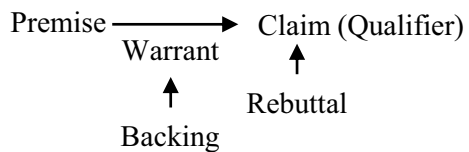
These two aspects can be further extended into various subcategories. For example, investors can base their analysis on many different parts of the financial statement, including assets, liability, or equity terms [1]. Events such as mergers and acquisitions (M&A) and lawsuits can also be considered as different aspects [3]. Different technical analysis methods can be adopted for different aspects. Aspects proposed in the literature are listed in Table 2.1.

2.1.7 Elementary Argumentative Units

In this section, we introduce the elementary argumentative units of financial opinions based on Toulmin’s argumentative model [4], shown in Fig. 2.3. *Claim* and *premise* are two basic units of an argument: claim is the subjective view of the investor, and premise is the objective fact used to support the claim.

Warrant is the background knowledge that causes an investor infer the claim based on the premise, and *backing* is used to support the warrant. Assume that the analyst states a claim of EPS growth based on a premise of improved margins via

Fig. 2.3 The relation between a premise and a claim viewed by Toulmin’s argumentative model



labor efficiency. The warrant is this: more efficient labor will help us produce more in the same amount of time, which will lead to increased income. In this case, the backing is simply accounting common sense. Here, warrant and backing are implicit information in the argumentation. That is, generally, warrant and backing are not written down in the argumentative documents.

In argumentative models, the qualifier represents the strength of the claim, and can be the investor's confidence. In Fig. 2.1, the price target can be taken as a proxy for the confidence of the analyst. The qualifier can also be considered as the degree of market sentiment. Finally, the *rebuttal* is composed of counterarguments meant to defeat the claim. We explain the rebuttal in detail in Sect. 2.3 when we construct the argumentation structure between opinions.

2.1.8 *Opinion Quality*

As mentioned above, the qualifier represents the confidence of investors in their opinions. Another evaluation metric is the quality of the opinion. Figures 2.1 and 2.2 show that opinions may have different weights with different investors due to their quality. Note that the evaluation of the quality of a financial opinion is still an open problem: the interpretation of the opinion is affected by the rationality of the inference, the writing style of the opinion holder, and so on.

In this book, the quality of a financial opinion is determined based on the rationality between the claims and the premises. That is, we evaluate whether the specific premises are trustworthy, and further determine whether the inference from these premises is reasonable given the claims. This is an objective evaluation of the premises supporting the investor's analysis, as opposed to the subjective confidence of the investor. An investor may be very confident about a certain trading strategy, but sometimes the setting of the strategy may not make sense to others. This raises another research question: whether rational analysis always lead to profitable results? Since there is little discussion in this direction, this topic is worthy of investigation. Because quality is related to the argumentative units, we illustrate the relation between all opinion components in Sect. 2.2.

2.1.9 *Influence*

In financial opinion mining, we seek to predict market movement based on investor opinions. We must thus judge whether the given opinion will influence the market, and how much of an impact it will have. Although an investor may provide sound analysis, it is possible that this investor has not entered the market, or that no other investors view the analysis. In such a case, is it prudent to consider this opinion when analyzing the financial instrument that is the subject of this analysis? On the other hand, a sensational article headline or a social media post with false —or even

fake—information can have a big impact on the market. Therefore, to understand how the opinion will influence the market, the influence power of the opinion must be considered.

2.2 Argumentation Structure in Opinions

After defining all the components of a financial opinion, we now construct a graph that shows the relationships of these components. Figure 2.6 shows the argumentation structure of the analysis in Fig. 2.4. In this report, the main claim (*MC*) on Michaels stock is overweight, which is the final market sentiment (*s*) of this opinion. The

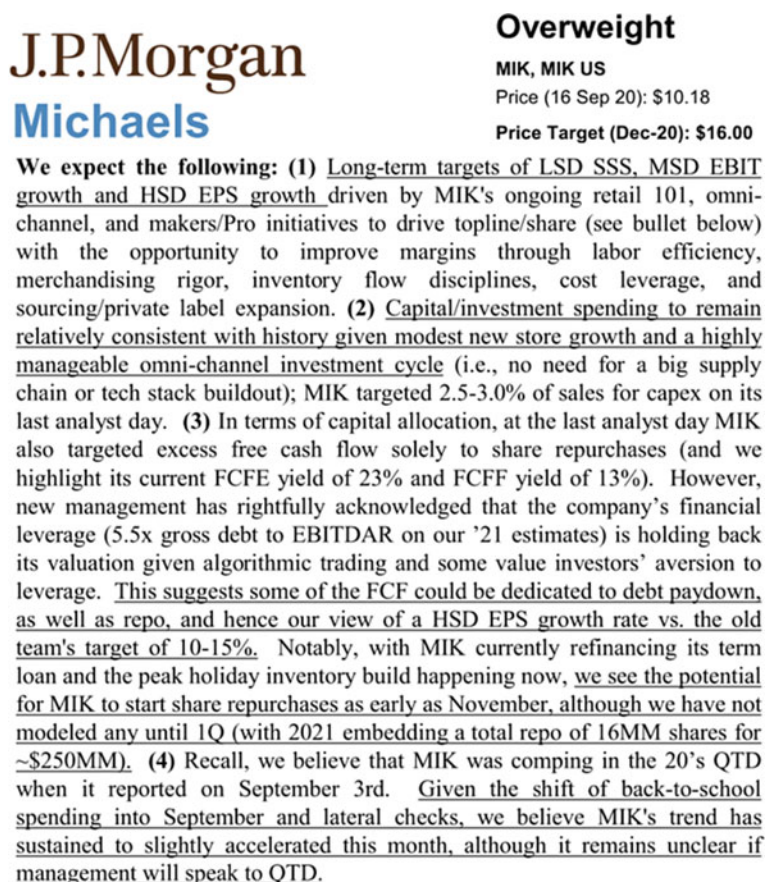


Fig. 2.4 Arguments of a professional analyst

analyst makes six claims (c) to support the main claim, most of which are supported by one or more premises (p).

Below we introduce the basic concepts behind different argumentation structures. Firstly, the structure from p_1 to the MC is termed a *sequential structure*, where w denotes the persuasiveness of the premise for the claim. Secondly, the structure of (p_2, p_3, c_2, c_3) is a named linked argument, where p_2 supports c_2 and c_2 is also supported by c_3 with p_3 . Thirdly, claims such as c_4 may not be supported by any premises. Fourthly, the structure of (p_4, c_5, c_6) is a divergent argument, where two claims are supported by the same premise. Lastly, the full argumentation structure is a hybrid structure.

In Fig. 2.6, parameter w denotes the weight of the premise supporting the indicated claim. Many proxies could be used as w . For example, the warrant for inferring the premise to the claim is one possible proxy. The rationale behind using this premise to support the claim is also a possible proxy. Parameter w thus influences q , the quality or qualifier of the claim, and q has a further impact on the main claim. That is, w influences the trustworthiness or quality of the financial opinion.

Based on the above rationales, the relationships between the opinion components can be listed as follows. The investors can make claims from different aspects to support the main claim. Thus, the aspect is related to individual claims instead of linking to the main claim directly. Additionally, the market sentiments of the claims can differ from the main claim. For example, investors may consider both bullish and bearish perspectives to come to their final decisions. The validity period of the main claim and the claims may be different, because investors may take both short- and long-term influence into account. Because other investor's opinions may become the premise of the other opinion holders, the opinion holder of the main claim may be different from that of the premises. Finally, the opinion quality of the main claim will be influenced by q of the claims and w of the warrants or premises that directly support the main claim.

Previous work shows that modeling the argumentation structure in this way is useful for evaluating the quality of persuasive essays [5] and the persuasiveness of online debates [2]. However, few studies adopt this idea to analyze investor opinions. In this section, we not only provide an example of representing investor opinion as an argumentation structure, but also show that we can evaluate the rationality of each node pair in the structure and assign weights to the edges. Given rationality or quality scores, the argumentation structure becomes a directed weighted graph. This kind of structure also better reflects an investor's behavior when reading a report.

2.3 Argumentation Structure Among Opinions

As mentioned in Sect. 2.1.7, investors regularly debate price movements. Figure 2.5 shows the argumentation structure of the opinions expressed during a discussion conducted on an online forum. The original poster makes a claim about TSM's price and backs this up with several premises from different aspects. The first reply, R1,

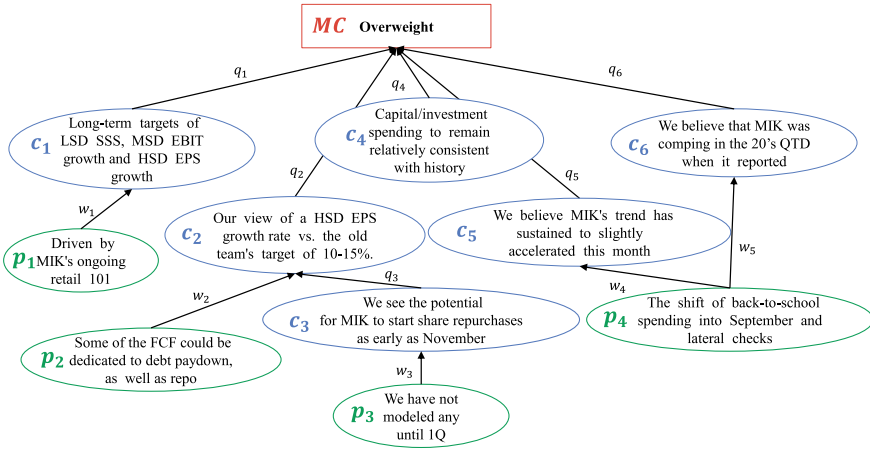


Fig. 2.5 Argumentation structure of the report in Fig. 2.4

which agrees with the original post, can be considered as supporting the main claim of the original post. The second reply, R2, supports one of claims of the original post. The third and the fourth replies, R3 and R4, attack the main claim of the original post from different aspects. In this case, R3 and R4 are rebuttals of the claim in the original post.

Because the components mentioned in Sect. 2.2 are inherent in a financial opinion, support or attacks from other opinions may not influence those components. Interaction between opinions at time t can be considered as the premises of other opinions at time $t + 1$. In contrast to analyzing a single financial opinion, the readers of the thread in Fig. 2.5 treat the discussion as an opinion, and consider it based on the concepts outlined in Sect. 2.2. We discuss this in detail in Sect. 2.4.

As in an online debate platform on which debaters discuss a given topic over several rounds, posters in online financial forums discuss the possible price movement directions over several rounds from different aspects. This makes it possible for us to adopt the concept of supports and attacks from argument mining to evaluate the persuasiveness of the original post. We can further construct a larger argumentation graph, where all arguments of the investors are connected using edges denoting bullish/bearish stances toward certain financial instruments. Comparing the rationales from the investors from both stances allows us not only to link opinions from different investors and different documents to a graph, but also to formulate an explanation of the decision process.

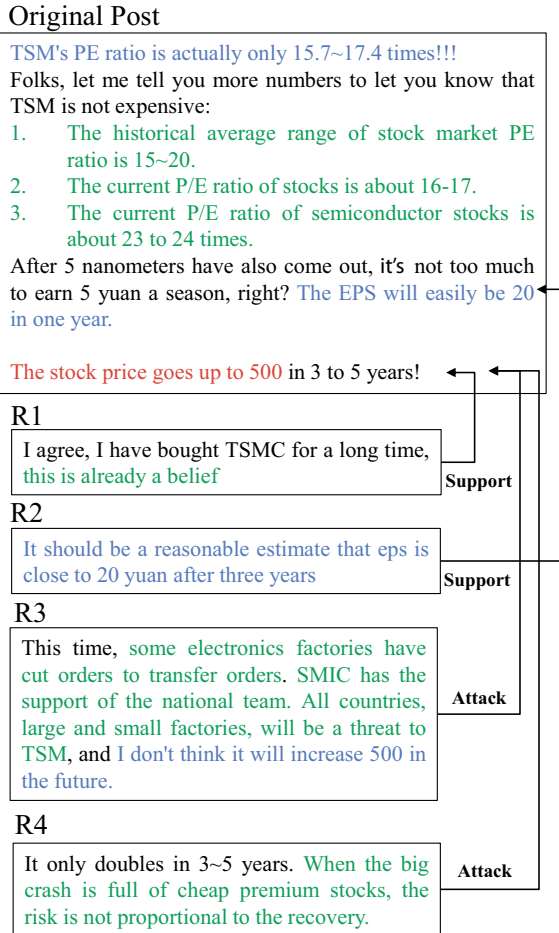


Fig. 2.6 Argumentation structure among opinions. The span in red represents the main claim of the original post, spans in blue denote claims, and spans in green denote premises

2.4 Relations Among Opinions and Target Entities

Investor opinions are linked to the target financial instrument (e) and may influence outcomes—such as the stock price—in the next time step. Figure 2.7 shows an example discussing the relations of opinions (O) and financial instruments (e), where U and D denote bullish and bearish, respectively. UI denotes an investor with bullish opinion and long e , DI denotes an investor with bearish opinion and short e , and UN denotes an investor with bullish opinion who takes no actions in the market. At time t in Fig. 2.7, the facts related to e_1 ($P_{1,t}^{e_1}$, $P_{2,t}^{e_1}$, $P_{3,t}^{e_1}$, and $M_t^{e_1}$) are considered the premises, where $M_t^{e_1}$ denotes market information such as the close price of e_1 . For

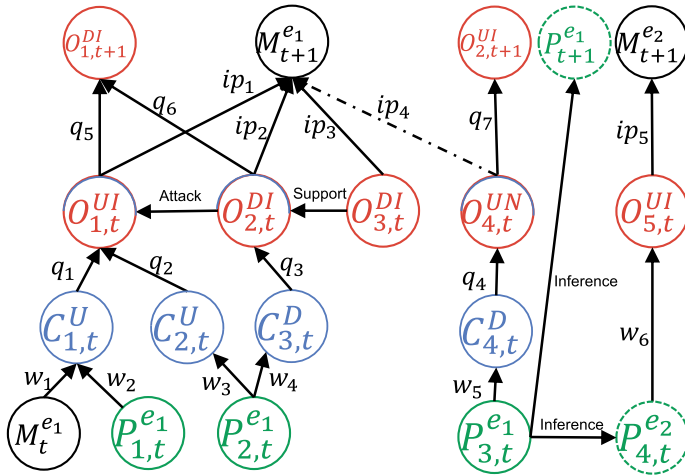


Fig. 2.7 Relations among opinions and target entities

example, claim $C_{1,t}^U$ is based on M_t^{e1} and $P_{1,t}^{e1}$. Because good news does not always lead to increased stock prices, the same premise may lead to different claims. The structure of $P_{2,t}^{e1}$, $C_{2,t}^U$, and $C_{3,t}^D$ is an example of this case.

After investors form their opinions based on the given facts, they may take actions $O_{1,t}^{UI}$, $O_{2,t}^{DI}$, and $O_{3,t}^{DI}$ in the market—or they may do nothing ($O_{4,t}^{UN}$). This leads to a problem. This example includes two bullish opinions and two bearish opinions. Should we therefore conclude that the investors currently have neutral attitudes about e_1 ? If we remove $O_{4,t}^{UN}$ from the market, will the stock price fall due to the two bearish opinions? Consider an example. If the opinion holder of $O_{1,t}^{UI}$ buys 1,000 shares and the opinion holders of both $O_{2,t}^{DI}$ and $O_{3,t}^{DI}$ only short 5 shares, the influence power (ip) of $O_{1,t}^{UI}$ may be greater than that of others. This shows the importance of evaluating the ip of an opinion. Since this is little discussed in the literature, it is still an open problem.

The opinions at time t not only influence the market at time $t + 1$, but also become the premises for opinions at time $t + 1$. The opinion holder of $O_{1,t}^{UI}$ may change his/her view from bullish to bearish ($O_{1,t+1}^{DI}$) after considering the attack of $O_{2,t}^{DI}$ on the original opinion (i.e., $O_{1,t}^{UI}$). Although $O_{4,t}^{UN}$ may not influence the stock price, the rationale of this opinion may become the premise of someone's opinion in the next time step (i.e., $O_{2,t+1}^{UI}$). Thus, another interesting topic for future work is how to construct a graph that represents the interaction between opinions over time.

Last, although $P_{3,t}^{e1}$ is a fact related to e_1 , it may also be implicitly related to other entities (e_2). That is, an investor may make a claim about e_2 based on information about e_1 . Additionally, investors can also infer possible events for e_1 at time $t + 1$ (P_{t+1}^{e1}) based on the given facts at time t ($P_{3,t}^{e1}$). In Chap. 4, we will discuss how to infer implicit relations between entities given the results of previous work.

2.5 Summary

In this chapter, we provide an overview of the opinion-based financial market, introducing the inherent components of a financial opinion and adopting the concept of argument mining to link financial opinions. We propose an overall picture of financial opinions and the financial instruments. In the rest of this book, we further discuss the sources of opinions and the methods explored before based on the notions proposed in this chapter.

Since there is much discussion about the operations of the financial market, the ideas in this chapter are just one of the possible pictures of the market. We seek to provide an opinion-based point of view so that readers can understand the goal of this book.

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