Knowing What Others Know: Common Knowledge, Accounting, and Capital Markets

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SYNOPSIS: The concept of common knowledge concerning higher orders of knowledge has seen exciting new developments in the fields of philosophy, game theory, statistics, economics, and cognitive science in the recent decades. Even though information lies at the heart of accounting and capital markets research, these new developments have remained at the periphery of these fields. Common knowledge thinking may significantly advance our understanding of financial reporting, analysis, securities valuation, managerial control, auditing, and information systems. Such accounting and business applications will also make important contributions in the form of concrete, real-life examples and applications to the basic fields where the idea of common knowledge originated. This paper is an overview of common knowledge and its actual and potential applications to accounting and capital markets research.

Keywords: common knowledge; accounting; capital markets; beliefs about others’ beliefs.

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INTRODUCTION

In Hans Christian Andersen’s fable, “The Emperor’s New Clothes,” two scoundrels convinced a vain emperor that they could make a magnificent cloth of silk and gold threads invisible only to the incompetent and the stupid. After the emperor gave them money and materials to make the royal garments, they dressed him in nothing at all. Not even the emperor, much less his courtiers, dared admit to not seeing any clothes for
the fear of being branded stupid and incompetent. The public applauded as the emperor paraded in the buff to show off his new “clothes.” Then a child asked, “Why does the emperor have no clothes?” After a moment of stunned silence, others posed the same question.

If the child’s words did not change what the people saw, then why did they change their minds? Are there interesting accounting, capital markets, and business phenomena for which the fable might yield insights?

The Stock Market and the LIFO Inventory Cost Flow Assumption

Before returning to the emperor and his magnificent clothes, consider two stories from the world of business and accounting. First, consider John Maynard Keynes’ classic description of the stock market:

Professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not a case of choosing those which, to the best of one’s judgment, are really the prettiest, nor even those which the average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligence to anticipating what the average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees. (Keynes 1936, Chapter 12).

The second business story concerns LIFO (last-in, first-out) accounting for inventories. Since World War II, U.S. tax law permits use of the LIFO method of inventory valuation for tax purposes by firms that use the same method for preparing public financial reports. During periods of inflation, LIFO can conserve cash by postponing tax payments to the government. Many firms that experienced significant inventory inflation during the 40 years following World War II failed to adopt LIFO accounting. When surveyed about their reluctance to adopt LIFO, corporate financial officers stated that the adoption of LIFO, and the consequent rise in cash flows and fall in earnings, might lower their stock price. Yet, empirical studies fail to reveal any such drop (e.g., Sunder 1973, 1975). How do we reconcile these observations?

Beliefs about Others

In all three stories—the emperor’s clothes, the stock market, and LIFO accounting—what we believe about others and about their beliefs plays a crucial role. Because people were led to believe that the emperor’s clothes were invisible only to the stupid and the incompetent, even as they saw the naked emperor, each hid their supposed stupidity and incompetence by pretending to see his clothes and joining in the general applause. Under the maintained hypothesis about the link between the visibility of clothes and the wisdom of the beholder, applause became the evidence of one’s own stupidity—they must be seeing the clothes but I don’t! Fortunately, one’s stupidity could be concealed from others by joining in the applause. It is possible that everyone in the crowd was privately convinced of his own stupidity and incompetence, and cheered loudly to deny it publicly.

It is also possible that the cheering masses included people who did not believe that they were stupid and incompetent just because they could not see any clothes on the
emperor’s body. Knowing that if they admitted not seeing the clothes, others would falsely regard them as stupid and incompetent, they kept their observations to themselves. Such people did not have to be in a minority, the results would be the same even if no one in the crowd believed in the maintained hypothesis. It is enough that the people believed that others around them believed in the maintained hypothesis.

The child, too young to know or understand the maintained hypothesis, blurted out what he saw, and sent the “house of cards” of beliefs about beliefs crashing. Had the child simply been innocent of the maintained hypothesis, the adults would have ignored his words. Common knowledge among adults that children are innocent made all the difference because they could not ignore his words. If an innocent observation matched the observation of the adult, then it made them doubt the maintained hypothesis. Self-esteem guards against questioning conclusions about one’s own wisdom. Combined with the unusual spectacle of the emperor parading naked and an innocent voice that said so, the weight of evidence turned against the maintained hypothesis. Each expressed doubt reinforced the doubt in others. A child’s innocence, peoples’ belief in the child’s innocence, and peoples’ belief in the other peoples’ belief in his innocence all played a role in public recognition of what all could plainly see but would not admit.

The higher the orders of beliefs on which the applause was based, the easier it would have been for the child’s remark to change their minds. As a house of cards gets taller, it takes just a slight nudge to bring it down.

**Stock Market as a Beauty Contest**

What about the stock market? Keynes (1936) suggests that the decision rules become better at describing how the stock market works as we move up the hierarchy he created. Suppose the price of Microsoft shares today is $100. I believe that, given the future plans and prospects of Microsoft, its fundamental value a year from now will be $125. Should I buy the shares now? At Keynes’ (1936) first level of analysis, if my cost of capital is less than $25 for this year, then the answer is yes.

At Keynes’ (1936) second level of analysis, suppose I also believe that a year from now other people will believe the fundamental value of Microsoft is $90. Is it still a good idea to buy the shares at $100 now? No—because in this case, I expect to incur a loss of $10 by acting on my own beliefs about the fundamental value. Unless I have enough confidence and economic power to influence others’ beliefs to coincide with my own, the market will follow others, not me.

In the stock market, too, our beliefs about others’ beliefs play a key role. Why were many people jittery at Federal Reserve Chairman Alan Greenspan’s public mention of “irrational exuberance”? Not everyone is sure of what others think of Mr. Greenspan’s views. If they believe that others in the stock market pay attention to Mr. Greenspan, then it is not rational to ignore his words.

**A LIFO Story: Managers’ Beliefs about Investors’ Decision Rules**

Let us return to the LIFO inventory accounting method. Business organizations address the agency problem of aligning the incentives of the hired managers and the interests of shareholders by linking the compensation of the former to changes in shareholder value. Such linkage makes the shareholder value reported by the manager subject to opportunistic manipulation. If stock market values are less manipulable than accounting values, then compensation could be linked to stock prices. In an efficient stock market, this solution to the agency problem should work reasonably well.
Suppose a manager is induced to maximize shareholder value as measured by stock prices. What should the manager do if he knows that the adoption of LIFO accounting increases the present value of cash flows of the firm but lowers its reported income? If the objective of the manager is to maximize the present value of firm’s cash flows, then the right course of action for the manager is clear. As in the case of Keynes’ (1936) stock market example, because investment decisions can be made on the basis of the fundamental value of the firm, the manager should adopt LIFO if it increases the net present value of cash flows. However, there is another layer to the story.

The shareholders recognize the difficulty of observing either the manager’s actions or the future cash flows and link the manager’s compensation to stock prices. Such a manager considers not only the direct effect of his actions on the cash flows and fundamental value of the firm, but also on the stock prices. If the stock prices are the fundamental value—the present value of investors’ first order beliefs about cash flows—then we should expect such a manager to adopt LIFO.

What if the manager doubts that investors use the fundamental valuation rule? The manager may well decide that his own interests are best served (higher stock prices yielding greater compensation) if he does not adopt the income-reducing LIFO decision. Amershi and Sunder (1987) analyzed the common knowledge consequences in accounting. They proved that an error in the manager’s beliefs about how shareholders value shares prevents even an efficient stock market from disciplining the manager for making bad decisions. Depending on their beliefs about investor behavior, managers may rationally fail to adopt LIFO, while knowing that LIFO saves cash for the firm.

An Emperor’s new clothes, stock prices, and LIFO adoptions are but three examples of problems arising from consideration of common knowledge.

COMMON KNOWLEDGE

In his *Treatise of Human Nature*, Hume ([1740] 1976) argued that all agents must know what behavior to expect from one another in order to engage in coordinated activity. Common knowledge is a technical term in philosophy, statistics, game theory, and economics denoting knowledge that includes knowledge about what others know. Simply put, a piece of information is common knowledge between agents A and B if both A and B have the information, and both A and B know that the other has the information, and both A and B know that the other knows that the other has the information, and so on to the higher orders of knowledge. Common knowledge is the combination of all orders of knowledge from the first to the highest conceivable.

As with many other mathematical concepts, such as a point or a line in geometry, common knowledge is easier to visualize than to realize in practice. Cognitively, it is difficult to think consciously about orders of knowledge beyond the first few. Yet, common knowledge is a valuable theoretical benchmark. A great deal of accounting and finance literature assumes common knowledge.

Arriving at Common Knowledge

Whether we need explicit cognition of each nested layer of knowledge in order to arrive at common knowledge remains debatable. Lewis (1969, 57–58) mentions agreement, salience, and precedence as three ways of arriving at common knowledge:
• If two or more parties negotiate an agreement, and do not misunderstand the agreement, then it is reasonable to think that the contents of the agreement are common knowledge among the parties.

• Salience is a weaker basis for common knowledge. Salient features are more likely to be common knowledge than others. Schelling (1960) uses an overlapping concept of focal point in a similar vein. If people are more likely to believe that the others will also choose a feature that they find to be salient, then such features become a focal point for their actions.

• Precedence or past conformity, even in absence of agreement or salience, can be a third basis for common knowledge. If everyone conformed to a pattern of behavior in the past, then it is more likely that everyone understands that behavior, and that they are also likely to continue to conform in the future. Using the right hand to greet people or to wave goodbye is an example of common knowledge by precedence.

Agreement, salience, and precedence make common knowledge possible but do not ensure its attainment. Familiarity with one another may generate agreement and precedence. Before the cell phone era, Schelling (1960) discussed the problem of a husband and wife separated in a mall without a prearranged rule for where they would go if separated. He conjectures that most spouses have enough common knowledge to go to a “focal point” where each expects the other spouse to go. Schelling (1960) does not cite evidence to support this conjecture.

“The Newlywed Game” and Coordination

However, there are counterexamples where familiarity may not help. In “The Newlywed Game” television show, married couples were brought to the stage and each spouse was asked the same question independently, such as, “Where would you like to dine together?” Identical answers won them a prize, inducing them to think like Keynes’ (1936) stock market investors or the beauty-contest participants. Common knowledge is not enough to win this game. Unless their personal favorites are identical, the spouses also need a coordinating convention about the order of reasoning they will apply in answering the question (Lewis 1969). Suppose the husband likes H and the wife likes W, and these preferences are common knowledge between them. They both could name their own preferred restaurants (level one), H and W, respectively, and fail to win the prize. Or they could name the restaurants preferred by the spouses (level two), W and H, and still the miss the prize. Moving further up the levels of reasoning does not help unless the level of reasoning underlying their answers differs by an odd number (1, 3, 5, etc.).

Common knowledge is the basis of language, communication, and social life. Consider the problem facing the commanders of two army divisions who are trying to coordinate their attack at their common but powerful enemy from two opposite sides. They win if the two attack simultaneously, and lose otherwise. The only way available for them to coordinate their attack is through a messenger who tells one commander when the other will attack. However, there is a small chance that the messenger will be captured by the enemy and not reach the other commander to deliver the message. Halpern (1986) shows that there is nothing the two commanders can do, with the primitive communications technology available to them, to increase the chances of victory through a coordinated attack from both flanks of the enemy. Sending confirmations of confirmations does not help as long as there is a nonzero chance of missing on the confirmation. If this chance is zero, then confirmation is unnecessary.
As the commanders receive each confirmation, they climb progressively to a higher order of knowledge toward common knowledge. Yet, their optimal action remains unchanged until they actually attain common knowledge (Rubenstein 1987). Arriving at common knowledge through iterations in this instance is not possible. It is possible to create simple examples where a group fails to arrive logically at common knowledge. We need more examples of links between theoretic analyses and actual human behavior.

COMMON KNOWLEDGE AND “CONVENTIONAL WISDOM”

In contrast with Galbraith’s (1958) conventional wisdom, a term with diverse and charged economic and social connotations, common knowledge is neutral. Galbraith’s (1958) use of conventional as well as wisdom drips with irony, referring to ideas whose elevated status in the market for ideas is no more legitimate than inherited wealth is in the market for talent. In rejecting stifling conformity with elite opinion, Galbraith (1958) followed the tradition of Bohemians and “Beat” poets who viewed the establishment as a “nameless, faceless conspiracy against innovation and dissent” (Foer 2001).

Others, starting with logician, scientist, and pragmatist Charles Sanders Peirce (1931–1960), view conventional wisdom as the filtered wisdom of society, indicating prudence and social consensus that marginalizes demagoguery. McCroskey (1969) defends conventional wisdom and gives seven concrete examples. Conventional wisdom is, perhaps, boring and banal simply because it is unassailably correct.

But compared with other methods of regulating ideas—totalitarian dictatorships, doctrines of papal infallibility—CW is remarkably open-minded. American social movements arrive and shout their ideas: Ban child labor! Outlaw abortion! Redistribute wealth! And CW responds in its reassuringly predictable pattern. First it dismisses these ideas, then it argues with them, and then it reconsider and absorbs the insurgent movement’s best insights into the mainstream. (Foer 2001)

In accounting, the idea of Generally Accepted Accounting Principles (GAAP) is a pragmatic, consensual interpretation of conventional wisdom. Galbraith’s (1958) irony and implied criticism is largely absent in accounting contexts. Common knowledge appears in accounting and control in several forms, though not always explicitly.

COMMON KNOWLEDGE AND ACCOUNTING AND CONTROL

We can think of every organization as a set of contracts among participating individuals or groups. The provision of shared information among the contracting parties helps design and implement these contracts, and makes it possible for organizations to function (Sunder 1997, 2002). Contracts are mutual understandings, explicit or implicit, short-term or long-term. Both an apartment lease and a lunch date with a friend are contracts. Agents are rational in the sense that they do not knowingly choose what they do not like. Contracts obligate each agent to contribute resources—capital, skills, or information—to the organization’s pool and, in return, entitle each agent to receive resources from the pool. The form, amount, and timing of resources an agent gives and receives are a matter for bargaining among agents.

Accounting and control systems serve several essential functions in these contracts. They measure resource contributions, measure distributions of resources to each agent, determine contract fulfillments, and disseminate information to potential participants in the system of contracts. Most important for our present purposes, accounting also provides common knowledge for conflict abatement and resolution.
Shared Facts for Conflict Resolution

Disputes waste resources; knowledge-sharing helps avert and settle disputes. Unsettled conflicts among agents weaken, or even wreck, the complex fabric of socioeconomic exchanges from which so much of our prosperity is derived. Industrial strikes and lockouts are examples of such conflicts. The practice of carefully collecting and sharing information arises to meet this fundamental demand for a means to preserve our socioeconomic system. Sharing knowledge and expectations is a large part of acculturation and socialization.

Many conflicts in families, neighborhoods, workplaces, and trade are averted or settled by sharing information. Courts rely on written documents and the testimony of witnesses—both forms of shared information. However, only a minuscule proportion of all conflicts ever enter the courts of law; most conflicts are promptly and inexpensively resolved or prevented through systematic provision of shared information outside the courts.

Defining executable contracts among agents also requires common knowledge. The use of variables that are not common knowledge in contracts gives rise to contention or deception. Common knowledge is more than the observability of an event by all parties; every party must also be aware of its observability to the other. When everyone knows about the event, but not about others’ knowledge of it, some may be tempted to use such information opportunistically, creating conflict avoidable by common knowledge.

In addition to its other functions, accounting and control produce common knowledge to help define contracts among agents. Deciding involves two kinds of uncertainty: imperfect and incomplete information. In the first, the rules or structure are common knowledge, but we do not know about events and actions of others. Roulette, for example, is a game of imperfect information. The players know the rules of the game and the probabilities of various outcomes, but they do not know where the ball will stop. In viewing accounting as an information system for decision making, assuming that all parties know the players and the rules of the game, we model accounting as a system with imperfect information.

If we do not know the rules or structure of the problem, we decide under more difficult circumstances called incomplete information (Harsanyi 1967, 1998a, 1998b). In “The Wizard of Oz,” Dorothy faces a game of incomplete information. She knows neither the rules nor the players in the game, who keep popping up to surprise her. Accounting, as a system for implementing contracts or as an accountability system, must function effectively in an environment of not only imperfect, but also incomplete information. In the less certain and more complex environment of incomplete information, accounting informs agents not only about events and the actions of others, but also about the structure of the game and the relative positions of the players in that game. Some aspects of accounting and control, such as public disclosure of financial statements, may appear to be redundant until we look at organizations as games of incomplete information.

Common Knowledge for Renegotiation of Contracts

Contracts cover varied periods of time and numbers of transactions. Some contracts to buy are one-time deals while others are long-term commitments. The same is true of labor and capital transactions. With the exception of shareholders’ indefinite commitments, all contracts are periodically renegotiated.

An important function of accounting is to provide information in the form of common knowledge to facilitate contract renegotiation among current participants. Although
agents may also use private information, availability of a common verified database helps eliminate certain types of strategic bargaining that makes some participants worse off without improving the lot of others.

The practice of negotiated renewal of contracts lies between the two extremes of (1) starting a fresh search for potential participants in the appropriate factor market at the conclusion of each contract, and (2) entering long-term or permanent contracts. Uncertainty, the changing environment, and the boundedness of human foresight rule out rigid, long-term comprehensive contracts. Incremental costs of frequent transactions render the “fresh-search” option uneconomical. In addition, participants in the firm learn about local conditions, tasks, and techniques from their previous experience. Increased efficiency of the experienced participants makes it attractive for other participants to want to retain them in the contract set. However, the special knowledge an agent acquires on the job is not available either to the manager who negotiates the agent’s contract on behalf of the firm, or to the potential replacements of the agent recruited from outside. Existing participants seek to exploit this special knowledge by demanding a larger share of resources. Competition among many such participants reduces their ability to increase their compensation. But contract renewal negotiation can give rise to prolonged conflicts.

Dependence of the efficiency of economic relations on the ability of agents to renegotiate contracts by adjusting them to the changing environment occurs throughout economics. Commons (1934) emphasized the role of organizations in promoting continuity of relationships by reducing actual or potential conflict. Hayek (1945) insisted on the importance of rapid adaptation to changes in “particular circumstances of time and place.” Arrow (1969) analyzed the importance of minimizing the cost of bargaining among agents in organizations.

Addressing Information Asymmetries

Wiggins and Libecap (1985) presented a dramatic illustration of how large the deadweight losses to social welfare can be when asymmetric distribution of information prevents economic agents from arriving at mutually beneficial arrangements. Owners of leases that cover a single underground pool can extract as much as 100 percent more oil and gas if they form a partnership to operate the field as a single unit. Yet, most lease owners in the U.S. fail to unitize their leases because they are reluctant to share their superior information about the value of their own leases during negotiations on their relative shares in the net profits of the unitized field. The same lease owners have little difficulty in sharing the cost of exploratory drilling on neighboring lease tracts when there is no information, and the secondary recovery phase when most of the information about the relevant characteristics of the leases has passed into public domain.

Accounting includes a pre-commitment to reduce certain information asymmetries among the contracting parties by sharing information through public disclosure. Public financial statements, accounting policies and significant details in footnotes, management’s analysis of financial statements and results, and even financial forecasts reduce surprises at the time of contract renegotiation. The losses to society from such surprises, and the confrontational attitudes they engender can be so large and have such significant externalities that securities laws in the United States and in many other countries require public disclosure by publicly held firms. In the latter half of the nineteenth century, state regulators in the United States used public disclosure as an instrument to reduce confrontation between railroads and a suspicious public. The failure of many public corporations to meet their common knowledge obligations has generated a public outrage in 2002.
Private disclosure to those who request information is deemed insufficient. If information is only privately available, then many agents will have reasons to doubt that others have the information and may, therefore, be tempted to behave strategically. Public disclosure laws abate such behavior by making financial statements common knowledge. Since contracts of various agents are periodically renegotiated, accounting provides a pool of common knowledge of verified information to all participants to facilitate negotiation and contract formation.

**COMMON KNOWLEDGE AND ACCOUNTING RESEARCH**

Attention to the consequences of the presence and absence of common knowledge may help us gain insights into many areas of accounting research: reporting standards, human cognition and information processing, financial analysis, trading volume, price bubbles, and mathematical modeling of accounting phenomena.

**Accounting Standards**

Accounting standards serve many functions in society. They help define template contracts to save transaction costs, propagate best practices in a corporate economy, and serve as common knowledge rules of the game. Here we examine the last of the three.

Effective accounting standards define the rules of the game in a corporate economy. When rules pop up as surprises, they lose their legitimacy and effectiveness. In the U.S. and in many other countries the process of setting accounting standards is designed to promote them as common knowledge. Such processes include agenda advisory committees, project task forces, exposure drafts, public hearings, open discussion and debate on the merits of accounting standards, and dissemination of standards. In addition to the standard-setting bodies themselves, such as the Financial Accounting Standards Board and the International Accounting Standards Board, accounting periodicals and pamphlets of accounting firms disseminate knowledge about accounting standards. This effort raises interesting and largely unaddressed questions. How close do we get to making accounting standards common knowledge? How far does each layer of knowledge about accounting standards penetrate various accounting constituencies such as CPAs, corporate financial officers, financial analysts, professional investors, casual investors, and students? To what extent does the extent of common knowledge vary across standards? Is the degree of common knowledge of a standard linked to the degree of effective compliance with the standard? How effective are the programs designed to increase the common knowledge of accounting standards? What is the optimal allocation of resources to make accounting standards common knowledge among the accounting constituents?

**Auditing and Cognition**

Certain aspects of auditing can be seen as a strategic game between the auditor and the managers of their client firm (Antle 1982). As in any other strategic game, what is common knowledge among the players is important in the audit process, too. Although auditing research developed a tradition in applying and contributing to cognitive psychology, the field of common knowledge has barely been touched. Consider three related issues:

- The countless loops of nested knowledge included in the mathematical definition of common knowledge seem well beyond human cognition. Most people can no more
comprehend the difference between the 15th and the 16th layers of common knowledge than visualizing a cube in more than three dimensions. Yet, it is possible that we can intuitively understand common knowledge in its entirety, even without a full grasp of all of its parts. People drive cars without understanding thermodynamics and play ball without ever having heard about Newton’s laws. Most cognitive research in accounting confines itself to the first order of knowledge. The field of common knowledge remained almost untouched by auditing researchers until recently, and may yield rich harvests to those who explore its potential insights.

- How much of the behavior and strategies of the auditor and the firm managers are common knowledge between them? What would be the consequences of changing the degree to which the audit plan, for example, is common knowledge between them? With the introduction of statistical sampling during the past few decades, and the move toward greater emphasis on analytical modeling by auditors, research to understand the common knowledge consequences of such innovations could be valuable.

- Cognitive science tradition in accounting pays much attention to how individuals process information and develop their beliefs about the state of the world. Extending this tradition to the domain of common knowledge may yield insights into how we process information about information, and how we develop beliefs about the beliefs of others. Jamal and Tan (2002) is an example of an empirical assessment of the extent to which auditors can predict the preferences and knowledge of their colleagues within the firm.

**Financial Analysis**

The valuation of securities supports a great part of accounting practice and research. Virtually all models of valuation use the fundamental approach rooted in the present value of future cash flows—dividends from equity securities and interest and principal from debt claims. This fundamental model is a definition that cannot be shown to be wrong. All independent variables of this model—the cash flows—are to be realized in the future, forcing us to work with their current expected values. Since expectations themselves cannot be reliably observed, any mismatch between the fundamental valuation model and the data can be blamed on the error in measuring the expectations.

Financial analysis and security valuation use currently available data from financial reports and other sources to estimate the future cash flows to equity claims. In these models current and past earnings, with a variety of adjustments, are projected into the future to estimate cash flow and the current market value of claims. Fundamental analysis is scrupulously confined to the first order of knowledge.

What about the higher orders of knowledge? Do investors think about how others interpret the information they have? A day trader who expects to liquidate his positions within hours must rationally consider higher orders of knowledge. How confident are the investors that others’ interpretations are similar to their own? What if an investor’s own interpretation differs from his belief about how most others interpret the same event? Economic theories of price bubbles (Flood and Hodrick 1990; Allen et al. 2002) rest on such differences arising from two or more orders of knowledge.

**Trading Volume and Price Bubbles**

Literature attempting to explain stock market trading volume is an exception to the frequently made assumption of homogenous trader beliefs. The reason for this exception is
that in a common knowledge environment no trading is possible. If I think that a stock is worth $100, and you bid to buy it at $105, then, given common knowledge of rationality, I should figure that you must know something about the prospects of the stock that I do not, and I will promptly adjust my own assessment of its value to $105—thus eliminating the motivation for trade. Conversely, if I offer to sell the stock to you for $100, then you will adjust your own assessment of its value to $100, again eliminating the motivation for trade. Groucho Marx would resign from any club that admits people like him to its membership. Aumann (1976) shows that it is impossible to agree to disagree under common knowledge. Milgrom and Stokey (1982) proved that common knowledge leads to no trades.

Yet, trading volume in stock exchanges far exceeds anything that could be explained by new investment, consumption, portfolio rebalancing, and liquidity. A great deal of trading is speculative, which suggests that people hold diverse beliefs, and trading mechanisms do not entirely eliminate this diversity. Perhaps Aumann’s (1976) theorem does not describe human behavior because people do not hold common knowledge beliefs.

If, for the purpose of explaining trading volume, we agree that people hold diverse beliefs about the value of stocks and that this diversity persists in spite of their knowledge of its existence, then we open the door for weakening the common knowledge assumption to allow formation of price bubbles in the stock market. Whether for tulips or silver or shares of stock, price bubbles arise because some traders believe that others value the coveted items more. Thus the same relaxation of the common knowledge assumption yields trading volume and price bubbles. Accounting research devotes plenty of attention to the former, but little to the latter.

By analogy, the story of three girls in red or white hats (Littlewood 1953; Gardner 1984) helps explain the reach and interpretation of capital market studies of information content of events. Three girls sitting in a circle cannot see their own hats, and therefore when the teacher asks each girl if she is wearing a red hat, no one can answer. Suppose that all three girls are wearing red hats. If the teacher announces that at least one of them is wearing a red hat, a fact plainly visible to them all—no new information here—then the first girl still cannot answer the teacher’s question; nor can the second, but the third can tell the teacher that she has logically deduced that her own hat is red.

How could the teacher’s announcement contain information? Common knowledge analysis shows that even if a public announcement contains no information of the first order, it contains important information of the higher orders. The fact that the first two girls could not tell if they are wearing red hats, combined with the teacher’s announcement, helped the third girl reach the conclusion that she is wearing a red hat (see Geanakoplos [1994] for proof).

Just as higher order information changes the behavior of the girls in the story, higher order information about future cash flows from securities can also change their valuation in markets where investment horizons are shorter than the maturity of securities. Since an equity security has no maturity, investors value it, at least in part, on the basis of the price at which they expect to sell it. Their expected sale price, in turn, depends on their second and higher order beliefs about future cash flows from the security, a point made so vividly by Keynes (1936) through his newspaper beauty contest story.

**Modeling Accounting Phenomena**

Relaxing the common knowledge assumption may also open the door to a broader class of models and results in accounting, security valuation, corporate finance and
governance. In addition to relaxing the common knowledge assumption to address the earlier LIFO puzzle, consider three other examples:

- Dominance of the fundamental valuation model in accounting and finance is rooted in the common knowledge assumption on beliefs about future cash flows. Usefulness of the fundamental model diminishes with relaxation of the common knowledge assumption except for investors committed to hold the security indefinitely. If an investor plans to hold the security for only a limited time, then his beliefs about others’ beliefs become relevant to his investment decision. Attention to common knowledge may help develop alternatives to the fundamental model that Hirota and Sunder (2002) tested empirically.

- Models of financial disclosure by corporations and grade disclosure by students in job interviews constitute a second example. In both instances it is argued that, given freedom of choice, the best performers will disclose; inducing the second best to disclose, who in turn induce the next best to disclose (Grossman and Hart 1980). This chain of disclosure continues until the very last person, for whom disclosure becomes irrelevant. Given this chain of reasoning, it is in everyone’s interest to disclose.

  The simple elegance of this unraveling argument conflicts with evidence from the field. The fact is that, given the choice, many corporations and job candidates choose not to disclose. Again the unraveling argument also depends on the common knowledge assumption. Weakening this assumption—perhaps the interviewer does not know the unraveling argument!—might aid in building more realistic models of this and many other accounting phenomena (Dye and Sridhar 1995).

- Third, consider the problem of ultimatum games. In these games, two players must divide a fixed sum of money between them, say $10.00. Player 1 proposes a division. If Player 2 accepts the proposal, it is implemented; otherwise both players get zero. A theoretic solution to this game is that the first player should take almost the entire amount, and give the minimum possible amount to the second player. The argument is that the latter should prefer even one penny to nothing. Human experiments indicate that Player 1 gives away between 25 and 50 percent of the amount on average. This is not consistent with game theory.

  Lin and Sunder (2001), show that weakening the common knowledge assumption makes it possible to build models that are much closer to the data than the theoretic solution. Specifically, assume that Player 1 has a probability distribution of Player 2 rejecting the offer based on the amount offered, and offers an optimal amount of money, given this probability distribution. This weakening of the common knowledge assumption holds the promise of building models that more closely describe actual human behavior.

CONCLUDING REMARKS

The past half-century has seen a great deal of thinking about information in the fields of philosophy, game theory, statistics, economics, cognitive science, and accounting. Some of the most exciting developments concern common knowledge, or knowledge about what others know. These developments lie at the periphery of accounting, even though information is often said to lie at the heart of accounting. Common knowledge thinking may shed significant new light on many of our concerns including financial reporting and analysis, security valuation, managerial control, auditing, and information systems.
Thinking about various orders of knowledge will not only yield better understanding of accounting, capital markets, and business, but it will also make important contributions to the fields where this idea originated and developed. Illustrative examples from those fields tend to be simple, lacking real-world flavor. Accounting and business researchers have the advantage of institutional knowledge of information systems, and observations of real behavior in the field. Such data and their analyses are the strength of business research. We can conduct our own research, obtain better insights and examples, and feed them back to the basic disciplines to enrich them through our work.

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