Attention Structures and Valuation Models:
Cognitive Networks among Securities Analysts

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ABSTRACT. This paper suggests that the way competitors interpret a given market situation is based, not only on information on that situation, but also on the (portfolio of) other situations they pay attention to. Specifically, we hypothesize that the more two competitors allocate their attention similarly in the market, the more they will solve a problem they face in a similar fashion. It is so, we argue, i) because competitors make (independent) cognitive associations between the situations they are contingently assessing and the other situations that are in their field of view; and ii) because they are more likely to update and adapt their interpretations on the basis of the assessments made by the competitors with whom their attention patterns intersect more frequently (than with those who allocate their attention farther apart in the market). We test our theory on a sample of financial analysts' forecasts of US listed firms' earnings per share from 2001-2006. We find that, even when blind to each other assessments and decisions, the more two analysts pay attention to a similar portfolio of securities, the more they release similar earnings per share forecasts on a focal stock they both assess. We also find that, once they disclose their independent assessments, analysts who have paid attention to a similar portfolio of securities are more likely to adjust reflexively their forecasts so as to get closer over time. These effects are amplified when analysts share their stock coverage with the same third parties.

INTRODUCTION

How do competitors interpret the different market problems, issues, and situations they face? What shapes the cognitive frameworks through which they assess them? And how are these refined over time? These are questions that speak to the core of economics and strategy. For these questions, economists and strategy scholars have provided answers that rely on the cognitive and organizational capabilities individuals can leverage (March and Simon 1957; Nelson and Winter 1982; Gavetti and Levinthal 2000; Ocasio, 1997). Sociologists have contributed to this debate, bringing novel concepts that shed light on how institutional logics influence the ways in which problems are framed (Lounsbury, 2007), how social networks convey and disseminate information (Burt 2004), and how categorical structures guide the classification of market candidates (Zuckerman 1999; 2004; Hannan, Polos and Caroll, 2007; Pontikes, 2010). In this paper, we are interested in the role played by attention across competitors and market situations. Our core argument is that attention has *connective properties:* 1) it creates (intra-cognitive) links across the issues that are in the competitor's "field of view," and 2) it creates (inter-cognitive) links among the competitors who pay attention to the same market issues. Common to both is the notion that what matters is not only what we focus on but also what is in our peripheral vision.

Building on the first (intra-cognitive) relational property of attention, we will suggest that a given market actor is likely to make associations across the market situations on which she focuses prominent attention. A feature viewed as salient when assessing one market problem might be recognized as relevant for another. That is, the situations across which market actors allocate their attention can make a difference in the salient properties to which they will be attentive. If this is the case, we expect that *competitors that pay attention to the same problems will be more likely to independently make similar associations and, hence, come to more similar solutions on a given problem*, at least with respect to another competitor who regards the same problem but does so with very different ones in her peripheral vision.

Building on the second (inter-cognitive) relational property of attention, we expect that market actors are more likely to come across the assessments of the competitors who focus their attention on the same issues. When two competitors allocate their attention across more similar portfolios of problems, we contend, their assessments become prominently visible to each other. Associations made by one actor become noticeable to the other and vice-versa. Conversely, mutual exposure would be limited, or even absent, when two competitors are not in their respective fields of vision because they are allocating their attention to different market aspects. Because of this mutual exposure (or the lack thereof), we expect that, *the more the portfolios of attention of two actors overlap, the more their assessments will tend to converge*.

Two competitors, meanwhile, are also exposed to other market actors' viewpoints depending on the structure of the broader network of attention in which they are embedded (specifically, whether they are exposed to the views of the same "third" actors). *Redundant attention structures (i.e., networks characterized by triadic closure) increase the likelihood of evaluative resonance, leading to a dominant, univocal way of interpreting market situations within that attention cluster*. More open attention structures, by contrast, increase the opportunities for the emergence and recombination of dissonant views.

In our view therefore the network created by patterns of attention across market actors and market issues is a map to navigate the *cognitive networks* among competitors. The position a competitors occupy vis-à-vis each other in this network affect how similarly or differently they will interpret the same market situation.

To test our hypotheses, we focus on a strategic empirical site in which competing actors selectively allocate their attention to a restrained portfolio of market problems that they evaluate: the securities analysts. Securities analysts select a constrained portfolio of assets for which they write detailed reports presenting their evaluations and assessments. This setting allows us to track the attention portfolio of each analyst as well as the attention network in which each analyst is embedded when she makes her evaluations. We can also leverage the abundant data available on analysts' earnings-per-share forecasts to chart, over time, the difference in interpretation of the same market issue for every pair of analysts who analyzed the same security (on the same day).

We adopt a dyadic, linear regression approach, employing econometric techniques that exploit our panel data, address the dyadic character of our models. Consistent with our theory, we find that two analysts that jointly cover a higher proportion of their portfolio of assets tend to independently issue closer earnings-per-share estimates (on the stocks they both evaluate). We also observe that analysts whose stock coverage overlaps greatly tend to converge more over time in their estimates, even more so when their coverage overlaps with the same third actors.

We divide the paper in the following manner. We will first review the relevant literature that addressed the issue of cognition and attention in financial markets. We will thus develop our hypotheses on how the cognitive networks created by attention pattern across securities analysts affect their evaluative frameworks. After describing the data and the statistical model we use to test our theory, we will illustrate our findings. We conclude by discussing how our findings contribute to several streams of literature.

COGNITION AND MARKETS

For many years the efficient market hypothesis (EMH) has informed theoretical and practical knowledge of how financial markets operate (Fama 1965; Brav and Heaton 2002). The EMH revolves around the assumption of individuals' atomistic calculation, where each individual strives for maximizing his own utility. In this view, no individual is necessarily fully rational, but the market as a collective entity ultimately is. If inefficiency arises in the market, and the price of an asset is misaligned from its intrinsic value, some arbitrageur will immediately recognize the investment opportunity and eliminate the inefficiency. As a result of the autonomous calculation of individuals the market price of assets always matches its intrinsic value.

The sociological response to the efficient market hypothesis initially revolved around the idea that market actors are not autonomous, fully conscious calculators, but individuals who share cultural, taken-for-granted, and often economic suboptimal scripts. "Categorical rules," Meyer and Rowan (1977: 355) argued, "conflict with the logic of efficiency." In their programmatic statement for a new institutionalism in sociology attentive to categories and classifications, DiMaggio and Powell (1991:24) emphasized "the centrality of cognition." But, in shifting the ground from action *as choice* to action *as the semi-automatic enactment* of routines, "cognition" acquired a very specific meaning – referring to "taken-for-granted scripts, rules, and classifications" (Powell and DiMaggio 1991: 15) and, above all, "unreflective activity" (DiMaggio and Powell 1991:13).

The notion that markets are rooted in institutional logics that drive action has stimulated valuable research in economic sociology (Lounsbury 2007; Thornton and Ocasio 2008; Fligstein 2002). Yet, a sociology of economic action will remain impoverished if it continues to reduce cognition to "taken-for-granteds" and "unreflective activity." We see the limitations of the new institutionalism less in the commonly aired complaint that it lacks a theory of how institutions change[1] than in its failure to take into account that there are economic actors in many domains of fast-breaking activity who are aware that taken-for-granteds are likely to be out-of-date. In the field of finance, valuation models, indeed, are scripts – quite literally, formulae. But, in the hands of skilled practitioners, these models are objects of deliberate, reflective action[2] to be updated and adapted. A sociology of cognition must have a role for such agency. If it does so by situating agency in social structures and social processes, it can meet that challenge without returning to the atomistically calculating actor caricatured in the neo-classical framework.

Recent research in the sociology of finance is directly addressing the problem of calculative agency. Inspired by theoretical and methodological developments in Science and Technology Studies (STS), this work focuses on "calculative spaces" populated not only by human actors but also by models, instrumentation, and other "market devices" (Callon 1998; Callon and Muniesa 2005; Callon, Millo, and Muniesa 2007; Beunza and Stark 2004; Lépinay 2011). Calculation, in this view, is a form of distributed cognition, socially distributed across networks of individuals, artifacts and devices[3].

Prominent in the new finance literature drawing on STS is the "performativity" perspective led by Donald MacKenzie (MacKenzie and Millo 2003; MacKenzie 2006; MacKenzie, Muniesa, and Siu 2007). That approach focuses attention on financial models. Models, argues MacKenzie, are not representations of markets; they are interventions. As the title of MacKenzie's recent book contends, they are "an engine not a camera" (MacKenzie 2006). Performativity occurs when a model, such as the Black-Scholes model for option pricing, diffuses throughout a financial market. A model, even one that is flawed, can be said to

[1] Several works on institutional theory have recently provided theoretical and empirical accounts describing how institutions change (e.g., Hoffman 1999; Holm 1995; Greenwood, Suddaby, and Hinings 2002).

[2] In a later essay, DiMaggio recognizes that automatic thought does not exhaust the forms of cognition to which sociologists should be attentive. He specifically points to "deliberative cognition" as "a quite different form of cognition, which is explicit, verbalized, slow, and deliberate. When sufficiently motivated, people can override programmed modes of thought to think critically and reflexively" (DiMaggio 1997: 271).

[3] It follows that agency, too, is similarly distributed. To a network analytic sociologist, the notion of "actor-network" in Actor-Network Theory (ANT) might suggest that there are actors (humans) in networks. But "Network-Actor Theory" might have been the more apt label for this school because the radical break of ANT was to conceptualize the network (of humans and non-humans) as the relevant unit of distributed action.

“perform the economy” when its use improves its predictive fit. Like a map with instructions “This is how to get from A to B,” the more the model is used by actors the more it will predict their course. In the performativity approach, improvement of predictive fit is a function of its widespread use – not of its refinement, updating, modification, or adaptation in the hands of traders. Herein lies one of the major limitations of the performativity approach. Agency is distributed – among the model itself, the academic economists who formulate the model, and the regulators who embrace it. But deliberate cognition occurs only in the minds of the academics who developed the mathematical model. Once it is recognized as valuable by practitioners, the model becomes taken for granted, passively enacted by each and every actor. Within a market there is one model that performs it.

Alongside the performativity school, an alternative approach also with a direct lineage to Science and Technology Studies and led by Karin Knorr-Cetina, stresses the role of “epistemic communities” (Knorr Cetina 1999, 2007). Knorr-Cetina's main contribution is the idea that a modern financial market is not an ensemble of atomistic individuals but is, instead, a global collectivity that transcends physical co-presence. Most importantly, in contrast to the view that a set of market actors needs tangible, local space-sharing in order to emerge as a community (Abolafia 1996), Knorr-Cetina argues that an epistemic community may be constructed through screen-mediated joint attention.

Knorr-Cetina develops this perspective by reaching back to classical insights in micro-sociology (Schultz 1964, 1967; Garfinkel 1967; Goffman 1972) and then extending these to the hyper-connected, warp-speed world of quantitative finance. Focusing on processes that are constitutive of local order, and specifically on the role of situational interactions, micro-sociologists had examined "any physical area anywhere within which two or more persons find themselves in visual and aural range of one another" (Goffman 1972: 63). The most commonly studied form of local sociality was eminently discursive (Garfinkel 1967), built around how individuals play "language games" to coordinate and create social order (Wittgenstein). Two persons who are in each other's field of vision, however, coordinate their activities also through nonverbal processes. The reciprocal orientation of social actors toward one another makes another person's presence and consciousness accessible as the background for overt interaction (Schultz 1964: 27-33). But micro-sociologists also identified an even more subtle form of sociality upon which Knorr-Cetina bases her argument: Two persons might be brought into a "state of intersubjectivity" not only by discursive interactions or by looking at each other but also by watching the same event, their experience thereby changing in similar ways in response to what unfolds (Schultz 1967).

Knorr-Cetina leverages this latter form of micro-sociality to overcome the confinement of micro-order to the physical setting and mutual co-presence. In modern financial markets, where space is separated from place and where interaction can be disembedded from local settings, the computer screen facilitates a new form of global, yet still micro, sociality. Not unlike MacKenzie, who states that models are not representations of markets, Knorr-Cetina asserts that the screen does not represent the market; instead, it "appresents" (Schultz and Luckmann 1973: 11) the market.[4] That is, it brings that which is geographically distant and invisible near to

[4] Knorr-Cetina’s work can be seen, in part, as an answer to the question “where is the market?” The screen world is not representing a market that is elsewhere; it is the site at which the market is present.

participants, thus rendering it "interactionally present," or, in Knorr Cetina and Bruegger's (2002: 909) words, "response present." In so doing, the screen enables recursive mechanisms of reciprocal sense-making: Once two observers construct a textual or visual rendering of the observed (in our case of securities analysts, for example, a report on the firm's strategy, a chart on the asset price trend, an estimate on the firm's earning, etc.) and televise it through the screen, they "may start to react to the feature of each other's reflected, represented reality rather than to their own embodied, pre-reflexive occurrences" (Knorr Cetina 2003: 8).

Our approach draws on Knorr-Cetina's concept of screen-mediated joint attention. But there is an important difference. In Knorr-Cetina's account, the global micro-structures of a modern financial market result in a *single epistemic community* – one market, one epistemic community. In our perspective, by contrast, the screen not only mirrors the interpretations of distant actors but also conceals the views of those that do not appear there. While the screen grants access to the evaluative practices of analysts with whom a focal analyst shares stock coverage, it also obscures the evaluative practices of those that are focusing their coverage elsewhere. In network analytic terms, Knorr-Cetina's account of an attention structure with all players jointly, simultaneously, and, indeed, universally attentive to the same appresented market could hold only in an extraordinarily dense, almost fully-connected graph. Our approach, by contrast, posits that a financial market is unlikely to be composed of *an* attention structure. Accordingly, we examine the effects of actors' differential location in structures of attention.

Thus, like MacKenzie, we focus on valuation models; and, like Knorr-Cetina, we analyze patterns of screen-mediated joint attention. But we depart from their one market-one model, one market-one community characterizations. Markets, even those in which there is a basic model that is conventionally accepted, are populated by actors with heterogeneous views who are attempting to improve their specific models in competition with other actors holding different beliefs.

The notion that markets are comprised neither of a univocal model nor of a single epistemic community but of multiple belief communities is the core insight of Ezra Zuckerman's (1999, 2004) account of securities analysts. Although multiple, each of these viewpoints is a robust and emphatically coherent belief system. For Zuckerman, *markets are composed of segmented communities with strong cognitive boundaries built around established categories*. Analysts who specialize on the same category of securities (typically within the same industry) share a common, distinct, interpretive framework. Indeed, securities that are positioned across such interpretive communities are penalized for their "categorical mismatch" (Zuckerman 1999) and, for similar reasons, exhibit greater price volatility (Zuckerman 2004).

We build on Zuckerman's insights, for they provide an important stepping stone to understand how the distribution of attention in markets affects valuation. We depart from him, however, in several important respects. First, and fundamentally, our objectives are different: Zuckerman is

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For Knorr-Cetina, the screen is considered the "building site on which *a whole* economic and epistemic world is erected" (Knorr Cetina and Bruegger, 2002: p.13, emphasis added).

not interested in explaining the formation and evolution of valuation models; the dependent variables that he explains are security mispricing and stock price volatility. Whereas Zuckerman's primary objective is to study the *activity of securities* (i.e., how the firm is positioning itself vis-à-vis an established categorical structure) our primary objective is to study *the activity of analysts* and how their location within structures of attention shapes this activity. For Zuckerman, patterns of actors' attention are analytically useful – but only because they can stand in as a measure of the coherence or incoherence of the securities themselves.

Our second departure follows directly from the first. Because Zuckerman uses analysts' patterns of attention to make inferences about the categorical coherence or incoherence of securities, his models are based on an assumption that every analyst is located within a coherently bounded, categorical community. That is, although his view of markets as comprised of multiple models provides a sharp contrast to the one-model-per-market view in the performativity school, nonetheless, for Zuckerman, within each cognitive community there is a single univocal model. This is a necessary assumption underlying his analytic and methodological strategy. Because our problem is different, we can relax that assumption. Among analysts specializing in the same industry, we can find analysts that hold different valuation models. For us a cognitive community is not necessarily a categorical community but is an observational network. We do not assume that attention structures map isomorphically to classificatory categories.

Third, we differ from Zuckerman in specifically addressing the question of how models evolve. By exploiting panel data, we can chart how analysts compete to develop models that out-perform their rivals and how such updating is shaped by their exposure to the views of these rivals themselves.

COGNITIVE NETWORKS AMONG SECURITIES ANALYSTS

Making associations across a portfolio of attention

Consider analyst i evaluating focal stock S. One way to think about actor i and security S is that she is focusing her attention on that security. But analysts, like other actors who evaluate assets, seldom assess only one stock. They do so in relation to other, more or less comparable, securities. Although we commonly speak about an actor *allocating* attention, in fact, the very process of focusing on an object entails *locating* it in a field of other objects (Podolny and Hill-Popper 2004).

Thus, in addition to paying attention to focal stock S, actor i is also allocating attention to securities T, U, and V. In network terms, securities S, T, U, and V are linked through their common ties to actor i. In terms of the process of evaluation, the fact that analysts allocate their attention across multiple securities raises the possibility that they make associations among them. In particular, we are attentive to the possibility that features that arise as salient in the assessment of one security can become salient in the valuation of others within the analyst's structure of attention.

Let us assume, for example, that analyst i observes that firms T, U and V have dramatically increased their earnings after expanding their businesses overseas. Analyst i will likely consider international expansion as a factor to take into account in her model, and she will be inclined to positively associate such activity to firms' earnings. She will thus be inclined to be optimistic in her estimate of S' earnings, if S invests abroad. Conversely, if S invests only domestically, analyst i will more likely to be pessimistic about S's earnings. To take another example, we can consider the case of Henry Blodget, recently examined by Beunza and Garud (2007). Blodget was an analyst at Canadian bank CIBC Oppenheimer, who became a celebrity in the pre-internet-bubble period for his prophetic prediction on Amazon's stock price target. In October 1999, Blodget issued an extraordinary bullish estimate which attracted large attention in the financial community. This estimate was in sharp contrast to the estimate issued barely a few hours later by Jonathan Cohen (a financial analyst at Merrill Lynch). In analyzing Blodget's and Cohen's reports on Amazon, Beunza and Garud (2007) argued that behind these analysts' different estimates was the fact that they were comparing Amazon to different firms: Blodget was making associations to Dell Computers, Cohen to Barnes and Noble.

To test whether actor i's assessment of a given security S is shaped by the associations she draws among the other stocks in her field of attention, we cannot access the intra-subjective states in the mind of calculating agent i. But we can gain analytic leverage from the fact that other agents, j, k, and l are also making assessments of S while allocating their attention across other securities that may be nearly the same as (or different from) those of analyst i. Analyst j, for example, might be observing S, T, U and W; while analyst k is observing S, A, B, and C; and so on.

We can thus compare actor i's assessment of focal stock S with those of all other actors who evaluate that stock. In such dyadic comparison, we can compute the similarity or dissimilarity in the coverage portfolio of each pair of dyads. If we find that analysts with similar portfolios make similar assessments of focal stock S, then we can draw the conclusion that the analysts' valuations are shaped by associations made across the securities in their portfolios.

We thus exploit the network ties that are created when multiple agents allocate their attention across multiple situations. The resulting patterns yield a social structure of attention. Securities are located within a network structure of attention given by the actors who observe and evaluate them. Meanwhile, actors are also located within a network of attention given by the ties that connect them through the situations they observe and evaluate. Note the peculiar feature of this network. There are no direct ties among the agents. They are not proximate because of some personal connection. Their location in the social space of attention – their proximity to or distance from each other – is a function of ties formed through the situations they pay attention to.

We define proximity in such an impersonal (two-mode) network as the overlap in the coverage structure of an analyst dyad, that is, the proportion of securities that two analysts concurrently evaluate. The more proximate are the members of a dyad, the more opportunities they have to make associations across the same securities. Members of a dyad with high coverage overlap will be focusing on focal stock S against a common background composed of the other securities to which they are both paying attention. The members of a dyad who are more distant from each other (with non-overlapping coverage) will see the figure (focal stock S) differently because seen against very differently patterned backgrounds. Making associations across differing sets of securities, their estimates of focal stock S are likely to be more distant from each other.

Because we contend that analysts' valuations are shaped by associations made across the securities in their portfolios, we hypothesize that

> H1: *the more the members of a dyad are proximate in the social space of attention, the more similar will be their assessments of a given security*.

Updating shaped by attention similarity

Consider again analyst i, now with her portfolio of securities S, T, U, and V. She has developed a model to evaluate these securities. And she has offered, early in the calendar year (therefore blind to the estimates of other competing analysts), a contingent estimate of the end-of-year performance of these securities. She must now continue to issue more reports to her client investors, responding in a timely manner to the release of new information about these securities. In this, she is aided by her model.

Analyst i has confidence in her model; but confidence in the model does not require that the analyst be entirely closed off from entering new variables into it. Whether deliberately willed or so deeply grounded in her professional habitus that it lies beneath conscious effort, she will be tuned to episodically ask, "What am I missing?" (Beunza and Stark 2011). In this search process, analysts make inferences about the cognitive processes of their rivals. Our argument is that location in the social structure of attention disproportionately leverages exposure to some rivals' arguments and not others. Here, in telegraphic form: We argue that an analyst's location in a network of attention is an avenue to intersubjectivity. We elaborate the specific mechanisms below.

We return to analyst i, monitoring securities S, T, U, and V, and bringing increasing realism into our account, she is monitoring information on these securities on her monitor. The networks that we shall monitor, in turn, are not face-to-face but face-to-screen. Our attention to the face-to-screen setting follows Knorr-Cetina. But whereas her analysis emphasizes that market participants have a common gaze – seeing the same market on globally dispersed screens – we emphasize the fact that analysts must necessarily have only a partial view. A screened vision means that some information is revealed while other information is screened from view.

The information that analyst i is exposed to on her monitor includes estimates and opinions of rival analysts who are also monitoring the security or securities that she is evaluating. And when she participates in conference calls, she also has opportunities to pay attention to the queries and comments of these same rivals (and they similarly have opportunities to be exposed to her opinions). But note that all of the analysts that are updating estimates on focal stock S have access to their rivals' opinions about focal stock S. The fact that actor i is exposed to the opinion of actor j does not automatically mean that actor i will take these opinions into account. But distinctive locations in the network of attention provide selective access, disproportionate exposure to the subjective views of particular others. The more i and j are proximate, the more they will be mutually exposed to each other's opinions about securities *other than focal stock S*. The more exposed to these subjective views, and consequently the more opportunities for reciprocal influence, the more their estimates *of focal stock S* will converge because the more their models for evaluating securities have co-evolved.

Moreover, as the models of i and j become more similar in their mutually attentive co-evolution, the opinions of each other are more easily recognized. They are more salient because they are more familiar. To analyst i, the proximate views of analyst j are more familiar not simply because she is exposed to them more often. Because of their reciprocal influence, the opinions of j increasingly come into a comfortable fit with her conceptional schemata. They are recognized as salient because they resonate, they fit.

Note, finally, that analyst i is not updating her model through some heroic process of intellectual self-reflection. To make adjustments that improve her model, she need not rely solely on her intellectual prowess, analytically powerful as it might be. Instead, she can leverage the fact that the activities that she conducts as a regular part of her work as an analyst – monitoring securities – will expose her to the viewpoints of other analysts. The structure of attention in which she is embedded is a kind of "cognitive scaffold" (Clark 1993) supporting and facilitating the work of updating her model. Not a property of the individual analyst, reflexivity, in this view, is socially distributed.

Because we contend that analysts' updating of their valuation models is shaped by their location in a network structure that disproportionately exposes their attention to the subjective views of some rivals and not others, we hypothesize that:

> *H2: The more the members of a dyad are proximate in the social space of attention, the more their assessments of a given security will converge over time.*

Updating shaped by attention closure

We have considered the attention structures of analyst i and analyst j (together with all the other members of the dyads that are evaluating focal stock S) as a function of their coverage overlap. We have done so to emphasize that focal stock S is not the only security upon which they focus their attention. We have argued, and our statistical analyses will demonstrate, that the information and assessments they are exposed to about these other securities are shaping their valuations of focal stock S. Our attention now turns to another question: does it matter how uniform or diverse are the subjective views that i and j encounter when they are paying attention to these other securities?

To do so, we must locate the dyad (i, j) in a cognitive network that includes the other analysts (e.g., f, m, g, k). Specifically, we examine the extent to which i and j are connected (via their coverage) to the same third actors (Burt 1992). Our concern will be to ascertain whether the resulting cognitive networks surrounding the dyad exhibit openness or closure.

We consider the dyad's location in the broader attention structure because we want to capture the extent to which the members of the dyad are exposed to views of greater or lesser diversity. When the dyad is embedded in more open networks (with less triadic closure, less "constraint" in Burt's terminology), the members of the dyad will be exposed to more diverse views because the opinions expressed about the securities they are monitoring will come from more diverse viewpoints. Whereas open networks can expose the dyad to discrepant, even dissonant messages, the recursive cycles of closed networks can build up resonance. When the dyad is embedded in a closed network (with more constraints imposed by greater triadic closure), diversity will be reduced because i and j are mutually encountering resonant opinions from other analysts who coexist with them in a relatively closed cognitive community.

Take for instance the example illustrated in figure 1. The network of attention surrounding the dyad composed by analysts i and j is "open". The two analysts share 50% of their stock coverage with each other (i.e. they cover together four out of the eight stocks that each of them cover), as well as with all the other actors with whom their attention patterns overlap. Specifically, analyst i shares 50% of her coverage with analyst j, f, w and m; whereas analysts j shares 50% with i, g, z and k.

Insert Figure 1 about here

Hypotheses 1 and 2 suggest that i will be equidistant in the attention space from j, m, w and f; whereas j would be equidistant from i, z, g and k. Because of the lack of "triadic closure" between i and j's coverage, however, i and j will be the dyad subject to less recursive cycle of influence. The only chance i will be affected by j's assessments, and vice versa, is through the opportunity to come across to each other evaluations of the four stocks they cover together. Take instead, for instance, analyst i and m. Not only do they come across to each other's evaluations through the stocks they cover together but also through the other analysts that they jointly influence (i.e., analysts f and w). Analysts i and m surrounding attention structure is more closed than that of i and j. Because we contend that closure in attention structure dampens exposure to diverse subjective views, we hypothesize that:

> H3: *The more the members of a dyad have stock coverage in common with the same third actors the more their assessment of a given security will converge.*

DATA AND METHODS

Empirical Setting

Securities analysts are employed by investment banks to give or sell investment advices to individual and institutional investors who are the bank's clients. To do so, securities analysts are assigned (or, in some cases, they may select) a portfolio of firms to cover from the set of publicly listed firms that are within their industry of expertise. About these firms within their "coverage" portfolio, analysts write detailed reports. These reports contain important figures and measures, such as the analyst's estimate on firm's future earnings per share, the firm's stock price target, and a summary recommendation to buy, hold, or sell. Analysts' reports, however, do not contain only figures but also sophisticated narrative arguments explaining the numbers presented (Beunza and Garud 2007).

Writing such reports is an intensive, resource-consuming activity that requires deep scrutiny of the firms in an analyst's stock coverage. For each of these firms, analysts must collect and distill data on economic and accounting fundamentals as well as information on business strategy, corporate governance, senior personnel, product development, and operations. To do so, they must read and analyze annual reports, attend conference calls, chart stock market prices, and make sense of an overwhelming barrage of information. Analysts must therefore be selective on the stock they cover (Rao, Greve, and Davis 2001), and presumably they must pay close attention only to those stock for which they write reports. These characteristics make the securities analysts' context an ideal one to track the attention structure of financial actors over time. By tracking the stocks about which analysts have written reports, we can be confident we are mapping a reliable proxy of their attention structure.

The analysts' context is also an appropriate one to test how evaluative arguments flow in financial markets and to study specifically how the reciprocal direction of attention to the same assets influences such arguments. There are, indeed, many occasions when the reciprocal attention allocation of two analysts matters. By covering the same stock, two analysts attend and ask questions at the same conference call, see each other's interviews in articles in the financial press or on TV talk shows, and track each other's commentary on specialized blogs or other web-based venues. Most importantly, they actually read each other's reports. What another analysts thinks to be important in evaluating stocks as well as their stated reasons justifying such assessments does not have to be inferred from the aggregate behavior of the market: It can be extrapolated from the many textual and discursive artifacts that circulate in the community and that are projected on the analysts' screens.

Data

Our analysis is based on a sample of analysts' earnings per share (EPS) forecasts included in the Institutional Brokers' Estimate System, or I/B/E/S. Almost all American analysts enter their EPS forecasts and recommendations directly into this electronic system. We extract from this database, all the estimates on the yearly earnings per share of firms listed on the 3 major US stock exchanges (i.e., AMEX, NASDAQ, NYSE).We also use COMPUSTAT to gather firms' accounting information, CRSP to collect stock price data, and rankings in the *Institutional Investor* magazine as an indicator of the status hierarchy in the financial analyst community.

One assumption of our theory is that analysts play a relative fair game, that is they build their estimates by processing *publicly* available information according to their valuation models; no analyst holds privileged information on a given stock. This assumption is reasonable only after October 23, 2000, the day in which the SEC's fair-disclosure regulation was introduced to prohibit firms from providing private disclosure of material information to particular analysts or investors. Our sample, therefore, includes estimates for the years 2001 to 2006[5]. Consistent with the extant literature, we include only observations pertaining to firms that have a December year-end report (Francis and Philbrick, 1993; Hillary and Menzly, 2006).

[5] As a robustness check we also run our regression analysis on a sample of estimated that goes from 1993 (first year in which data are available in I/B/E/S) to 2006 and we find qualitatively similar results.

Analytic Strategy

The above mentioned characteristics make the securities analysts' setting a strategic research site to capture the attention structure of competitors and study its influence on their evaluations of a given situation. There are several features, however, in which our context differs from an ideal laboratory. If we could design a laboratory experiment to test our theory, we would first randomly assign different (more or less) overlapping portfolios of market problems to people, asking them to assess them blindly (independently) from each other. In a subsequent step of such a controlled experiment, we would ask them to reevaluate the problems after they have been exposed the evaluations and arguments of those who face the same problems.

Securities analysts, of course, do not randomly select stock, and they do not necessarily issue or revise their reports at exactly the same time. We can approximate our ideal laboratory setting, however, 1) by controlling for past year distance in focal stock S' estimates and 2) by selecting only the first estimates issued early in the calendar year issued by more than two analysts on precisely the same day. The former statistical procedure addresses the possibility that stock coverage might be endogenous to analysts′ valuation models: Analysts with similar valuation models may be prone to focus on the same stocks. Adopting a Granger-test of causality (Granger, 1969),[6] we control for the dependent variable in t-1 and investigate the effects for the independent variables of interest. The latter constraint of selecting only estimates issued simultaneously (and therefore blindly from each other) allows us to rule out the possibility of herding. For example, if analyst i issues her estimate on stock S *later* than analyst j, we cannot exclude the possibility that the former is simply herding toward the latter, that is, she is matching (or, from a strategy of deliberately anti-herding, contesting) the estimate of analyst j without really changing the underlying model through which she evaluates S. Fortunately, data on securities analysts' reports have been so exhaustively collected that we can impose the constraint of selecting only estimates issued on the same day.

In this sample of observations, therefore, we can confidently test whether the contingent attention structure (created by the stocks that analysts have autonomously evaluated the same day) and the past attention structure (created by the stocks that analysts have evaluated the previous calendar year) make analysts estimate converge or diverge in their estimates.

To test the effects of attention structure on valuation models, we adopt a dyadic, linear regression approach. Our model accounts for clustering on each of the members of the dyad and includes stock fixed-effects. Mizruchi and Marquis (2006) suggest that dyadic analysis is "particularly appropriate when the dependent variable is quantitative" and "the behavior of interest is not a specific action, but rather the extent to which actors behave similarly." Our research questions meet these characteristics. In their analysis, Mizruchi and Marquis show that variables measured

[6] As our experimental scenario indicated, to fully control for this type of selection effect would require randomly assigning analysts to the stock they cover. This is not possible. Short of that, it would be desirable to have an instrumental variable that could grasp the difference in evaluation models before the focal pair of analysts shares any coverage (Winship and Mare 1992). The Granger test approach we adopt has recently been used in the peer influence literature because it "eliminates all the possible selection factors" (Haynie and Osgood 2005).

in raw dyadic form consistently perform better than variables measuring system-level properties. As explained in detail by Kenny et al. (2006), however, data collected at the dyadic level typically violate the independence assumption underpinning traditional statistical approaches. A type of dyadic dependence that has received particular attention in the network literature is that due to unobserved attributes at the individual level, which are likely to induce correlation among dyads sharing a common individual. Because of correlation within the individual rows or within the individual columns of the sociomatrix, standard errors might be inflated or deflated and thus jeopardize the research findings by giving rise to incorrect significance tests (Krackhardt 1988). A recently suggested technique for addressing this issue is the two-way clustering extension of the standard heteroscedasticity-consistent (robust) variance estimator (Lindgren 2010), a popular technique among econometricians and survey researchers (Thompson 2011; Petersen 2009; Cameron, Gelbach, and Miller 2009; Conley 1999).We employ this method in our analysis.

Dependent Variable

Our aim in Hypothesis 1 is to test whether analysts′ assessment of securities is a function of the cognitive comparisons and associations they make across the portfolio of securities to which they pay attention. Hypotheses 2 and 3 suggest that analysts′ cognition is shaped by intersubjective processes that are a function of their location within networks of attention. Ideally, to test these hypotheses we should access the cognitive processes of the individual analysts. An alternative, more viable, empirical strategy is to compare the outcomes of such individual′s cognitive processes with those of other actors that are performing the same comparisons and with whom they jointly allocate their attention. We can do so by testing whether the EPS forecasts that two analysts issue on focal stock S are closer when they pay attention to a more similar portfolio of securities than when they allocate their attention differently.

Therefore, to capture the similarity in analysts′ valuation models, we measure the difference, in absolute value, between the EPS forecasts given by each pair of analysts that focus on focal stock S.

Independent variables

Contingent Attention Similarity. Hypothesis 1 suggests that actors that compare stock S against a more similar portfolio of assets tend to issues closer estimates on S. It is so, we argue, because these actors are more likely to independently make similar associations across the assets in their field of view, thus seeing S more similarly.

To measure the portfolio of other assets an analyst has in her field of vision when evaluating stock S, we consider the other stocks on which the analyst issued her estimates the exact same day she issued her estimate on S. We then calculate the similarity in *contingent attention* between two analysts as the proportion of stocks the two analysts are simultaneously paying attention to. Specifically, we measure the contingent attention similarity between two analyst i and j as:

$$\text{Contingent Attention Similarity}_{ijd} = s_{ijd} / n_{id} * s_{ijd} / n_{id},$$

where s_{ijd} is the number of stocks on which both analysts i and j issue an estimate the day d in which they issue an estimate on S, and n_{id} and n_{id} are the total number of stocks followed respectively by analysts i and j at day d. The variable thus calculated equals zero when *i* and *j* do not have any stock in common. It equals one when their stock coverage fully overlaps.

Past Attention Similarity. When we observe two analysts issuing more similar forecasts on stock S, even if they are issuing them simultaneously and therefore blindly to each other, we cannot exclude that they are influenced by the respective assessments they have reported in the past. In our H2, we indeed claim that once analysts form and make public their evaluations and reasoning, those who focused on the same stocks will be more likely to come across each viewpoints and take into consideration them in re-evaluating their predictions. Such reciprocal convergence can only occur over time and, more importantly, requires analysts' argumentations to be visible to each other. This is only possible when analysts have disclosed their own views, that is, after they have issued their reports. We therefore construct a variable, *past attention similarity*, based on the stock coverage of analysts in the previous calendar year. Specifically:

$$\text{Past Attention Similarity}_{ijd} = s_{ij,y-1} / n_{i,y-1} * s_{ij,y-1} / n_{i,y-1}$$

where $s_{ij,y-}$ is the number of stocks on which both analysts i and j issued an estimate the year y-1. Similarly to what we did for the contingent measure, we divide it by $n_{i,y-1}$ and $n_{i,y-1}$, respectively the total number of stocks followed by analysts i and j at year y-1.

Past Attention Closure. In Hypothesis 3, we extend our analysis to the broader network of attention. Our overarching argument is that two analysts positioned in a densely connected observational network will move towards more similar evaluations over time than two analysts who are positioned across different observational perspectives. As with reciprocal attention, such recursive attention can only take place over time. To test our hypothesis that the more the members of a dyad have stock coverage in common with the same third actors the more their assessment of a given security will converge, we construct a variable which builds upon Burt's dyadic constraint measure (1992), and calculate the proportion of stocks that i and j are covering together with the same third actors.

$$\text{Past Attention Closure}_{\ ij,y-1} = \sum_f [(m_{if,y-1} / n_{i,y-1}) * (m_{fj,y-1} / n_{j,y-1})],\ f \neq i,j$$

where f are the other analysts with whom i and j have jointly issued earning per share estimate the previous calendar year. Thus, $m_{if,y-1} / n_{i,y-1}$ corresponds to the proportion of stocks that analyst i has jointly allocated attention with analyst f, ($m_{fj,y-1}/n_{j,y-1}$) the proportion of stocks analyst f in turn has jointly allocated attention with j. Past attention closure$_{ij}$ equals zero when *i* and *j* do not have any stock coverage overlap with any third parties. Similarly, past attention closure$_{ij}$ is high insofar as *i*'s stock coverage highly overlaps with the stock coverage of third parties *f* whose stock coverage in turn highly overlaps with *j*.

We also include in our regression a measure of how much the stock coverage of *i* and *j* jointly overlaps with (each) third analyst *f* when each of the three analysts are still blind to their respective evaluations. To do so, we compute the measure above described on the contingent attention structure created by the stocks that are covered the same day. We include this variable because, as a corollary of our theory, we should expect it not to be significantly correlated to our dependent variable. We have, indeed, no reason to expect that *i* and *j* would issue estimates which are *closer to each other* because they are simultaneously and jointly paying attention to stocks with *f*, if *f* has not released the reasoning underlying her estimates yet[7]. The inclusion of this variable functions therefore as a further robustness test of our theory. If we find that there is no "recursive loop" among evaluations of (three) securities analysts that issue their estimate blindly to each other, we may be more confident that i) their estimates are indeed blind to each other, increasing the reliability of our test of H1; ii) our results are not affected by some unobserved factor which influences both securities analysts' attention structure and valuation models. If the processes of structuring attention and evaluating them were driven by a common third process, we should observe *all* the variables measuring the attention structure to be correlated to our dependent variable.

Control variables

First, as already mentioned, to estimate firms' earnings, analysts may leverage their pre-constituted valuation models and, more importantly, their previous models can affect their stock coverage choices. To account for previous similarity or difference in analysts' valuation models, we focus our analysis only on those analysts that have shared stock coverage also the year prior the focal observation. In this manner, we can use the lagged dependent variable (calculated on the last forecasts given the previous year) as a proxy for the standing differences/similarities in valuation models and observe whether the attention of securities analysts have an effect on reducing or augmenting the pre-existing differences between the two analysts' forecasts. Presumably, this variable will be positively associated to future differences in valuation models: analysts with more different valuation models at time t-1 will be the ones with more different valuation models at time t.

As a further control of potential selection bias, we include also a variable measuring the number of years two analysts have shared coverage for at least one stock. This variable accounts for the history of influence among the two members of the dyad. Two actors that shared coverage for a longer period of time (possibly extending as far back in time as 1993) may have influenced each other not only in the way they evaluate things but also in their attention allocation.

[7] Note that we do expect that two analysts *i* and *j* would respectively issue estimates which are *closer to a third analyst* with whom they are comparing the same stock; this effect is captured by the measure of contingent joint attention.

To control for potential herding effects by which less experienced, less accurate, or less reputed analysts would tend to follow more experienced, more accurate, or more reputed ones in their forecasts, we consider the differential in experience, accuracy, and status between the two analysts composing each dyad. We calculate the professional experience of each analyst as the number of days that elapse between the first forecast issued by each analyst who appears in the IBES dataset (going back to 1993) and the day of the focal estimate. The experiential differential is then calculated as the difference, in absolute value, in days of experience of each pair of analysts. Because of career concerns, less experienced analysts have been shown to follow the crowd more than others (Hong, Kubik, and Solomon 2000).

Another analyst characteristic that has been shown to affect the propensity to herd is prior accuracy (Hilary and Menzly 2006). We account for this effect by calculating the differential in prior forecasting accuracy on the focal firm between each pair of analysts. To obtain this variable, we first measure the errors each analyst made the previous year in predicting the EPS of the firms. Accuracy differential is the difference in absolute value between each pair of analysts′ errors.

Reputation is a third factor which the finance literature has shown to be related to herding. Less reputed analysts, for example, have been shown to be more likely to follow peers (e.g., Scharfstein and Stein 1990). To construct a measure of analysts′ reputation we consult the All-America Research Team ranking (Stickel 1990), appearing each year in the October issue of *Institutional Investor*.[8] Selection to the All-America Research Team is a coveted award associated with professional reputation and financial reward. It is commonly used in the sociology literature as a proxy for status among securities analysts (Phillips and Zuckerman 2001; Rao et al. 2001; Hayward and Boeker 1998; Burt 2007).

To capture reputational effects, we construct a dummy variable, labeled status, which has a value of 1 (i.e., high status) if the analyst was cited in the All-America Research ranking in the year we measure our dependent variable and a value of 0 (i.e., low status) if the analyst did not appear in the ranking in that year. Given the dyadic unit of analysis we may have three relevant cases: a) both analysts are high status; b) only one of the two analysts is high status; c) none of the two analysts is high status. To account for all these possibilities, we introduce two dummy variables in the regression: one that identifies the case in which only one analyst is high status, the other for the case in which both analysts are high status. Another important variable we control for is the number of analysts that have focused on focal stock S the previous calendar year.

[8] This ranking, which began in 1972, names a first, second, third, and runner-up analyst in each of several industries which are considered and is constructed by aggregating votes from a few thousand institutional investors in several hundred financial organizations. Analysts are rated for their stock selection, earnings forecasts, written reports, and service (Institutional Investor 1999:105-06).

FINDINGS

Table 1 reports the results of our empirical analysis. Model 1 includes only the control variables.

Insert Table 1 about here

As expected, the effect of the lagged dependent variable is positive and significant. This suggests that the models through which analysts evaluate stocks are persistent over time. Differences in earning per share forecasts are in other words auto-correlated: two analysts that have more distant forecasts on a given firm′s earning per share at time t-1 will also be the ones with more distant forecast at time t.

Among the variables controlling for the analysts′ characteristics potentially driving herding behavior, only the dummy variable identifying a dyad composed by just one high status analyst is statistically significant. The negative sign of the coefficient suggests that when one of the two analysts composing the dyad is a high-status one the distance between the two analysts´ EPS forecasts is lower than when both analysts are low-status analysts. While the dyadic approach we adopt in our analysis does not allow to conclusively tease out who is following whom, we are inclined to believe that this convergence is driven by low status analysts following high-status ones. The fact that the dummy identifying a dyad composed by two high status analysts does not significantly behave differently from a dyad composed by two low status actors suggest that, as low status actors have no incentive to follow other low status ones in their predictions, high status analysts are confident enough in their predictive capacities to avoid being influenced by other high status peers. The non-significance of the other variables measuring the dyadic difference in professional experience and prior accuracy might suggest that lower experienced and lower performing (less accurate) analysts do not follow a particular analyst (the other member of the dyad in our analysis) but, as the finance literature suggests, they follow the consensus (i.e., the average opinion among peers).

Both the variable measuring the number of analysts who have covered stock S in the past calendar year, and the variable counting the analysts who are contingently focusing (the same day) on stock S are statistically significant. They differ, however, in their signs. The coefficient of the former variable is positive, meaning that the higher the number of analysts who have issued an estimate on stock S in the past, the more two analysts will differ in their estimates on S. One possible interpretation of this result is that, on average, analysts that allocate their attention on a stock that was covered by many analysts the previous year are more likely exposed to a wider spectrum of evaluations [a broader array of dissonant views], and less likely therefore can make univocal sense of that stock. Finally, the number of analysts that are focusing on S at day d seems to have an opposite effect. The more two analysts are issuing estimates on stock with other analysts, the more they will tend to issue closer forecasts.[Interpretation for this to be written.]

Model 2 introduces the network variables testing our hypotheses. As hypothesized, all the variables but contingent attention closure are statistically significant. The effect of contingent attention similarity is negative, meaning that the higher the proportion of firms two analysts have in their field of view when they issue their estimates on S, the more similar will be their estimate on S′ earning per share[, the more similarly they will see S]. This finding supports hypothesis 1. Note that we are controlling for any influence that can emanate from past patterns of attention and for the past distance in earning per share estimates between the two analysts, as well as for many other control variables associated to herding. We can confidently claim that analysts′ valuations in financial markets are therefore driven by parallel, but autonomous, cognitive association across assets.

H2 is also confirmed: two analysts that came across more often each other evaluations more often in the past tend to converge more in their future estimate of S. It is important to emphasize again that all the analysts that are issuing their estimate on S, issued also an estimate on S in the past (calendar year). Arguably, therefore, all analysts have been equally exposed to their evaluations of S. They differ in how much they have exposed to each other′s assessments on stocks other than S. This finding shows that each analyst does not only make association across the assets in his own field of view, but she is affected by association made by others.

Finally, the negative sign of past attention closure shows that the higher the proportion of stocks two analysts jointly evaluate with the same third actors, the more the two analysts will converge in their estimate of focal stock S. When analysts are located in an observational clique, where all of them pay attention to the same assets, they fuel a resonant cycle which will induce ultimately all the analysts to see the same things, to evaluate stocks through the same model.

DISCUSSION

Thirty years ago Nobel Prize winner Herbert Simon suggested that, in the increasingly information-rich world in which we live, the wealth of information we face "creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" (1971: 40-41). The key idea in Simon’s thinking pointed to the limitations of individual cognitive capabilities. Departing from neo-classical assumptions, Simon stressed that we cannot all pay attention to everything. Even within a particular market or a particular organization, no individual can process all of the relevant information. For Simon and his collaborators, organizational forms can partially address this problem. Hierarchy, for example, is a form of distributed cognition, allocating or distributing attention across the units in which various problems and tasks were decomposed. In that sense, organizations can be analyzed as attention structures (see also Ocasio 1997).

Our study also begins with the limitations of individual cognition. But the attention structures we examine span organizational boundaries. We do so because we want to highlight that among the cognitive scaffolds that prop up, support, and aid the cognitive work of calculation are not only organizational infrastructure, research departments, models, algorithms, and instrumentation. If attention structures are a means within organizations for dealing with the limitations of individual cognition, attention structures that span organizations can also be a resource for action in the face of bounded cognitive abilities.

The securities analysts that we studied confront the problems of limited cognitive abilities on a daily basis. Like actors in many other domains, they are relentlessly searching. At times, it is a search to find what others have already seen but you are missing. At other times it is a search for innovative insights to find what others have not yet seen. Such relentless search, we have argued, is shaped by the analyst's particular location vis-à-vis competitors in the network of attention.

Our analysis demonstrated, in the first instance, that an analyst's estimate of the end-of-year earnings per share of a given security – made contingently, early in the calendar year – is shaped by the other securities in her field of view. In terms of Podolny and Hill-Popper's (2004:91) insight that valuation takes place from the "particular orientation of an individual to an object of exchange," we found that, when evaluating a given security, an analyst is not facing that security alone. In place of a singular relationship – a given analyst to a given security – we found a more multi-sided set of relations. The security is not alone. As our findings indicate, it is evaluated in terms of the other securities that are in the analyst's field of view.

Our analysis further demonstrated that analysts' estimates are influenced by the views of other analysts with whom they share stock coverage and that these effects are amplified when individuals share attention patterns with the same third parties. How does a given analyst search when she knows that she has limited cognitive abilities? Our answer began with a simple proposition: The analyst is not alone. Again, the relationship between analyst and security is not a singular one – there are multiple analysts evaluating that security, each of whom is simultaneously evaluating other securities. Given limited individual cognitive abilities, analysts leverage this multi-sided relationship. As in the contingent estimate, where the view of the focal stock is given by the securities that form the background, so in the updated estimates, the view of the focal stock is shaped not simply by the views of others about *that* security but also by their views of other securities that are not shared. If my views are shaped by my peripheral vision and yours are shaped by your peripheral vision, then to the extent that we mutually influence each other, we can say that my views are shaped, in part, by your peripheral vision.

The cognitive networks we have explored are thus a form of collective sense-making. But we must emphasize that this is not a singular, global collectivity. And, if it is multiple, its facets are not groups that are cooperating for some common purpose on the basis of their personal ties. These are impersonal networks, linked not face-to-face, but face-to-screen, comprised not of partners in a common endeavor but of rivals in competition. We believe our approach contributes to several streams of research.

From categories to situated cognition. Sociological understandings of cognition revolve around the notion of categories and the underlying psychological processes of category learning (e.g., Gluck and Bower 1988; Homa 1984; Kruschke 1992; Nosofsky 1984; Posner and Keele 1968; Rosch and Mervis 1975; Shanks, 1991; Trabasso and Bower, 1968). These processes assume that selective attention isolates critical information in a category's exemplars, stores it in memory, and discards irrelevant information. Over time, information abstracted for the category accumulates, providing an increasingly rich concept that represents the category during perception, thought, and action. In this process of abstraction, background situations are progressively left behind. Indeed, once the properties of an exemplar have been abstracted from the background situation, information about the situation is discarded. In establishing the concept of chair, for example, the cognitive system accumulates properties of chairs per se (e.g., seats, back, legs), discarding properties of the situations in which they occur (e.g., offices, living rooms, classrooms). It follows that, independently of the context in which it is evaluated, a chair will be more "chair" depending on whether its structure resembles more the stereotype of chair we have in mind. Sociological theories have brought these processes at a broader level assuming that classification systems and categorical meanings are typically shared by a community.

In this paper, we departed from a pure categorical view of markets to embrace a situated cognitive approach. Our view follows recent advances in psychological research which have started to rejecting (provided overwhelming evidence against) the static cognitive approaches revolved around established and abstracted categories, and emphasize the role and importance of background situations in cognitive activities (e.g., Brooks 1991; Greeno 1998; Suchman, 1987; Clark 1997, Dunbar 1991, Glenberg 1997, Greeno 1998, Barsalou et al. 1993, Barsalou 2003, Yeh and Barsalou 2006). Mental representations, in this more recent view, are not abstract, stable and activated in a relatively automatic, context-independent process. Cognitive processes are adaptive and context-specific (Smith and Semin 2004).

Following this new line of research we suggest that the process of assets' valuation is not simply a process of matching an asset with an abstract conception of what it should ideally be, but a process of situating the focal assets in a space comprised by other assets and people's evaluations of these assets. Attentive to processes that occur across time, we do not abandon the notion of category but highlight a different aspect. The concept of category here refers to temporary constructs[9] rather than to already-established taken-for-granteds. As a temporary container of knowledge, a category integrates knowledge from several information sources and is shaped by the pragmatic interests of its interacting users.[10] By charting how analysts make new associations across securities, we are able to make a contribution to a network-analytic approach that examines how categories emerge and evolve.[11] Categorical exemplars are not necessarily a stable mental representation formed by the individual actor, or a common conception univocally shared by a community. They are cognitive constructs whose stability and commonality depend on i) the portfolio of objects available in the market; ii) the structure of attention created by the attention allocation of actors across objects.

[9] "In this sense, in human cognition, categories are seen as linguistic constructs used to store temporary associations built up from the integration of knowledge from several neural subnetworks. The categorization process, driven by language and conversation, serves to bridge together several distributed neural networks, associating tokens of knowledge that would not otherwise be associated in the individual networks." (Rocha 2001: 18).

[10] Our concept of category thus resembles transient, context-dependent knowledge arrangements characterized by Clark (1993, 1999) as "on the hoof" category constructions. Such "short-term categories bridge together a number of possibly highly unrelated contexts, which in turn creates new associations in the individual information resources that would never occur with their own limited context" (Rocha 2001:25).

[11] Categories, and their construction and evolution, is at the core of the new population ecology program (Hannan, Polos, and Carroll 2007; Pontikes 2010; Negro, Koçak and Hsu 2010).

Depending on the change rates of the portfolio of objects available in the market, categorical abstraction and stability is more or less possible. This first point may be illustrated by considering the case of the mobile phone industry. For long time, before the introduction of the IPhone, we have presumably had a clear and relatively stable categorical understanding of what a mobile phone was. The launch of the IPhone, and the consequent proliferation of new smartphones that it has promoted, has dramatically changed our expectations[12] as well as fostered the instability of what is the categorical exemplar of a mobile phone. In valuing a phone, constantly new introduced features become salient and affect the characteristics we include in our valuation models. As a result, a phone that we valued $500 only five month ago is not worth half today, because in the meantime, our expectations of what a $500 should be able to do are dramatically changed. This suggests that in evaluating a phone we are less and less comparing it to a stable categorical exemplar, but we instead contingently assess the attributes and features provided at the moment in the market.

Not all the actors however value the same phone alike, as not each of them values it differently. Our valuation of a given phone depends on the other phones we pay attention to as well as on the expectations of others that we encounter by allocating our attention. Others' expectations flow and reach our attention through blogs, reviews and comments posted on the web. Once our opinion is formed and we post it ourselves we affect the expectation of someone else. Our theory thus suggest that in the World Wide Web actors that pay attention to the same objects are more likely to form similar viewpoints.

Reflexive modeling and structural holes. Our findings shed therefore light on how attention structures create socio-cognitive interdependence and thus reflexive modeling (Beunza and Stark; 2011). Reflexive modeling dynamics are stronger, in our view, when pairs of financial actors evaluate the same portfolio of stocks and evaluate it with the same others. These actors become embedded in a self-referential cluster of calculative practices that ultimately create evaluation model's isomorphism (DiMaggio and Powell, 1983).

Beunza and Stark (2011) suggest that this distributed valuation models' resonance can lead to financial disasters, as the models that support financial decisions cease to be questioned by the actors that enact them. Dissonance across valuation models is therefore often required to avoid convergence that could lock-in a univocal biased model. This generative dissonance is ostensibly promoted by those who hold a structural hole position in the attention network (Burt 2004). Due to their privileged position, structural holes are more likely to observe different models and can therefore more likely broker and blend together different evaluation practices. In other words, they can take the role of "valuation entrepreneur" in the system (Becker, 1963).

However, because of their lack of visibility in the groups they connect, usually the models that structural holes promote are not taken up by others. Future research may thus focus on the conditions that give visibility to structural holes' models and thus facilitate their dissemination. More generally, scholars can focus on the conditions under which the dissonance promoted by structural holes is beneficial for the whole system and when it is not. Structural holes may, for instance, have an impact only if they can leverage on past successes or if they hold a greater social status; performance and status arguably give structural holes a visibility and credibility

[12] Note that the IPhone (or even better the IPad) has not been penalized because it did not fit in an established product category.

which goes beyond their group of reference. The securities analysts' setting represents an ideal setting to investigate these hypotheses as it allows to easily capture analysts' past forecast accuracy (Hillary and Minzley, 2006) and status (Phillips and Zuckerman, 2001).

Attention structures and perspective advantage. In this paper our goal has been to identify processes of valuation models' formation and development. While we emphasize the role of attention structures, we do not directly address the question of how attention structures give some actors a privileged position in the market. Our framework allows however to identify what position grants actors a perspective advantage.

Figure 1.

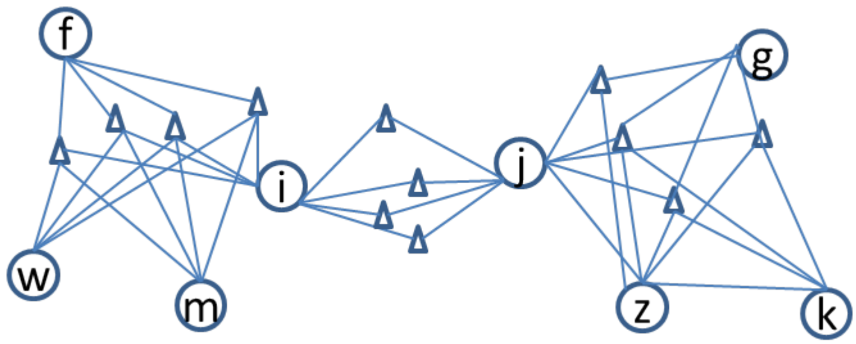

Table 1.

Dyadic linear regression on differences across pairs of analysts' EPS forecasts (2001-2006)

	I	II
Intercept	.1490**	.3033***
	(.060)	(.115)
Lagged DV (calculated on last estimates on S)	.5870****	.5864****
	(.1143)	(.1137)
Number of Years of Joint Coverage	-.0041	-.0063
	(.0043)	(.0047)
One High-Status	-.0432***	-.0356**
	(.0163)	(.0209)
Both High-Status	-.0375	-.0241
	(.0237)	(.0195)
Difference in Prior Accuracy	.0465	.0047
	(.0086)	(.0086)
Difference in Professional Experience	.00006	.000003
	(.00000)	(.000008)
Number of analysts covering S at d	-.0083****	-.00143****
	(.0016)	(.0003)
Number of analysts covering S at y-1	.0015****	.0066***
		(.0047)
Contingent Attention Similarity		-.1341**
		(.0684)
Contingent Attention Closure		-.0010
		(.0016)
Past Attention Similarity		-.4468**
		(.2195)
Past Attention Closure		-.0689***
		(.0184)
No. observations	12,724	12,724
R square	.40	.41

Standard errors in parentheses are clustered by first analyst and by second analyst in the dyad

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