

Dangerous Connections: Hedge Funds, Brokers and the Construction of a Market Crisis¹

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Abstract

Financial risk theory focuses on the potential outcomes of investment decisions, but ignores virtually the decision making process itself. Focusing on hedge funds, this paper is the first to analyze in detail the social structures and practices through which investment decisions are made in these organizations. We collect and triangulate data from interviews and field observations in addition to mapping and analyzing social networks. We investigated 26 hedge funds and 8 brokerage firms in Europe, the United States and Asia between December 2007 and June 2009. The hedge funds analyzed controlled 15% of all assets managed by hedge funds. We find that decision making in hedge funds relies crucially on an elaborate two-tiered structure of connections among hedge fund managers and between them and brokers. Our findings indicate that the connections among hedge fund managers, and between them and their brokers, contributed to a situation whereby, once hedge funds collectively accepted an investment idea and invested accordingly, they 'locked in' on the idea, ignoring warning signs. These findings add to our understanding on how financial risk events emerge and to practical expertise of financial risk managers.

1. Introduction

In the last few decades, hedge funds have been associated with some of the most dramatic market events witnessed; events such as the devaluation of the British Pound on September 16th, 1992 and the subsequent withdrawal of Britain from the European Exchange Rate Mechanism, the record levels of volatility in August and September 1998, which were related to the collapse of the hedge fund Long Term Capital Management (Booth, 1998; President's Working Group on Financial Markets 1999) and, more recently, hedge funds activity played a

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pivotal role in the emergence of the Porsche-Volkswagen market crisis of October 2008. What can account for the centrality of hedge funds in such financial ‘risk events’?

The answer is related, partly, to the centrality of hedge funds in many financial markets. According to Greenwich Associates, a prime financial services research engine, in 2007, 30% of U.S. fixed income, 20% of global foreign exchange, 95% of distressed debt, 61% of high-yield credit derivatives, 60% of structured credit and 55% of leveraged loans volume was traded by hedge funds. Even in spite of a sharp decline during 2009, in 2010 hedge funds still ‘remain key players in U.S. fixed-income markets’ (Greenwich Associates, 2010).²

Equally important to our understanding of the risks introduced by hedge funds is fact that these investment vehicles are designed for taking risky market positions, free of most regulatory restrictions, in the hope of producing large gains. This commonly accepted maxim that hedge funds are risky ‘by their nature’ glosses over a significant gap in our understanding of how these organizations actually operate. Furthermore, stating simply that hedge funds make risky investment decisions disregards the social nature of such decision-making processes, in particular, the inter-personal communication and assessment of trading ideas and the norms that affect these activities. In this paper, we document and analyze how investment decisions are made in hedge funds, trace the inherent risks in these processes and offer first steps towards a more empirically informed sociological theory of financial decision-making.

Between December 2007 and June 2009, we interviewed 60 hedge fund managers, brokers, analysts and traders from 26 hedge funds and 8 brokerage firms in Europe, the United States and Asia and conducted fieldwork in ten of these hedge funds and brokerage firms. We use the data collected to develop qualitative and quantitative accounts of investment practices in hedge funds. We find that the hedge funds’ decision-making process is preformed, primarily, through a network of social connections among hedge funds and between them and brokers. The structure of the network in which the hedge funds are located affects the quality of their decision-making and crucially affecting the strengths and vulnerabilities of their investments. The risks embedded in the hedge fund’s decision-making practices are illustrated vividly in the Volkswagen-Porsche market crisis of October 2008, a case that we analyze in detail as part of the evidence.

In the following section, we develop a theoretical framework. That section is followed by a methods section (section 3), which discusses our use of qualitative and quantitative

² Data for 2007 is from <http://www.greenwich.com/>.

methods. In section 4, we use qualitative evidence to examine the practices of decision making among hedge funds and brokerage firms and the motivations driving these practices. In section 5, we corroborate the qualitative empirical findings by constructing a map of the connections, calculating relevant measures and then test the statistical significance of the relation between the observed network and the actors' and the institutions' attributes and their network-structural positions. Following our general analysis of decision-making in hedge funds in sections 4 and 5, in sections 6 and 7 we focus on the emergence and the unfolding of the VW-Porsche market crisis. Section 8 concludes the paper.

2. Theoretical framework

Financial risk theory focuses on the potential outcomes of investment decisions, but typically ignores the organizational and social nature of decision-making. Arguably, this is due to the pervasive influence of assumptions underlying theories of market efficiency; namely, investors are rational with costless and immediate access to all relevant information, and subsequently follow analogous utility maximization processes to select portfolios of assets. These assumptions have been challenged in the extant literature³ and it would appear credible that different organizational and social contexts within which information is gathered and processed, lead to divergent investment decisions. As a corollary, it might be asked whether the type of context affects (i) asset price movements and (ii) risk profiles, both for individual firms and for the wider financial sector.

Sociological research provides ample empirical evidence about the impact that the organizational and social contexts have on financial decision-making. Baker's seminal work (1985) demonstrates that the size of crowd on the trading floors have a key role in preferred trading patterns. Similarly, the study by Zaloom (2001) of the introduction of electronic trading at the Chicago Board of Trade concludes that the change in environment from face-to-face trading to screen-based trading resulted in losing a nuance-rich communicative environment; a move that contributed to less informed, poorer financial decision making among traders. Analyzing the cognitive dimension of decision-making, Zuckerman (2004) found that incoherence in stocks' categorizations contributes to increased levels of trading. Managerial environments are also regarded as a source for biases in decision-making. In an

³ Research in behavioral finance, for example, depicts phenomena that deviate from the assumptions about actors' rational decision-making. In an influential paper, Barber and Odean (2000) show that traders tend to intervene in the market too often; a tendency that leads to poor performance. Gervais and Odean (2001) describe that investor learn to become overconfident as they trade more. Hirshleifer, (2001) summarizing important points from this literature, concludes that biases related to prevailing perceptions of risk and misvaluations affect investment decisions.

influential paper, March and Shapira (1987) identify the professional socialization that managers undergo and the performance-focused organizational culture where they operate as the main driver for managers' insensitivity about probability and risk taking. Levinthal and March (1993) expand these findings about risk biases by placing them in a more general framework about organizational learning myopia, which appears when managers are required to balance competing goals.⁴

A recent strand of this research has focused on the rich communicative dimension of financial decision-making. For example, MacKenzie (2003), examining the case of the hedge fund Long Term Capital Management (LTCM), found that technological inter-organizational connections among hedge funds, a computerized risk assessment model, served as a focal point for imitations, increased the similarity between the trading positions of different hedge funds and precipitated financial crisis. Similarly, Beunza and Stark (2010), show how a mathematical model serve as common point of reference for hedge funds, who deduce from the model's results how competitors behave and adjust their own behavior accordingly. This model-mediated, indirect communication between market actors brings about, in both Mackenzie's and Beunza and Stark (2010) research cases, an inadvertent result whereby risk is amplified. However, whilst both describe phenomena where risks emerge from the structure and nature of connections among actors, they infer the existence and effectiveness of such inter-organizational connections on the basis of data collected, effectively, within a single organization. In turn, this empirical limitation motivated this research strand to focus primarily on technological devices (the mathematical models) and treat them as 'super-nodes' in the assumed network; nodes that connect all other market actors.

This research identifies the material and technological nature of connections between financial decision makers. However, connectivity in decision-making process involves more than the employment of (possibly) common technology. Hong et al. (2005) and Cohen et al.(2008, 2010) examine the trading behavior of professional money managers and find that behavior co-varies more positively when managers are (i) located in the same city and (ii) went to college together, respectively. These findings correspond with economic activity being embedded in pre-existing network of social ties (Granovetter, 1985; Uzzi, 1996, 1997), but also, crucially, indicate the possibility of contemporaneous social connections between

⁴ Also see, McNamara and Bromiley (1997) mix cognitive and organizational factors in when studying their impact on decision-making biases. Simon and Houghton (2003) examine the relations between risky market positioning of products and between managers' overconfidence.

financial decision makers.⁵ Given that social connections may play a central role in financial decision-making, it is relevant to query why competitive financial agents, such as professional money and hedge fund managers, would want to converse honestly with each other. Ingram and Roberts (2000) show that meaningful exchange of information among competitors is common and beneficial, especially when the competitors are members of densely connected structures. The findings of Mizruchi and Stearns (2001) indicate that financial actors (bankers) seek advice and information through strong ties as uncertainty increases. Uzzi and Lancaster (2003) show that such connection serve as an arena where organizational learning takes place.

More generally, Zuckerman and Sgourev (2006) find that firms in the same industry maintain relationships within 'Industry Peer Networks' where they identify and use opportunities for learning and motivation. Finally, Stein (2008) posits a formal model of bilateral conversations in which actors honestly exchange ideas with their competitors when the flow of information is bi-directional between each pair of actors and when the actors can develop useful ideas on the information shared. Given these assumptions, actor A will share a good idea if the expected payoff of the idea augmented by (possibly repeated) conversation with actor B is greater than the actual payoff from the current informational advantage A has over B. Furthermore, it is entirely conceivable that actor B may subsequently share the final developed idea with actor C. Consequently, Stein suggests that relatively underdeveloped ideas can travel over long distances in this sequential and bilateral manner. However, more valuable ideas are kept typically within structures characterized by small chains of actors because the large informational advantage derived from well-developed ideas are hard to overcome for additional actors.

In summary, the extant literature considered above shows that some organizational and social contexts (i.e., trading floor, material and technological) affect financial decision-making and that these contexts may not only affect the decision taken by individual actors but impact on the wider financial system (see Mackenzie, 2003). However, the impact of the *structures* of social connections in these linkages is not fully established. We therefore identify three important questions that appear under-explored. Firstly, are financial market competitors conversing honestly with each other and, if so, which specific structures of social connections are employed in such conversation? Secondly, assuming honest conversations, does the specific structure of social connections among market actors affect financial decision

⁵ Also, Hardie and MacKenzie (2007b) suggest that a hedge fund 'is part of a rich network of inter-personal and inter-organizational connections' (pp. 390).

making? Thirdly, does this decision making have a significant impact upon financial markets' behavior? To examine these issues, we will later provide detailed empirical evidence collected through interviews with a large number of hedge fund professionals and field visits to hedge funds and brokerage firms. However, let us consider initially why hedge funds are motivated to maintain communicative connections:

To interact with brokers – Brokers execute trades on behalf of the hedge funds. They also provide the funds with 'flow information'. Flow information is descriptive information about the conditions surrounding a possible investment action. For example, whether there are more buyers than sellers for certain assets, the type of institutions that are interested in buying or selling, and the magnitude of specific orders. The brokers' flow information is frequently combined with initial trading ideas.

To interact with competing⁶ hedge funds – The works of Ingram and Roberts (2000) and Zuckerman and Sgourev (2006) reveal empirically that competitors converse. We build on this and augment with the theoretical model suggested by Stein (2008), to imply that a hedge fund will enter into conversation(s) about a good trading idea if the expected payoff of the idea improved by a competing hedge fund is large enough, outweighing any prior competitive advantage. This 'Stein Type' of mutual co-operation assumes reciprocity to be suitably beneficial in a narrow financial sense and involve the exchange of a single trading idea between two bilateral partners. As the economic sociology literature indicates, reciprocity is also expressed through non-financial remuneration such as legitimization or confirmation and be a product of many trading ideas exchanged over time.

Based on the connections between hedge funds and brokers and among hedge funds, we conceptualize a map of N individual actors, where there are N_1 hedge funds and N_2 brokers (i.e., $N = N_1 + N_2$), creating a two-tiered industry structure formed by the two different node types and connection types. We suggest that the resulting structure of connections reflects the two types of motivations described above, which we term 'logics of connectivity'. A logic of connectivity is the set of intentions guiding the actor's communicative actions, which, if reciprocated by the actor's counterparties, are likely to lead

⁶ As we discuss later in more detail, when asked who their competitors were, hedge fund managers typically viewed other hedge fund managers as their competitors (some also mentioned the market as a whole as their competitor).

A possible rationale for competitiveness amongst hedge funds is illustrated by Agarwal, Daniel and Naik (2005) who show that hedge funds with good recent performance experience relatively higher money inflows.

to the establishment of connections.⁷ We posit that the hedge fund managers' dominant logic of connectivity will encourage creating connections with other hedge fund managers, but the hedge fund managers will be selective, preferring connections within small and cohesive groups.⁸ Brokers' logic of connectivity, on the other hand, will motivate them to create and maintain communicative connections with as many hedge funds as possible, but not with other brokers. In other words, brokers will aim to position themselves at the centers of star-like network formations. We argue that the two logics of connectivity and their resulting structure of connections are inherent to decision making among hedge funds and have a crucial impact on their structure of opportunities and risks.

This framework correlates with the distinction between embedded and arm's length ties. Arm's length ties are relatively superficial relationships used to transfer low-quality, general information and are consequently suggestive of the posited Broker-Hedge Fund connections. On the other hand, embedded ties are closer relationships that are based on long-term co-operation and used for the transfer of complex knowledge (Hansen, 1999; Lawrence et. al. 2005), tacit knowledge and proprietary expertise (Larson, 1992; Uzzi, 1997, 1999), analogous to the suggested Hedge Fund-Hedge Fund connections.

We recognize the usefulness of the concepts of embedded and arm's length ties to the analysis of hedge funds. However, the impacts of the connection types and two-tiered industry structure we propose are different from the ones described and analyzed in the literature. In particular, honest conversations and idea sharing between hedge fund competitors reasonably leads to a higher probability of consensus trades i.e., where a number of firms adopt the same trade or position. The similarity in position increases overall risk and the impact of expected losses. For example, if many hedge funds close a particular position by selling asset Z at approximately the same time, selling pressure may generate a lower price for Z than would have otherwise been the case. This dynamic therefore carries the risk of over-embeddedness among hedge funds (Choi, 2011), a situation where the actors circulate among themselves a limited set of ideas, becoming effectively insulated from developments in other parts of the network. The possibility of over-embeddedness may lead to 'groupthink' and the adoption of a trading strategy, which although at odds with the advice from other groups, is being played by the fund's tight knit cluster. Again, this is likely to further increase the

⁷ The concept of logic of connectivity borrows its epistemology from Luhmann's system theory (Chernilo, 2002; Nassehi, 2005). However, the way we conceptualize other components in the theory (in particular, the concept of actor) is very different from Luhmann's.

⁸ This logic of connectivity is related to the predictions of Stein's model and to the findings by Reagans and McEvily (2003), although they do not refer specifically to hedge funds.

expected loss from a poor consensus trade as firms ‘lock-in’, exiting the position at a significantly later time period than would have occurred without over-embeddedness. Moreover, given a hypothesized tendency of brokers to disseminate trading ideas among the clusters of densely-connected hedge funds, this may turn relatively isolated consensus trades into wider financial risks.

3. Methods

Our paper is the first to triangulate interviews, field observations and social network analysis in the research on hedge funds. We conducted 60 interviews between December 2007 and June 2009. We interviewed 36 hedge fund professionals (managers, analysts and traders) and 24 representatives of the brokerage side (see appendix 2 for details). We focus mostly on the families of trading strategies known as ‘long-short’ and ‘event-driven’. Long-short hedge funds invest by taking positions in different groups of assets, typically taking a long position (buying and holding) in one asset and a short position (borrowing and selling) in another. Event-driven hedge funds choose their targets of investment based on the announcement and materialization of certain events (e.g. a merger/acquisition or an asset sale after bankruptcy procedures). Our choice is motivated by the fact that these strategies, combined, represent the biggest single group of strategies in the hedge funds world (38.3% of all assets under management)⁹ and that both strategies typify elements that distinguish hedge funds from most other investment vehicles: their ability to go short and their focus on arbitrage-like opportunities. Organizations such as mutual funds or pension funds rarely, if ever, hold a ‘short’ position. Hedge fund managers, being aware that they are a minority in the financial world, tend to be certain that when they short an asset, their position is reciprocated many times over by long positions held by institutional investors.¹⁰ In other words, when the hedge fund managers need to buy back the asset and return it to the lender, they can safely expect that the asset will be there in abundance. For the same reason, hedge

⁹ As of Dec. 31, 2007, Barclays Hedge data.

¹⁰ A representative example comes from HF25, a hedge fund manager in the long-short strategy: *You see although I am competing against them for investors’ money, we are not the only type of market participants. Actually we are a minority. What percentage of total assets is held by hedge funds? 2%? [M]uch of the price discovery in those stocks is done by traditional mutual funds and pension funds who look at it totally differently than we do. Also, most of them can not go short. So I can be the 10th or the 50th one in a trade and still make some decent money.*

fund managers are less reluctant to share investment ideas that include a short position with other hedge fund managers: the assets themselves are not a scarce resource.

This research is also the first of its kind in terms of global reach and scope of coverage. The hedge funds in our dataset manage 15% of global hedge funds' assets under management.¹¹ We conducted interviews in New York, Hong-Kong, London, Geneva, Madrid and a fourth European city that cannot be identified because of anonymity considerations. All interviews were taped and transcribed, and were conducted on the basis of strict anonymity.

In addition to the interviews, we conducted observatory fieldwork at eight hedge funds and two brokerage houses servicing hedge funds. The observations were held typically in blocks of two to five days and, where possible, were repeated at different times. At our request, at most sites a rotation system¹² was organized and some informal 'debriefing' sessions were held outside the offices of the hedge fund or brokerage firm (often held at coffee shops or at a local bar/pub) to follow up issues that raised during the observations.

Following our qualitative data gathering, we analyzed connections between hedge funds and between them and brokers and constructed a network. For our network analysis, we incorporated brokers and hedge fund managers that practice either the Long-Short or Event-Driven strategies. To construct the network we asked our informants to give us the names of people with whom they have *relevant* professional interactions.¹³ For each dyadic relationship to be taken into account, it had to be confirmed independently by both parties. Thus, if informant A told us they have a relevant professional relationship with B but B did not mention A, the relationship was not taken into account. We condition the network on the existence of meaningful bi-directional connections, following our motivation to explain how meaningful connections affect market behavior. Of the 60 people we interviewed and observed, 25 confirmed independently of their relationship and also agreed to provide detailed information about their past employment and their personal connections. Of these

¹¹ As of Dec., 31st, 2007.

¹² Rotations consisted of spending between a half a day and two days with different professionals at a same firm. The purpose of this is three-fold: 1) understanding how the different functions connect, 2) observing what information is shared and 3) triangulation of questioning.

¹³ *Relevant* for hedge fund managers was defined as: 'have influence on the investment decision, be it directly through e.g. idea sharing, or indirectly through e.g. second opinion or selective contribution'; while for brokers it was defined as: 'hedge fund managers: a) with whom consider to have a good relationship, and b) would belong to your top 20 clients or top client list, if you would have one.

actors, five worked on the brokerage side¹⁴ and 20 in hedge funds (14 in London, three in New York, one in Geneva and two in the European city).¹⁵ Apart from one, all of the hedge funds we examine, had assets of at least USD 5 billion under their management (and thus represent the largest 20% of funds in these strategies). In addition, each of the hedge fund managers had known personally at least one other manager through previous work in financial institutions and/or studying together. The brokers all specialize in executing orders and providing research material for the long-short and event-driven strategies and are tied, through daily interactions, to the hedge fund managers¹⁶.

4. Connections and communicative practices between hedge funds and brokers and among hedge funds

4.1. Connections between hedge funds and brokers

To introduce the empirical findings, we discuss the main organizational actors. Hedge fund managers are the most central functionaries in the hedge funds we studied. Typically, hedge fund managers are partners to the initial capital collected during the set up of the fund and they are frequently also the founders. This function's centrality is reflected in the decision making process. Almost without exceptions, the hedge fund managers we examined made the final decisions on the composition of the fund's portfolio of holding (e.g. which assets to buy and which to borrow and sell). Hedge fund managers are often assisted by analysts¹⁷ (i.e., 'buy-side analysts'¹⁸). The major task of analysts is to develop investment ideas through the assessment of the countries, industries, sectors or companies on which they focus. The last function holder we typically encounter in hedge funds is the trader, who executes the trading orders that follow the decisions of the hedge fund manager. While the analysts and the hedge fund managers tend to take a long-term investment horizon, the trader in the fund focuses typically on the short term. That is, the information provided by

¹⁴ The brokers examined are all Managing Directors at their firms and responsible for the coverage of the hedge funds managers, communicating on a daily basis.

¹⁵ We identified only one broker-broker connection in our network, as was also indicated in our qualitative data. Hence, the questions to brokers referred, in effect, to their connections with hedge fund managers.

¹⁶ Although our observations indicate that brokers do not tend to have professional relationships with each other, BR7 and TRS1 did have a connection. The two informed each other of their best ideas and big orders they received. BR7 had even introduced TRS1 to some of his customers.

¹⁷ The hedge fund managers we observed and interviewed had, each, between one and four analysts assisting them.

¹⁸ To distinguish between analysts and traders at the brokerage side, the ones belonging to hedge funds are known as 'buy-side', while their counterparts at the brokers are referred to as 'sell-side'.

the trader does not tend to change the hedge fund manager's view on the valuation of the opportunities in a security, but only influences, for example, the timing of the execution.

Brokerage firms, with which hedge funds interact, are typically sub-units in an investment bank or a bank holding. Brokerage firms typically perform the executions of the trading orders for hedge funds, provide operational support for these trade executions and may also provide additional capital with which the market positions can be leveraged or requested assets can be bought. Most commonly, the immediate contact person of the hedge fund in the brokerage firm is salesperson and our informants frequently referred to these salespersons as 'brokers' (we use the terms interchangeably). A salesperson would normally provide the hedge fund with initial investment ideas and may also be involved in organizing meetings between hedge fund managers and executives from companies or institutional investors (this area of activity is known commonly as 'corporate access'). In addition to the salesperson, another important figure is the brokerage firm's analyst who produces research reports with trading recommendations. We saw that analysts also meet occasionally with hedge fund managers, typically when the latter requested more focused information about the reports.. Finally, traders in brokerage firms, similar to the ones in hedge funds are responsible for the actual execution of trading orders on behalf of the brokerage firm's clients.

What information and ideas do hedge funds receive from the brokers? The bulk of the communication that we witnessed between hedge funds managers and brokers revolves around the transmission, by the brokers, of 'flow-information'. Flow information, 'market color' or 'flow color', as they are also commonly known, is context-specific information about the conditions surrounding a possible trading action. Flow information, for example, answers questions such as whether there are more buyers than sellers for certain assets at a given time, the type of institutions that are interested in buying or selling and the size of common trading orders . Hedge fund managers or hedge fund analysts seeking flow information constituted the single most frequent type of phone calls or emails that brokers received from hedge funds during our observations. Such requests for information were followed up, typically, by brokers conducting some investigation and returning to the hedge fund managers with specific details and notes. For example, a hedge fund manager we observed, who was developing an investment idea that included buying Telefónica stock, the Spanish multinational company whose stock is traded in the Bolsa de Madrid (the Madrid Stock Exchange), called a local broker who had '*a good understanding of the intentions of major holders in the stock*'. The broker, whom we also interviewed four days

later, contacted his Madrid connections and provided to the hedge fund manager an assessment of the expected flows as well as a detailed, up to the minute information about the activity in the Telefónica stock. Flow information, in the words of another hedge fund manager is information ‘not found on the tape’; that is, not included in the price and volume information.

Hedge fund managers, as we saw frequently in our observations, have a keen interest in finding out about the types of investors involved in the market. Typically, a distinction is made between traditional asset management or corporations(‘real money’), between hedge funds (‘fast money’/‘smart money’) and between central banks. The distinction between real money and fast money is important, for example, when the hedge fund manager assesses the stability of current price levels of a certain: when a mutual fund (a real money player), for instance, is a buyer, it can be safely expected to hold the assets for a prolonged period, unlike some hedge funds (fast money), which are likely to sell it within a short period. The distinction between ‘real’ and ‘fast’ money, when the manager realizes that the buyer/seller is a competing hedge fund, is followed typically by another enquiry: ‘Are they smart?’ We saw that trades that were reported by brokers to have been performed by ‘smart’ hedge funds usually received more attention, were studied more carefully than trades that were deemed to have been conducted by managers that were not qualified as such.

The popularity of flow information in communication between hedge fund managers and brokers is explained by the mutual interests of the two types of actors involved. Hedge funds are eager to learn about the identity and intentions of other actors with whom they share the market and brokers, who know that such information may lead to more trade orders, provide the information. In addition, hedge fund managers rely on the superior number and variety of connections that brokers have and use them, in effect, as their ‘*ears and eyes in the market*’, as one hedge fund managers put it. However, in spite of it being timely, specific and frequent, flow information has a significant limitation, imposed by the fact that brokers are required to maintain the anonymity of their customers and prospective customers and are prohibited from disclosing their identities. In fact, the distinctions discussed above, between real money and fast money, follow the prohibition on stating explicit names of customer.

The nature of flow information is even more pronounced when the brokers disseminate information more widely, using emails or instant messaging. During our observations at one of the hedge funds (the one where HFM7 is a partner and manager) we noticed that much of the flow communication came in via Bloomberg or IB Chats

(Bloomberg messenger). These messages are sent to prepared lists of hedge funds the broker believes may be interested in the information. In following Bloomberg screens, we can see how brokers divulge important flow information while concealing the names of their customers (see figure 1).¹⁹

On this screen, the broker sending the message notifies HFMs that hedge funds with a very good past track record ('quality names') as well as long-term investors (which means that the buyers are less sensitive to short-term prices movements) are buying Euros (EUR) against US Dollars. 'Trichet comments' in the third paragraph refers to the potential effect that a press conference by Jean-Claude Trichet, the head of the European Central Bank, may have on the markets, and the broker is notifying that hedge funds ('leveraged players') were buying some short dated protective put options against a possible weakening of the Euro following this press conference. The 'coded' language used in the message illustrates that the information that hedge fund managers are used to receive from brokers lacks, frequently, important details and in many cases is superfluous for decision-making. For example, it was apparent in our observations that brokers initiate communication with hedge fund managers (be it via phone calls, emails or instant messages) at much higher rate than the latter seek their information. It is true that hedge fund managers call brokers and ask for specific 'market color', but for each of these there are many unsolicited phone calls and Bloomberg messages (known colloquially as 'Bloomies') sent to hedge fund managers. It was not uncommon for us to see hedge fund managers or analysts who deleted such messages after looking at them very briefly or even without reading them at all. At times, the trader at the hedge fund would call the broker asking if a certain flow indicated by the latter was 'real' or if they were just 'fishing'. Indeed, in some occasions brokers send out 'indications of interest' in the hope that it might generate a client order.

Another common type of communication between brokers and hedge fund managers are investment ideas. HFM9, a long-short London-based hedge fund manager explains:

'The way I see brokers is a process of scanning for money making ideas. That is basically what you pay for. You pay for research where they scan companies and they filter all the valuation cases for you'

This view is prevalent among hedge fund managers and it is also supported by an economic infrastructure. As brokers and hedge fund managers alike explained to us, providing investment ideas is a good way for the brokers to generate fees, because it is

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expected that the hedge fund manager would execute the trades through the broker who suggested these trades. The fees, although not routed directly to the individual broker, more fees do mean higher bonuses. Others explained that in present market conditions, the layoffs clearly followed a distinction between brokers who had high fee-paying customers and those who had not. In addition, recruitment managers at brokerage houses stressed that ‘strong commission generators’ would get access to larger customers and would advance faster. We also witnessed brokerage houses where a bell rang in the open-space floor each time a salesperson obtained a large order or where the head of the trading floor would pay an ostensible congratulatory visit to the salesperson who had just ‘printed’ a big order.²⁰

In addition to being a valuable service, investment ideas are also used as a form of ‘tradable’ asset: *‘Since business has been slow and we have not been able to pay our brokers the way we should, we have engaged more with them on the ideas’ side. We have been giving some of them some ideas we were looking at.’* Here, TRB1, a trader at an event-driven hedge fund explains how his hedge fund had tried to compensate the drop in cash commissions paid to brokers by sharing with them some of the fund’s ideas. This is a common practice we witnessed: hedge funds offer investment ideas generated in-house as an alternative form of payment to brokers.

This set of conventions also has an affect on the brokers’ motivations for creating and maintaining connections. Brokers want to create and maintain as many connections as possible with hedge funds, knowing that these connections serve as the basis for making revenue. This logic of connectivity also has a direct impact on the quality of information hedge funds share with brokers. Whilst hedge fund managers were eager to hear from brokers about what other hedge funds were doing, they also blamed brokers for their ‘parasitic behavior’, which follows the brokers’ exact practices of information sharing and distribution. This is illustrated by HFM2 and HFM16 who are senior hedge fund managers at two of the biggest hedge funds in the world:

‘The sales side people [brokers] are just desperate to print tickets. They do not care how [or] who with, and so if they hear a good story [i.e. an interesting idea], I mean they are starving for stories, they pass it on. [HFM16]

Interviewer: What is the perception of brokers by hedge fund managers like you?

²⁰ Incentives installed by clients could consist of one or more of the following methods: (1) percentage of commissions paid based on number of money-making ideas during a certain period; (2) direct pay-back mode - i.e. a useful idea would be executed via the broker who transmitted it; (2) broker rankings - at the end of a term hedge fund managers inform the broker’s supervisors how they ranked versus their competitors.

HFM2: In general they are good people, but you should be weary of them. They engage in what I call parasitic behavior. They try to know or understand what we do. Once they do, they will use that to generate business from another hedge fund. At the same time, they will tell me what other strategies or other hedge funds are doing.

It has to be noted that along with such expressions of restrained and controlled relationships, we observed that brokers and hedge fund managers often spoke with each other several times a day, had meals together and shared pastime activities such as going to sporting events. However, when we asked senior salespeople in brokerage houses and hedge fund managers about how close the ties are, they described most ties between brokers and HFMs as governed by a ‘business reality’, where the social engagements follow the level of commissions paid and where hedge funds managers only divulge to brokers information they do not mind being disseminated widely. These economic and social practices, which underpin the brokers-hedge fund managers logics of connectivity prevent, virtually, from timely, detailed and interpretative information to be exchanged between hedge fund managers and brokers.

4.2. Connections among hedge funds

An equally active set of connections, but distinctly different in the type of information shared and the underpinning sets of practices, exist among hedge fund managers. All the hedge fund managers we observed and interviewed operate in the same strategies and therefore compete for capital and return-generating ideas, which contribute directly to their performance and amount of assets under their management.²¹ In spite of this fact, a common feature in the daily routines of virtually all hedge fund managers we observed is that they communicate with other hedge fund managers who operate in the same strategy. In fact, such communication is so common that, for example, HFM9, a London-based long-short hedge fund manager, had the phone numbers of four competing hedge fund managers programmed into his speed-dial phone system, which consisted of 16 pre-programmed phone numbers (HFM6 and HFM16 being two of them). Our observations reveal that this is not an exception and that most of the hedge fund managers talk several times a day with one or more of their competitors and that they discuss potential investment

²¹ The majority of the hedge funds in our sample receive an administration fee of 2% and a performance fee of 20% of assets under management.

ideas, report on success or failure of existing positions and, in general, share detailed internal information related to the running of the fund.

Asking HFM7 what was the basis for such frequent contacts, he answered:

'I know those people from working in the same financial institutions. One guy that I know is head of a very, very big American hedge fund. He used to be a proprietary trader ten years ago and a colleague of mine.'

A similar explanation was offered by HFM3, manager of a New York-based convertible arbitrage fund:

'Between hedge funds a lot of it is just your personal contacts. In some of the small funds, you have great personal contacts with hedge fund managers at other large funds with whom you exchange ideas. You would be surprised how relationships endure over time.'

While common biographical history serves as a basis for the connections, a strong norm of informational reciprocity also affects the communicative content of the connection. In our conversations with hedge fund managers and when observing their regular discussions with other hedge fund managers, it was mentioned and demonstrated repeatedly that investment ideas and insights are shared with the expectation that the 'acquirer' of information would 'pay back' the favor in the form of offering insights or information of their own, insightful feedback on ideas, moral support or other assistance. HFM15, a London-based hedge fund manager explains:

'You try to share information and ideas. It is reciprocity, actually. You will not keep those people as friends if you don't have something else to offer.' In all cases where we discussed this practice of information exchange, hedge funds professionals explained that information sharing is a 'two-way-street', a 'quid-pro-quo', or a 'you scratch my back and I scratch your back' type of an implicit agreement.

The reciprocity among hedge funds, unlike the one existing between hedge funds and brokers, includes an interpretative dimension. Hedge fund managers expect other managers with whom they communicate to offer insights, commentary or criticism during the discussions. We witnessed many conversations that focused on specific issues relevant to trading positions; issues such as composition of boards of directors, product strategies or implications of regional law, but in almost all of these communicative exchanges, whether they were face to face, by phone or by email, the goal of the conversations was not to find out about a new investment idea, but to shed new light, explore different dimensions or scrutinize existing or contemplated investment ideas.

This interpretative dimension is related to the motivation, which was noticeable among hedge fund managers, to exhaust, it would seem, all possible angles of inquiry when evaluating a potential trading position. For example, HFM10, who manages an event-driven fund, answered the following when asked why he discussed in detail his position with a competitor:

'I speak to these guys because I know they have a very specific knowledge in that area. I know some of the guys I speak to although their funds might be similar, have very specialist knowledge and that can be very helpful.'

The discussion to which HFM10 refers was about the tax implications (exemptions) of a transatlantic merger. Although HFM10 and the fund he ran were very knowledgeable about European tax law and mergers, he felt that for mergers where US tax law might apply, it would be helpful to have the input of a competing hedge fund manager that he considered very knowledgeable about this specific issue. This rationale was presented to us frequently: hedge fund managers were fully aware of the competition among them, but the quality of interpretative knowledge they gained from talking with competitors and sharing with them their ideas, views and market positions was worth the exposure.

The motivation to seek out interpretations and analysis is related directly to the discursive nature of the communication among hedge fund managers. Hedge fund managers communicate with each other not only to share information, but, primarily, in the quest to solve specific problems. This is notable when considering the fact that brokerage firms have their own expert-analysts, but still hedge fund managers we observed clearly preferred to approach another hedge fund manager, a competitor, over contacting an analyst at a brokerage firm when a difficult question about a trading position arose. HFM11, a manager of an event-driven fund, who focuses on investing in announced mergers or acquisitions, offers an explanation for this preference. When asked about how he evaluates the likelihood of two companies to merge, which was a position he was examining at the time, he explained:

'I just do not want to be wasting time but I think analysts [in brokerage houses], they sometimes simplify their job a lot.[...]They will, say, put a 50-50 probability on it [the event] and that gives them a target [price], because that just simplifies their life. [...] But if I speak to someone else who is an event-driven investor, they will have done a hell of a lot of work on that. They will have spoken to lawyers and spoken to advisers and spoken to

consultants because that is what we focus on. This changes the probabilities. That is just very different from putting 50-50 on it. ‘

The quote above, which represents many situations we witnessed, highlights another set of motivations for the hedge fund managers’ collaborative process of interpretation. HFM11 knows that probabilities should be assigned to the possibility of a merger and he even has an opinion about which probabilities are appropriate. Nonetheless, he wants to share his views with someone who is equally knowledgeable to test the reliability and validity of his ideas. To find such conversation partners, HFM11 is reaching out to other hedge funds. As he stated, HFM11, like many other hedge fund managers, believes that analysts in brokerage houses are not as knowledgeable as other hedge fund managers (or their analysts) on specific issues simply because hedge funds tend to specialize in one type of trades, while brokers cater to a wider variety of trading strategies, often long-only (traditional asset management).

The motivation to add new layers of interpretation to an existing trading, which is inherent to the communication among hedge fund managers supports a development and maintenance of close-knit groups within which the managers communicate. It is very rare that a hedge fund manager would find it sufficient to ask only one other competitor for his opinion. Instead, the hedge fund manager would contact a second and possibly a third manager, share some of the earlier information and try to develop a more comprehensive picture.

This mode of communication is related directly to the selectivity that hedge fund managers apply and to the resulting small groups of hedge fund managers who engage in communication. Hedge fund managers told us numerous times that unless they trusted the other hedge fund managers there would be no point in having a relationship and in exchanging information with them. We saw that for hedge fund managers two dimensions of trust needed to be present so that communication would be established. First, they may trust the competence of other hedge fund managers:

‘I trust their opinion about stocks. I have had recently a situation where we were short one stock and the guy at [name of a competing hedge fund] was long. So we met up inside our offices with him to discuss why we had different opinions about the stock. He is very smart, so I wanted to pick his brains and share my views to see who was missing what.’

The last quote exemplifies how the concept of ‘trust in competence’ helps in shaping decision making among hedge funds. During the discussion described above, the hedge fund manager shared with the manager from the competing hedge fund the rationale behind

his trading position, the valuations that motivated it and the extensive research work that supported the decision. Following this, the visitor presented his fund's position and its supporting arguments. During that presentation, the hedge fund manager quoted above asked many challenging questions and a discussion developed around the different views. This exchange, which is typical to many of the discussions among hedge funds, lasted about two hours and was informative and open and amounted, eventually, to collaborative decision making, as all participants gained new perspectives regarding their trading positions, perspectives according to which they acted.

The other meaning of trust we encountered is related to the sensitive nature of the shared information. Earlier we saw that the willingness to expose such information is justified by the potential return the hedge fund managers believe they will receive (e.g., in the form of expert opinion), but this willingness is also explained in trust about the intentions of the parties to the communicative ties. We heard the phrases 'integrity', 'a shared set of values' and 'honesty' being used when hedge fund managers expressed their belief that others would not abuse the sensitive information that is given through the sharing practices. When we asked about cases where hedge fund managers *did* take advantage of such information it was obvious that the topic made our informants uneasy and they were reluctant to speak about such instances. However, in one of the conversations at the end of a trading day, a hedge fund was mentioned that used information to spread false rumors and to inflate prices. The person who mentioned it said that 'everyone knows about them and now no one talks to them'.

This meaning of trust also adds another dimension to the information segregation that forms structural secrecy in the hedge fund world. Hedge fund managers tend to suspect the safety of information shared with brokers because an inherent part of the broker's practice is the re-distribution of information. Because of this inherent tendency, hedge fund managers explained to us, brokers simply cannot be trusted with information the same way other hedge fund managers can be. The following quote from HFM14, who was previously an equity hedge fund salesperson at a brokerage house, represents nicely the communicative practices and their justification:

Interviewer: Do you find that those people [hedge fund managers] are closer to you than brokers?

HFM14: *Yes, definitely.*

Interviewer: Even compared to former colleagues who are still brokers?

HFM14: *Of course. Because what I tell to a broker, former colleague or not, he might easily tell other hedge funds to create goodwill. This means that I will not really trust him. Not because it is him, but because it is part of his job. So there will always be some distance. This is not the case with other hedge fund managers that I trust. The only thing which holds us together is not business, it is that we trust each other.'*

The quote indicates that the effect of the position of the actor in the network of connections is so strong that even in the cases where the hedge fund manager knew the broker from a previous joint working place (a basis for many of the connections, as we saw), they still restricted the type of information they shared.

In this section, we examine two sets of connections that make up the network of hedge fund managers and brokers: the brokers-hedge fund managers ties and the ties among hedge fund managers. These two sets of ties are a fundamental feature of investment decision making in hedge funds. Brokers broadcast initial investment ideas and pinpointed, partial (sometimes 'coded'), flow information. The specific content included in much of the flow information, combined with its wide dissemination, lead hedge fund managers to assign low priority to this type of information and, frequently, to ignore it altogether. In contrast, using some of the information from brokers as a basis, hedge fund managers conduct a consultative process where more detailed and timely information is collected and investment ideas are examined and evaluated. The differences in the qualities of information exchanged are reflected also in the structure of connections. On the one hand, hedge fund managers share and discuss information in small groups within which everyone, virtually, knows everyone else and from which brokers are excluded. Brokers, on the other hand, serve as informational hubs: they are connected to many different hedge funds, many of which are not connected directly to each other. This analysis reveals that the combination of the two ties, underpinned by arm's length ties and embedded ties is the social and organizational arena where decision making in hedge funds take place. The combined set of practices and conventions brings about and maintains a constellation whereby the different types of information and knowledge circulate in separate paths, connected only by highly restrictive gateways. This constellation, while being effective and beneficial for decision making most of the time, proved to lead to destructive outcomes in the case of the VW-Porsche trade. Following a discussion of our quantitative findings, we will focus on this trade and analyze the emergence of the crisis.

5. Network Findings

To provide further evidence to the findings from the semi-structured interviews and observations, we mapped the verified connections among hedge fund managers and between them and brokers. We examine the resulting networks to see if this additional mode of enquiry contributes to our analysis, supplying converging evidence to supplant and strengthen the insights gleaned from the interviews and participant observations. We wish to further corroborate the general hypothesis, that hedge fund managers and brokers are motivated by two different logics of connectivity.

In particular, we suggested in Section 2 that brokers aim to have a large number of connections with hedge fund managers, as these connections provide them opportunities for generating fees, whilst hedge fund managers tend to be selective and maintain clusters of densely connected actors. Certainly, these hypotheses are broadly supported by the findings from the interviews and observations in the previous section. If the two logics of connectivity are expressed not only in the actors' conversations and in interviews, but also in their aggregate map of connections, then we should expect them to be reflected in several descriptive network measures. First, the average number of connections (degree) that a broker has should be higher than that of the hedge fund manager's. Second, brokers aim to position themselves at the centers of star-like network patterns, where each of them has connections with many hedge fund managers, while hedge fund managers prefer to be part of higher density patterns of connection, where information can be verified and triangulated easily. We expect these different preferences to be reflected in hedge fund managers having, on average, higher aggregate dyadic constraint²² than brokers do, while the brokers have higher betweenness centrality.²³ Table 1 reports these measures for brokers and hedge fund managers.

The measures indicate that brokers have, on average, almost twice as many direct connections (or 'degrees') as hedge fund managers have, while having about half the level of dyadic constraint of hedge fund managers. Brokers are less constrained by virtue of having more connections and occupying more central positions in the network: brokers obtain higher betweenness values. The higher betweenness centrality testifies that brokers

²² The measure of dyadic constraint is based on the triads to which the measured actor belongs. Complete triads impose constraint on the actors connected in them (none of them can broker between the other two), while incomplete triads gives one actor potential brokerage opportunity (as that actor connects the two others). The aggregate constraint on an actor is the sum of the dyadic constraints that actor has as a result of the actor's membership in triads, weighted by the importance of the connections for the actor. According to this rationale, a low dyadic constraint is related to increased brokerage opportunities (Burt, 1992; Breiger, 2004).

²³ The measure of betweenness centrality (Freeman 1977, 1979) is based on the number of shortest paths between pairs of nodes in the network on which the measured node is located. The rationale behind the measure is that the more such shortest paths 'cross' the measured actor, the more brokerage opportunities that actor would have.

‘hold the network together’ and that their removal would disintegrate the network into separate components. These findings corroborate the picture emerging from the data collected in the participant observations and interviews.

The network is presented diagrammatically in Figure 2. The five brokers are displayed by five circles placed in a horizontal line at the upper-middle part of the figure. Hedge fund managers are represented by squares: those specializing in Event Driven strategies are represented by black squares and are placed above the line of brokers. Those specializing in Long-Short strategies are represented by grey squares and positioned below the brokers. The size of the node represents its betweenness centrality. Eyeballing the figure supports the results shown in Table 1; brokers have more connections and despite their small number they are instrumental in holding the network in one large component. Furthermore, brokers’ centrality tends to be greater than the centrality measure of hedge fund managers. An additional corroboration to a qualitative findings is illustrated in the diagram: besides their connections to brokers, hedge fund managers connect to other hedge fund managers that specialize in the same trading strategy as they do: those specializing in Long-Short strategies tend to connect between each other, as do those specializing in Event Driven strategies. There are only two ties that connect hedge fund managers that specialize in different strategies (namely the ties of HFM20 with HFM24 and HFM17). To test whether the patterns of connectivity revealed in the descriptive measures reflect genuine network effects rather than random associations between the actors, we use Exponential Random Graph Models (ERG models) for social networks (Snijders et al 2006, Frank and Strauss 1986). ERG models are a family of stochastic models used to identify significant network effects. These effects are understood to be idiosyncratic tendencies of nodes to connect, disconnect or maintain the state of their tie depending on their local environment. Despite operating at the micro level, these tendencies account for macro-level deviations between the observed network and a benchmark “random network”, a network generated by arbitrarily connecting nodes, each connection independent of the others. In contrast to random networks, real-world networks exhibit properties that are oftentimes very different from the properties of random networks, implying important dependencies between adjacent ties. For example, it would be very unlikely for a random process of network formation to yield a network characterized by a few central hubs and numerous peripheral nodes (Barabasi and Albert 1999). However, many ‘real-world’ networks do indeed exhibit such a property, manifested when the number of a node’s contacts follows a highly skewed distribution. Estimating the magnitude and relative importance of these micro-network

effects, ERG models attempt to account for deviances between the random network and the network observed in the data.

Moreover, estimating an ERG model provides a way to disentangle between different effects that contribute to similar macro-outcomes, thus allowing for a comparison between competing explanations for an observed macro-property of the network (Wimmer and Lewis 2010). As in the estimation of standard linear models, effects may vary in their importance, contributing differently to the same response variable. Take for example the homophily effect (McPherson, Smith-Lovin, and Cook 2001), defined as the preference for association between individuals with similar properties. This is a widely observed effect, a local level effect (like nodes are ‘attracted’ to each other), resulting in macro-level properties, namely the segregation of the network according to individual’s properties such as race, gender, or socio-economic status.

Homophily may easily be overestimated if other effects are not controlled for, such as the tendency of friendship to be returned (reciprocity) or the tendency of friends of friends to befriend each other (triadic closure). Homophily, reciprocity and triadic closure are all local effects with macro consequences to network properties. To judge the importance of each of these effects, they must first be disentangled, since any observed tie might be explained through more than one effect. For example, observing a two-way relationship between similar individuals A1 and A2, each of the two way relationships may be explained either by homophily (A1 is connecting to A2 because they have similar attributes) or by reciprocity (A1 is connecting to A2, conforming to a norm of reciprocity), or indeed by triadic closure (A1 and A2 are additionally related to another node, A3). The estimation of the ERG model strives to disentangle and control for the various local effects, each of which contributes differently to the pattern observed in the network data (Wimmer and Lewis 2010).

The ERG model is a logistic linear model, its response variable denoting the probability to observe a specific realization of the network among a family of possible realizations. The network is represented by the random variable \mathbf{Y} , itself consisting of a set of random variables $\mathbf{Y} = \{Y_{i,j}\}$. For each two nodes i, j , the variable $Y_{i,j}$ is set to one to reflect an existing relationship between i and j , and it is set to zero otherwise. The diagonal values $Y_{i,i}$ are not defined (usually set to zero) since relationships to self is not meaningful in this dataset.

The response variable depends on the network effects chosen by the analyst to be estimated in the model. Once the model is estimated, it defines a distribution of networks, and the estimation of its coefficients is chosen such that it would maximize the likelihood to observe the actual social network, as expressed in equation 1 (Robins et al. 2007).

$$P(Y = y) = \frac{1}{K} \exp\left(\sum \eta_A g_A(y)\right) \quad (1)$$

In this equation, the random variable Y is distributed such that the probability of observing each of its realizations y is associated with the expression on the right hand side of the equation. Since every tie may depend on the existence of other ties in its vicinity, the random variables are interdependent. These interdependencies are captured by the effects on the right hand side of the equation, effects that are chosen by the analyst on the basis of substantial dependence hypotheses regarding the mechanisms that govern the formation of the ties, mechanisms that spell out how nodes and ties might affect other ties in their vicinity.

The effects chosen typically include homophily, reciprocity and triad closures as defined above. For each of the mechanisms, $g_A(y)$ represents the network statistic associated with a certain configuration A. These statistics could include the existence of a symmetric tie for reciprocity, the existence of a triangles for triadic closure etc, where $g_A(y)$ is equal to one for each observed configuration. The normalizing constant K is responsible for assuring that the sum over the probabilities for all network configurations would add up to one.

Once the effects of the model are chosen, the coefficients of each of effect, η_A , and its standard deviation are estimated. The magnitude of the coefficient is associated with the marginal increase in the log odds-ratio for the observing the network in question. The proportion of the standard deviation to the coefficient is associated with the significance of the effect.

Our ERG model initially estimates parameters that reflect two properties of networks that are common to many real-world networks that rarely appear in random networks. The first property is the appearance of a few central hubs in the network, nodes endowed with an unusually large number of relationships. This property is captured in the skewedness of the degree distribution of the network. The second property is the tendency of the observed network to form areas of high density, also an unlikely property in a random network. Each of the estimated parameters is associated with a network statistic. The skewedness of the degree distribution is measured by a network statistic known as “alternating k-stars”, whereas regions of high density are measured by network statistics

known as “alternating k-triangles” and “alternating 2-paths” (Robins, Pattison, and Wang 2009; Snijders et al. 2006). By controlling for these two effects, effects that are not specific to ties between brokers and hedge fund managers, we aim to single out the connections between brokers and hedge-fund managers and focus on the different logics of connectivity that drive these ties. In addition, provide to an indication whether brokers and hedge fund managers each form their ties according to different ‘logics of connectivity’ we estimate additional effects that are based on the attributes of individuals, such as the preference to connect to similar others (homophily) (Snijders et al 2010).

To test the goodness of the models fit to the empirical data, we use the estimated parameters of the network statistics to generate a population of networks that conform to the dependencies defined in the model. Then we compare between these networks and the observed network in terms of new network statistics whose parameters we did not estimate in the model. Such a comparison can tell us how well the model represents those mechanisms governing the formation of a family of networks, all of which exhibit global characteristics observed in the network data.

Two models were fit using the software PNET (Wang, Robins, and Pattison 2006, Wang et al 2009²⁴). This program estimates the model parameters using a Markov-Chain Monte-Carlo (MCMC) maximum likelihood estimation techniques. For each network statistic in table 2, we report the estimated value of the associated parameter and its standard deviation. The results for the two models are presented in table 2.

In model 1, the k-triangles and two-path parameters can be interpreted together: a significant positive alternating triangle effect together with a significant negative alternating two-path effect indicate that nodes tend to ‘clump’ into dense regions of connected triangles (Robins et al. 2009).²⁵ Two additional exogenous effects are estimated, the first is the extent to which a node of a certain kind tends to create connections with other nodes, an effect termed ‘activity’ or popularity. The greater the activity associated with a certain attribute, the more likely it is for nodes endowed with this property to connect to other nodes. The second effect is an interaction effect, which is the propensity of a node to connect with another node of the same kind, over and above its overall activity. The results yield a significant positive

²⁴ We choose PNET because it allows to incorporate certain effects in the ERG model, effects that do not exist in other ERGM estimation software packages such as STATNET (Wimmer and Lewis 2010), exogenous effects that include local network configurations that depend on node attributes such as t3u as explained below.

²⁵ The edge effect in sparse networks determines the marginal log-likelihood of observing a tie between two random nodes. The estimation of the edge parameter has a relatively high standard error, and is therefore unreliable in the first model. A negative value for the alternating star effect indicates that there is no tendency towards skewed network degree distribution.

activity effect of 4.23 for hedge fund managers and an additional significant negative interaction effect of -6.76 between two hedge fund managers. This means that each hedge fund manager in each dyad contributes 4.23 to the log-odds ratio that a tie is formed. However, the log-odds ratio that a tie is formed between two hedge fund managers is penalized by -6.76. Taken together, this means that the log-likelihood of tie forming based solely on the activity effect of the hedge fund managers is about double the log-likelihood for a tie between two hedge fund managers ($(4.23+4.23) - 6.76 = 1.70$ compared with 4.23). Hedge fund managers ‘attract’ brokers more strongly than they ‘attract’ each other. This is not surprising considering that despite more hedge fund managers than brokers (20 hedge fund managers compared to 5 brokers), fewer ties form between pairs of hedge fund managers than between pairs of hedge fund managers and brokers (28 of the former vs. 45 of the latter).

Appendix 3 presents the goodness of fit of this model. Most of the network statistics fit well, but the statistics that fit least are the t3u statistics. These statistics count the number of triangles that consist of a single type of actor: the statistic ‘HFM_t3u’ counts the number of triangles consisting of three hedge fund managers, whereas the statistic ‘ls_t3u’ counts the number of triangles consisting of three long-short hedge fund managers, etc. In all these cases, these statistics are underestimated by the model. To correct the model, we need to account for an additional mechanism that explains why different kinds of actors tend to form triangles, over and above what is expected by the first model.

To achieve this aim, various triangle statistics are added to the model, as well as activity and interaction effects for hedge fund managers who specialize in the long-short trading strategy. The result is model two, which improves the goodness of fit, as can be seen from the comparison in annex 3.

As before, we see a positive activity and a negative interaction effect of hedge fund managers, as well as a slight but significant difference between different types of hedge fund managers. As before, hedge fund managers are likely to realize ties between each other, but are more likely to do so with brokers. However, there is an important difference between the two models: the network-wide tendencies to form triangles (captured by the diverse triangle and alternating two-path statistics) have become less significant in the second model. These effects have been completely replaced by activity and interaction effects, that is, forces of homophily and heterophily.

These findings correspond well with the qualitative analysis discussed above. First, the ERG models identify a *difference in kind* between two types of ties: the broker to manager tie on the one hand is rather common and ‘cheap’, as it were, whereas the manager to

manager to manager tie is more seldom and expensive. This result underlines the different processes of tie formation and their different quality, depending on the attribute of the nodes: Connections between hedge fund managers demand more resources and put the parties at risk when discussing private information. These connections require more commitment from the parties involved than connections between hedge fund managers and brokers, it is therefore reasonable to see hedge fund managers being more selective about contacts with other hedge fund managers than with brokers.

Additionally (though perhaps less interestingly), we see that the type of strategy hedge fund managers specialize in is a key factor in explaining their ties. In the second model, the specialization of hedge fund managers fully explains the clustering of actors together.

A few caveats to the analysis are required, due to the small number of brokers in the network means that these conclusions include certain caveats. First, we do not know if brokers 'repel' each other: try to avoid making connections. We have qualitative evidence, however, that broker-to-broker connections are exceptional. For example, BR7, a broker, told us that he found out that a hedge fund was using his investment ideas, but executed the trades through a cheaper broker. BR7 learned about this because the broker who executed the trades was his good friend and shared this information. BR7 emphasised that it was highly exceptional that a broker would share such information with another broker. Second, the small number of brokers limits our certainty about whether or not two hedge fund managers connected to the same broker are less likely to know each other directly.

6. Consensus Trades

Having discussed the general structure of social ties and sets of norms and conventions that govern decision-making in hedge fund, let us now focus on how investment ideas gain popularity. During our fieldwork, we noticed that hedge fund managers and brokers frequently referred to certain trading positions as 'consensus trades'. Consensus trades were trading positions that were popular among hedge funds. We were told by numerous hedge fund managers that at any given time there were a few similar or even identical consensus trades, which were held by many hedge funds. The relation between consensus trades and the ties among hedge fund managers was explained by many of the hedge fund managers and analysts with whom we spoke. Here is a typical explanation:

'Yes, there are many people that have similar kind of trades. There is a certain universe of consensus trades, everyone has those trades... Because if one hedge fund manager knows that something is cheap he is likely to let another hedge fund manager know it is cheap. People share information, especially amongst hedge funds.' [PBS1]

We witnessed many times how hedge fund managers introduce to each other investment ideas. Investment ideas were discussed, interpreted and scrutinized within the clusters of trusted hedge fund managers, the arena where investment decisions were made. Decision-making on its own, however, cannot explain the dissemination of the ideas and their turning into popular consensus trades. As the findings indicate, detailed discussions among hedge fund managers were limited to small groups of trusted individuals. In contrast, brokers were motivated specifically towards disseminating investment ideas and their wide variety of contacts enabled them to do so effectively. HFM9's description best encompasses our observations about the dynamics that lead to the emergence of a consensus trade:

In general, I would say that it starts with an idea. So somebody must have been the first one to come up with it. You look at it and [a certain stock] looks dirt cheap. So to be sure, you might talk with a couple of your friends at other hedge funds, go through the critical issues you are not sure of. You discuss it, see if you are not missing anything. Finally, you like it and invest in it. The other hedge fund managers are doing the same. By now, some brokers are seeing that hedge funds are [executing the trade] and start telling other similar hedge funds. That is where I think it becomes critical. These other hedge fund managers will analyze it. Because brokers will probably only mention what other hedge funds are doing but not why, and if they give you the why, it will be very general. So these other hedge funds will be doing their own research, talk to other hedge fund managers, etc., and if it makes sense, invest in it. If it does, you start having a consensus trade since at that stage everybody is talking about it: you, your friends, the brokers, other hedge fund managers and even [name of a television host on investments].

This description captures the two types of information exchange that underpin the general form of decision making in the hedge fund world. The information disseminated by brokers provides an outline of the trade, but does not develop a rationale and a detailed trading strategy. The latter is developed through the discussions among hedge fund managers. We witnessed these dynamics repeatedly during our fieldwork. Many of the hedge fund managers explained and demonstrated in their actions how having a common

background with other managers underpins their connections. Again, these findings portray a picture similar to the one described by Uzzi (1997): both embedded ties and arm's length ties play a crucial role in the making of a consensus trade. The arm's length ties, between hedge fund managers and brokers, are crucial for the diffusion of the initial investment ideas across the hedge funds' networks, whilst the embedded tie, among hedge fund managers, are the ties through which specific know-how or tacit knowledge is explored and are vital for the assessment and evaluation of the information.

An argument we heard less frequently was that the common educational and occupational background of the hedge fund managers also contributed to the emergence of consensus trades by encouraging the use of similar cognitive and analytical patterns, as BR3, an experienced broker, explains:

'It is a small village. What is interesting is at the end of the day, we all come from a similar background, we probably studied very similar things and often have worked together doing valuations or what have you together, using the same models. You probably have a big chance that you are going to look at similar things in a similar way, so you come to the same conclusion in a similar timeframe.'

This explanation according to which hedge fund managers develop similar strategies independently is feasible, especially when taking into account the high degree of homogeneity in the occupational background among hedge fund managers and brokers. The proposed causal mechanism, however, cannot be isolated from the one discussed earlier, where hedge fund managers communicate their ideas in detail, and this for the simple reason that such communication was so frequent and pervasive. For example, BR3 and HFM9 point out that analyses are made and compared on when can be referred to as joint 'evaluative frames' (Beunza & Garud, 2007): valuation methods and conventions, ideas and concepts that the hedge fund managers learned at previous joint work experiences. In fact, we did not witness many hedge fund managers who develop their investment ideas in complete secrecy. Instead, they preferred to share such ideas with their competitors, either because they expected some reciprocal return, or because joint discussion of the ideas helped in solving queries and problem.

Consensus trades, therefore, are not fundamentally different from any other investment idea that hedge fund managers decide to adopt. The practices and conventions applied when collecting and evaluating information are similar, whether a trade is adopted by many hedge

funds or not. The significance of consensus trades, however, is in their volume. A trading position gone wrong held only by a single hedge fund would cause a loss. In contrast, a failing consensus trade, because it is adopted by many hedge funds, may have near-systemic implications.

7. The VW-Porsche crisis

7.1. Increasing popularity of the trade

In January 2008, we first heard about the investment idea of the VW-Porsche trade. The rationale behind the idea was that Porsche had been buying VW stock for some time and had by then accumulated a significant position. In 2005, Porsche held 18.5% of VW stocks. In 2006, this amount rose to 27.4% and rose again to 31% in 2007. However, the rationale continues, when taking into account the accumulated VW stake by Porsche, the market valued the rest of Porsche close to zero, or, as a hedge fund manager put it: *'you can buy VW by going long in Porsche and you get Porsche, the carmaker, for free'*. This, according to the rationale, made Porsche's stock cheap in relation to VW's stock, which would motivate market participants to sell VW and buy Porsche stock, bringing their prices more in line with one another as well as recognize the value of Porsche as a carmaker. To take advantage of the pricing discrepancy while not having exposure to the overall market direction, the hedge fund managers chose a long-short trading position, composed of two trading actions. One is to buy Porsche stock (known as 'going long'). The second action is to borrow VW stock and sell it immediately at the market. The stock is bought back later and returned to the lender. The underlying logic behind the long-short position is that it is isolated, in effect, from the risk of price changes in the market in general. Instead, the factor affecting the profitability of the trade is the *difference* between the prices of VW and Porsche. In this case, the smaller it becomes, the more profitable the trade would be. The opposite, clearly, also holds: the larger the difference between the prices of the two stocks, the larger the losses would be.

Since their profitability depends on market conditions, long-short positions can be held for weeks or even months until they are unwound: the 'long' part is sold and the 'short' part is bought at the market and returned to the lender. The terms of a short sale include typically a set time for returning the borrowed stock, which can be extended, but the lender is also given the right to ask back for the borrowed stocks before the end of the set period. This practice can lead to what is known as a 'short squeeze': the aggressive buying by investors who have to cover their 'shorts'. This leads to a sharp price increase of the stock. The early recall of a

borrowed stock is taken, usually, if there are serious concerns about the ability of the borrower to complete their part of the transaction.

We noticed that the VW-Porsche trade was mentioned in discussions among hedge fund managers and in conversations between them and brokers at increasing frequency from the early months of 2008. In March 2008, when we asked about the concept of consensus trades, the first example given to us was that of the VW-Porsche trade:

Interviewer: Are you familiar with the term ‘consensus trade’?

HFM8: Sure, the big one now is Porsche-Volkswagen...You know Porsche got a chunk of Volkswagen. So a lot of people make valuation of these two and then strip out one to see what the rest is worth. But indeed, a lot of hedge funds have that trade on now.

As seen in the quote, the rationale behind the trade – the value discrepancy between the two companies – is easy to communicate and, indeed, we heard it discussed in conversations between brokers and hedge funds numerous times. In the following months, the popularity of the trade rose and in April 2008 HFM16, a long-short hedge fund manager, mentioned to us that: *‘I tell you something like Volkswagen and Porsche is brokered by everybody.’* The popularity of the trade, as was reflected in the brokers’ activity was also accompanied by similar activity among hedge funds. However, in spite of its seemingly general popularity, the VW-Porsche trade was a long-short trade and there were hedge funds that specialized in such trades and brokers who catered for these hedge funds. The connections among these particular actors were the most active in establishing the trade:

Interviewer: Do these[consensus] trades travel across strategies or within strategy?

HFM8: Almost always within. Those trades are mostly a function of hedge fund managers talking to other hedge fund managers and brokers talking to the same hedge fund managers. Most hedge fund managers only talk to people within the same strategy. What do I have to say to an emerging markets guy? Don’t really know what he does and vice versa. Also, what does an emerging market hedge fund care in Porsche? So his broker will not even talk to him about it. ‘

These quotes illustrate the concentration and homogeneity of expertise that typify the clusters of hedge fund managers we observed and that play a role in the evolution of the consensus trade. The concentration along strategy lines was not limited only to this trade. When splitting the interpersonal connections according to trading strategies, we find that only seven of the 101 ties crossed strategies.

Knowing this, we understand that when HFM8 stated that the VW-Porsche trade is ‘brokered by everybody’ it was not merely a figure of speech. Among the other hedge fund managers HFM8 was in daily touch with, virtually everyone was active in this trade. During our field research, we discussed the VW-Porsche trade with ten long-short managers of which eight admitted to be either invested in it, or having been invested in it. When asked whether they (or their analysts) came up with the idea or if they were introduced to the idea by a broker or a different hedge fund manager, all hedge fund managers admitted that the idea had initially come from outside the hedge fund. This finding, however, is not a result of simple mimicking behavior. Adoption of trading ideas and trading according to them comes after long and extensive discussions among hedge fund managers who communicate daily in tightly-knit groups.

The discussions within these dense clusters were indeed extensive. During our fieldwork, we witnessed numerous discussions about the VW-Porsche trade among hedge fund managers. The topics discussed covered a wide range: different valuations of both companies were presented; assessments of the likelihood of different scenarios of takeover or merger were done and exact details from the profit and loss accounts of the trade for each of the hedge funds shared. The discussions did not rely only on financial and accounting expertise. Particular attention was given, for example, to the implications that the ‘VW Law’ may have on Porsche’s intentions. Prior to 2008, the ‘VW Law’ capped voting rights of any shareholder in VW to 20%, regardless of their actual size of holding. However, the European Commission declared that the law violated EU legislation and it was speculated that the European Court of Justice would invalidate it, thereby opening the route to hostile takeover of VW. The discussion also looked at the section of the ‘VW law’ that required approval by holders of at least 75% of the company’s stocks before domination of a buyer over the company can be established. Again, it was speculated that the European Court of Justice would abolish this requirement.

Conducting such detailed and lengthy discussions between hedge fund managers and brokers, where arcane sections of German and EU law were analyzed, were virtually inconceivable. It is safe to assume that no broker among the ones we observed and with whom we spoke would spare the amount of hours hedge fund managers dedicate to analyzing the finer points related to the trade or would ask their analysts to devote their time completely to one trade in order to produce the focused background material. The economic incentives that the brokers face patently discourage such level of involvement with a single trade and called, instead, for distributing trading ideas among many prospective clients. In

addition, it would be safe to say that no hedge fund manager would agree to expose such detailed and sensitive information to a broker, in the fear of it being becoming widely available. The combination of these factors contributed to the fact that although many hedge fund managers learned about the VW-Porsche trade from a person outside their networks of trusted competitors, the discussions where the information was evaluated and investment decisions were made took place firmly within densely connected groups of trusted competitors.

The increasing popularity of the VW-Porsche trade that we witnessed during the first six months of 2008 led us to investigate the potential risks involved in holding such a popular trade. Of the eight hedge fund managers who were actively involved in the trade between January 2008 and October 2008 only one hedge fund manager (HFM17) told us that he decided to unwind his position and terminate the trade because he ‘felt’ that too many hedge funds had the same trade on. When we asked how he made this decision, he noted that he simply spoke with several of his competitors and that he did not use any formal risk assessment to come to this decision. Following this conversation, we asked all hedge fund managers if they treat popular trades any differently from other trades when they assess their risks. The answers in all cases were similar: no special treatment is given and the same set of measurements (VAR, scenario analysis, percentage of daily volume) is applied in all cases. We received similar replies from two risk managers who work at two of the largest global prime brokers. Prime brokers, typically large banks, provide credit to hedge funds and frequently finance their trades. These prime brokers also did not distinguish between consensus trades and less popular ones when lending stocks or providing capital on credit. PBS1, a Hong-Kong based risk manager working for one of these prime brokers explains:

Interviewer: Do you, as a risk manager, look differently at those [consensus trades], from the way you look at other trades, when you asses somebody’s risk?

PBS1: That is a good question, yes and no. From a client to client perspective—we treat them exactly the same way using the same kind of parameters as with other trades, but also from our perspective, we do aggregate all the exposures to see what would happen to all different books, to all different accounts, what could happen to us if that particular security went to zero. What we have not looked at so far is if there are certain clusters of clients who tend to have the same trade on and hence if A and B are in a trade, C is probably too, but C might have put on the trade via another prime broker. This

knowledge or at least the knowledge of the probability might indeed affect financing or even repo decision.'

Our findings indicate that this exact potential risk factor that is not examined yet, the 'clusters of clients who tend to have the same trade on', played a crucial role in the decision making process leading to the adoption of the trades. As we see below, these clusters also contributed to the unfolding of the crisis of the VW-Porsche trade.

7.2 Hedge funds' behavior as the crisis unfolds

Let us focus on the behavior of several hedge fund managers, who were deeply involved in the VW-Porsche trade during the week of September 15th, 2008. On Monday, September 15th 2008, Lehman Brothers filed for bankruptcy. This event led to speculation that Merrill Lynch, Morgan Stanley, Goldman Sachs and AIG, among others, might follow suit and some even feared an imminent collapse of the financial system. On that morning, we were in the offices of HF1, a London-based hedge fund, which is one of the three largest equity long-short hedge funds in Europe. HFM16 is a senior hedge fund manager in the firm. During the regular 7.00 o'clock morning meeting, HFM16 met with other managers, analysts and traders. A senior economist gave a quick briefing on his views on the macroeconomic situation, in general, paying particular attention to American banking system and its potential effects on financial markets. After the meeting, HFM16 spent 10 minutes with two of his analysts discussing specific stocks (in the banking and automotive sectors), after which we followed HFM16 to his desk. One of the large positions in HFM16's portfolio was the VW-Porsche trade and he monitored it closely. The rationale behind the trade, as he presented it that morning, was very similar to the ones we heard from other hedge fund managers; notably that Porsche's valuation compared to VW was unjustified by fundamental market variables and that eventually the relative difference between the VW and Porsche stocks would be smaller. Sitting at his desk, HFM16 examined the relative prices of VW and Porsche on his Bloomberg screen. The price differences of VW and Porsche had been increasing, making this trade, at that moment, a losing trade.

The burning question on HFM16's mind was what was driving this joint movement of the stocks and how the day's events were likely to influence it. Looking at the brokers' reports that were waiting on his desk and in his email inbox, he saw that brokers gave their views on the potential implications of the collapse of Lehman Brothers on financial markets. Most brokers' reports suggested to continue selling stocks of UK banks that had exposure to CDOs and real estate-based securities (RBOS and HSBC were mentioned) as prices were likely to

fall further. HFM16 flicked through the reports quickly and scanned the list of email without opening them.

That morning, HFM16 did not telephone any of the brokers whose reports he had received (and to which the hedge fund was subscribed). Instead, putting the pile of reports to one side and taking a notepad from the far side of the desk, HFM16 called HFM6, who is a former colleague of HFM16 and was working at a competing long-short hedge fund. HFM6 also held the VW-Porsche trade and had similar concerns about the trade. In their talk that morning, which was the first of several that day, HFM16 and HFM6 discussed the impact of Lehman Brothers' likely bankruptcy on borrowed VW stock. Their main concern was that assets held by Lehman Brothers, a major lender of assets to short sellers, would be frozen, leading to some assets lending being recalled, which would push the prices of VW stock higher, causing more losses in the VW-Porsche trade. HFM16 and HFM6 discussed the likelihood of this happening as well as possible action routes to avoid further losses. During the conversation, which lasted more than half an hour, HFM16 took notes on his notepad. A quick glance at one of the pages revealed that many sentences were followed by question marks. Toward the end of the conversation, referring to one of the details discussed, HFM16 asked HFM6: *'who could be in the know about that?'* When the conversation ended, we asked HFM16 about this query:

Interviewer: 'Couldn't one of your brokers look this information up, may be by asking his lawyers or his own prime brokerage?'

HFM16: If I do this, they will use it as an argument to other hedge funds to close their positions, generating commissions and increase my losses.

HFM16's queries were not trivial, but he could have easily asked one of the brokers with whom he had connections to look into the matter and return with answers, as we witnessed hedge fund managers do many times. However, by directing the query to a broker, HFM16 would be disclosing, in effect, that he holds the VW-Porsche trade and that he is losing money on it. Such an admission would give the broker a valuable piece of information: a direct indication that HF1, one of the largest hedge funds in Europe, is involved in the VW-Porsche trade and that it is likely that the position is at a loss. The broker, HFM16 predicts, would use this information to persuade others to withdraw from their own VW or Porsche positions, a step that would generate execution fees for the broker, but would also, if circulated widely

enough, increase the losses of HFM16 and everyone else holding the position. Following this conversation, HFM16 continued working on other positions in his portfolio.

In the afternoon, HFM16 received a telephone call from HFM6, saying he had just spoken with HFM2 about the question HFM16 and HFM6 had discussed in the morning. Even before HFM16 heard what HFM2 had to say, it was clear that he was relieved to hear the identity of the person with whom HFM6 shared the query. HFM6, HFM16 and HFM2 had all worked together at the same investment bank and knew each other well. HFM2, unlike a broker, was someone HFM16 trusted. HFM6 related to HFM16 that HFM2 had told him that their concerns were justified: there was a risk that Lehman Brothers' assets will be frozen, borrowings recalled and not given back to the lenders because British law, which would be applied in the case of borrowings initiated by Lehman Brothers' UK branch, did not allow 'ring fencing' of customers accounts in the case of bankruptcy. Such eventuality might trigger not only buying activity from the hedge funds who would have to cover their short position, but also from the institutions that had lent their stock to Lehman Brothers and would not get it back as Lehman Brothers' assets would be frozen under the British bankruptcy protection laws. Immediately after this call finished, HFM16 called HFM2, who was the source of the interpretation and discussed the matter in more depth. Between the telephone calls, different functionaries in the hedge fund were drifting in and out of the office, collecting the hurriedly written notes where HFM16 asked for more information and reporting on the progress and set backs in other trades.

Following the conversation with HFM2, HFM16 called back to HFM6. This time the conversation was of a slightly different nature. HFM16 was less inquisitive; the unresolved queries he and HFM6 had in the morning were now answered and it was time to choose and implement a course of action. HFM16 listed to HFM6 several steps that he thought were appropriate and asked for his opinion. HFM16's preferred move, one that he believed was supported by what he heard from HFM2, was to buy some call options on the VW stock. These options would pay if VW stock continued to rise and would thus compensate for the losing short position. HFM6 disagreed with this course of action. He believed that a recession was now unavoidable, the rising VW price would soon reverse and that VW and Porsche would continue to move in the same direction. He chose to withdraw from part of the position, although he did so at a considerable loss.

The above description of the day captures a focused, 'micro', version of the phenomena that were described in the previous sections from a broader perspective. We see that the hedge fund managers develop the evaluative framework jointly. That is, through their

discussions they decide what factors are relevant for assessing the risk embedded in the trade. Following this joint process, they also share and examine potential reactions to the issues they identified and then make decision, again, while opening their considerations to further examination and scrutiny. This decision making ‘forum’ is composed exclusively of competing hedge fund managers who trust each other and share detailed and sensitive information. Brokers, in contrast, are strictly excluded from participating in the discussions and even information produced by brokerage houses (the analysts’ report) is given only superficial attention. The outcomes of the decision making process, although they differ for HFM16 and HFM6, see both hedge fund managers still holding (a slightly reduced) VW-Porsche trade at the end of the day. In summary, during one of the most dramatic and volatile days in financial markets in recent history, managers of some of the leading long-short hedge fund managers made investment decisions while focusing exclusively on information and advice from a small group of trusted competitors.

While this analysis demonstrates the relative isolation in which decision making in hedge funds takes place, we still need to ask if this is indeed a case of over-embeddedness and structural secrecy at work that led to ignoring important information. That is, did brokers circulate relevant information or interpretative frameworks that were ignored or overlooked by hedge fund managers and, as a result, intensified the crisis? To answer this question we need to understand what information could benefit hedge fund managers when adopting and holding the VW-Porsche trade. As explained above, the ‘short’ side of the position is based on borrowed stocks, which are sold, bought back at a later stage and returned to the lender. A hedge fund manager involved in the trade, hence, would be interested in information about the possibility that there will not be enough stocks available at the market and would prevent him from unwinding the trade. Such a possibility is remote, since most investors tend to hold the stock, which leaves borrowers (short sellers) with many opportunities to buy them back. However, as the analysis of the events of 15 September 2008 show, the VW-Porsche trade had several unusual characteristics. A crucial factor for assessing and making decisions regarding a long-short trade is the difference between two amounts: the volume of stocks that are ‘free floating’ – available for trading in the market – and the volume of stocks that are tied to a short trade. In the case of the VW-Porsche, the popularity of the long-short trade determined the number of VW stocks that were tied in a short sale, while the number of stocks accumulated by Porsche and were put ‘out of the market’ played a crucial role in determining the second amount. Corresponding with our findings about the increasing popularity of the trade, between June and September

2008 the amount of VW stocks that were tied to short sales rose more than three-fold, from about 1.6 million to more than 5 million shares in VW. At that point, 13% of VW shares were tied to short sales, the highest ratio among the 30 stocks in the DAX Index. This amount meant that, theoretically, at least 13% of the VW stock had to be available for trading for all investors holding the VW-Porsche trade to be able to unwind their positions. In practice, only a fraction of the free float is for sale since many shareholders do not have their holdings up for sale.

Determining exactly how much of VW stock was free floating was difficult to establish. VW's two largest shareholders were Porsche, with 31% of stocks and the German state of Lower Saxony, which held 20%. However, in its semi-annual report from March 4th, 2008 Porsche announced its intention to 'acquire the majority shareholding in Volkswagen'. This announcement was accompanied, a week later, by a corporate statement where it was clarified that Porsche did not seek a domination position in VW and therefore the probability of Porsche raising its take in VW to 75%, a share size required for obtaining a domination agreement with VW, was 'very small indeed'. These two announcements were interpreted by many of the hedge fund managers we observed as indication that an imminent takeover of VW by Porsche is not likely and, as a result, that the risk of not having enough free floating stock to unwind the long-short position was low.

Given this, did information or interpretations regarding the amount of free-floating VW stock was available to hedge fund managers in the months leading to October 2008? To answer this question, we examined messages circulated by brokers in the 10 months leading to the crisis. As early as February 2008, analysts working for brokerage firms speculated about the ways in which Porsche built its stake in VW and offered interpretations about its implications. John Lawson, an analyst at Citi Investment Research (VW Note 190208), noted that the price movements in VW stock corresponded with an options' buying program that Porsche initiated in September 2005 and hinted at the possibility that Porsche was using options to gain control over VW stock. Using options to buy shares may help buyers to avoid reporting an increase in holding, as the options do not constitute an actual stock transaction, but only a potential one in the future. Less than a month later, however, the same analyst restricted the implied prediction he provided before and predicted that Porsche was not likely to increase its holding in VW beyond 51% (VW Focus 070308). Another report, published on February 26th, 2008 by Lothar Lubinetzki at MainFirst Bank AG, a leading car industry analyst, stated:

Our impression is that VW is a consensus short in the auto sector, while going long or

over weighting Porsche also seem to be a trade investors like to do. [...] To be frank, we do not believe that anybody except Porsche really understands why VW's share price is so stable at EUR 150. Borrowing VW ords [ordinary shares] does not seem to be difficult. However, we believe that shorting VW ords could be very risky. The question to be asked is who is lending out the shares? It is just a possibility, but how would the picture change if Porsche or banks who are supposed to hold VW ords on behalf of Porsche decided to make some extra money by lending out VW shares? If this was the case and if Porsche decided to call in its VW ords, there would be a substantial risk of a short squeeze.

(VW_Q4 2007 preview 26_02_08 shorting VW ords too risky)

This report ties together the two factors that stand at that basis of the VW-Porsche trade: the arbitrage opportunity and the trade's major source of risk. The main motivation for the VW-Porsche trade lies in the unexplained fact that the price of the VW stock was 'stable' at 150 Euros. However, this price discrepancy, the report speculates, can be tied to the accumulation of VW by Porsche and to the resulting risk of not having enough free-floating stocks.

Brokers' reports were not the only source for warning signs about holding a short position in VW stock. The market research company Data Explorers notified to its subscribers that the supply of VW stock available for trading (or lending) diminished at September 10th, 2008, from about 42 million shares to 33 million shares, dropping dramatically below the number of shares already borrowed on loan, because institutional investors began selling shares to institutions that kept them out of the market (Figure 4). In retrospect, it is obvious that these shares were bought by Porsche or on its behalf, but even at the time, such a dramatic decrease in stock availability was a clear warning signal to anyone holding a short VW position indicating that the level of risk associated with that position had increased significantly.

The reports presented above are a small sample from a much larger dataset of documents and messages in which brokers (or analysts working in brokerage houses) communicated about potential risk involved in holding short positions in VW stock. Many of the analysts who published reports during this period, including all the analysts cited above, are prominent car industry analysts whose predictions and reports are circulated widely. Given this fact, it is inconceivable that all this information was simply overlooked by hedge fund managers. A much more reasonable explanation, considering our other findings about structural secrecy that governed the exchange of information between hedge fund managers and brokers and the fact that the VW-Porsche trade rose in popularity exactly at the period

when information about the trade's risk was abundant, is that hedge fund managers ignored the reports and excluded them from their analyses when assessing the merits and risks of the trade. As it turned out, hedge fund managers paid dearly for their decision-making practices.

On October 28th, 2008 Porsche announced that it owned 42.6% of VW shares and that it had acquired options for additional 31.5% of the shares. Together, Porsche controlled, effectively, 74.1% of the shares. Adding to this figure the 20.1% of shares owned by the German state of Lower Saxony, the implication of the announcement was that only 5.8% of the shares were available for trading. As mentioned above, the total amount of shares borrowed stood at 13%, which meant that many of the investors who held short positions would not be able to return the shares to the lenders, were they asked to do so. Although Porsche stated that it made the announcement to give investors "the opportunity to close their positions unhurriedly and without bigger risk" (Story et. al. 2008), its announcement led to the realization of the risky scenario described above. Lenders of the VW stock, concerned about the ability of the borrowers to return the stocks under these distressed conditions asked for the stock to be returned immediately. These requests, given the scarcity of VW stock, drove the prices up. This, in turn, increased the concerns and drove even more lenders to ask for their VW shares, resulting in the price of VW stocks rising more than 6-fold in a few days.

The hedge funds we observed and that were involved in this trade, like many other long-short hedge funds, lost a substantial amounts of money due to the reactions to Porsche's announcement, as, whilst VW prices reached record heights, Porsche's price stayed relatively stable and the discrepancy between the prices of the two stocks grew.

We were present at one of the hedge funds that held the VW-Porsche trade in late October, when it became painfully apparent that the impact of the crisis was related directly to the structure of connections among hedge fund managers:

'The problem is that we are all positioned the same way, every hedge fund manager I know is screaming for [Volkswagen] stock and just can not get any. It is all exploding in our face'. [HFM16]

It is true that Porsche's share holding size of VW, as it was revealed in late October 2008 was unexpectedly large and was an extraordinary event that defied the conventional thinking. Yet, hedge fund managers knew that a fundamental uncertainty shadowed over the VW-Porsche trade during the year when it gained popularity: it was not clear why the

discrepancy between the stock prices of VW and Porsche remained in spite of it being a glaring arbitrage opportunity. Porsche's announcement resolved the mystery: VW's price did not drop because Porsche's acquisitions gradually decreased the supply of stocks. Porsche accumulated the stock secretly and even hid its tracks, but as the evidence shows, many warning signs existed about the potential risks of the trade.

Why did sophisticated and knowledgeable investors like HFM16 miss this information? HFM16, as seen earlier, belonged to tightly-knit cluster of hedge fund managers who created and maintained, in effect, a distributed decision making process regarding the VW-Porsche trade. The relative homogeneity that HFM16 observes (“...*every hedge fund manager I know...*”) is not simply a characteristic related to the popular trade, but a fundamental component of the decision making process that enables consensus trades. The initial investment idea is transported by the efficient, but shallow, hub-like connections of the brokers and then it is discussed, analyzed and scrutinized in the dense clusters of hedge fund managers. Hedge fund managers created homogenous groups, sharing the same strategy and relying on common occupational backgrounds where information was filtered and assessed, leading to the making of decisions about the desirability of investment ideas. Our observations indicate that these groups were effective in developing and honing interpretative frameworks that justified trades. However, when these frameworks were accepted and, crucially, the adopted trade proved to be profitable, the emergent agreement made it easy for hedge fund managers to reject and ignore conflicting information about the trade, especially when brokers were the source of that information.

8. Conclusion

The evidence indicates that the structure of connections among hedge fund managers and brokers contributed to the emergence of financial risk of a new type. The structural-informational segregation between hedge fund managers and brokers contributed to the increasing popularity of a single trading idea, which amplified the impact of potential informational shocks on the market. Naturally, this conclusion has wider implications than analyzing decision-making practices among hedge funds. The recent financial crisis brought to the fore intense criticism of investment decision making in financial institutions. One of the popular arguments is that financial organizations tend to rely on stylized representations of the past (e.g., normal distributions) when planning future scenarios. Such planning can lead to disastrous consequence because financial markets are prone to low-probability, high-impact

negative events that challenge such pre-existing assumptions. Such event, thus, surprise organizations and these surprises are the fundamental source of the high impact of such events. Organizations do not identify or develop, in advance, information that can warn against the negative events, and when these do occur, the resulting damage is significant. Our analysis shows that the hypothesis that financial decision makers find themselves surprised because of a lack of relevant information, is partial. Our findings indicate that financial institutions (in our case, hedge funds) do not simply fail to identify and gather relevant information, but that they construct decision making structures and practices that frame, in advance, the ways they evaluate information. Hedge fund managers preferred to include into their assessments information and analysis from other managers over information from brokers, although the latter contained vital details about the risks of the trading position.

Our analysis, then, criticizes the leading paradigm in today's financial risk management. According to this paradigm, the source of financial risk is the interaction between the trading position chosen by the investor and the market's behavior. That is, the decision making process leading to choosing a specific trading position is not seen as a potential source of risk and is not incorporated into the risk assessment.²⁶ We show that the inter-organizational nature of financial decision-making can be a major source of risk and thus, analyzing and understanding this arena is vital for assessing the risks facing financial organizations.

This paper contributes to the sociology of finance and especially to the stream within it that focuses on the importance of inter-organizational connectedness (MacKenzie, 2003; Beunza and Stark, 2010) by demonstrating the intertwined nature of decision-making and the structure of connections among financial actors. Furthermore, this paper also expends the notion of materiality of markets. While Callon (2005) states that an actor '... is made up of human bodies but also of prostheses, tools, equipment, technical devices, algorithms, etc.', we show that in case of hedge funds this 'agencement' might very well consist of human bodies, email messages and telephones located at *different and competing* hedge fund or brokerage firms. Whilst Hardie and MacKenzie (2007b) show that a hedge fund is comparable to Hutchins' control centre at a US warship where cognition is distributed over the navigators, skippers, plotters and charts, etc., we show, to continue the metaphor, that it is also distributed over the control centers of other ships.

²⁶ Possible exception to this view within mainstream financial risk management is operational risk.

In addition to the contribution regarding the role that connectivity plays in financial decision-making, the case also illustrates how difficult it is to distinguish between ‘normal’ and ‘risky’ conditions in financial markets. The events of October 2008 portray a crisis that did not represent a stark break from normal organizational and inter-organizational activities but as a development of these activities that leads actors to assuming increasing degrees of risk, a process that results eventually in a crisis. This description corresponds directly with Diane Vaughan’s concept of organizational deviance (1999) that refers to ‘organizational-technical failures that include acts of omission or commission by *individuals or groups of individuals acting in their organization roles*, with outcomes that either in the fact of their occurrence or consequences are unexpected, adverse, and of high social impact’ (Vaughan, 1999:293, italics added). Organizations, according to this conceptualization, frame and enable the professional socialization that constitutes the actors who operate in them and, hence, are the breeding ground of both positive and negative outcomes of organizational norms and practices. Put differently, organizational deviance is not different in the ways it emerges from normative and beneficial organizational practices. If this is so, then how can we identify dynamics that lead to the emergence of risk in organizations? Vaughan’s answer to this question, following her study of the Challenger space shuttle disaster (1996), argues that clues for the emergence of risky practices can be found in the ways organizations communicate, both internally and externally. Vaughan analyses the communication within NASA and shows that a condition of ‘structural secrecy’ developed in the organization. Under such a condition, Vaughan shows, flow of information and knowledge between different subunits is limited, leading to relative ignorance and to the possible emergence of deviant organizational practices. Similar mode of communication is also apparent, albeit more diffusely, among hedge funds and between them and brokers. Hedge fund managers maintain a type of structural secrecy when they limit the quality of information distributed to brokers. This practice, the findings indicate, helps to disseminate trading ideas, while not disclosing the rationales supporting them. Structural secrecy, however, does not explain the ‘lock in’ phenomena whereby hedge funds continue to hold their investments while ignoring or playing down warning signs.

Finally, our findings inform financial regulation and lawmaking. We see that decision making in hedge funds is unbounded by the contours of the single hedge fund, while regulation tends to focus almost exclusively on the single financial institution as its unit of analysis and enforcement. Failing to refer to the inherently networked nature of investment decision making ignores the potential systemic risks that these networks entail.

Risk-aware financial regulation, therefore, should incorporate the properties of the network, the properties of the actors in the network and the properties of the investment when assessing risks. The regulator should then be equipped with rules that allow it to uncover these networks, supervise them and where necessary intervene in them. Operating such regulatory framework seems unrealistic today, but the emergence of networked risks, such as the one analyzed in this paper call for thinking in this direction. The focus of the said regulatory framework would not only be on hedge fund managers, hedge funds, the entities and people which service them or relationships between these financial entities and people, but equally on the networks to which these hedge funds belong. For example, being ‘too big to fail’ could be a function of (belonging to) a network, not necessarily of the size of the financial organization. Thus, initiatives such as the Hearing on Regulation of Hedge Funds’ organized by the U.S. House Oversight and Government Committee on November 13 2008, are necessary but fail to incorporate the risks introduced by the network structures.

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Figures and tables

Seen a lot of quality name demand for euro/\$ off the session lows here
 maco and longer term players happy to invest into the dollar rallies
 still it seems

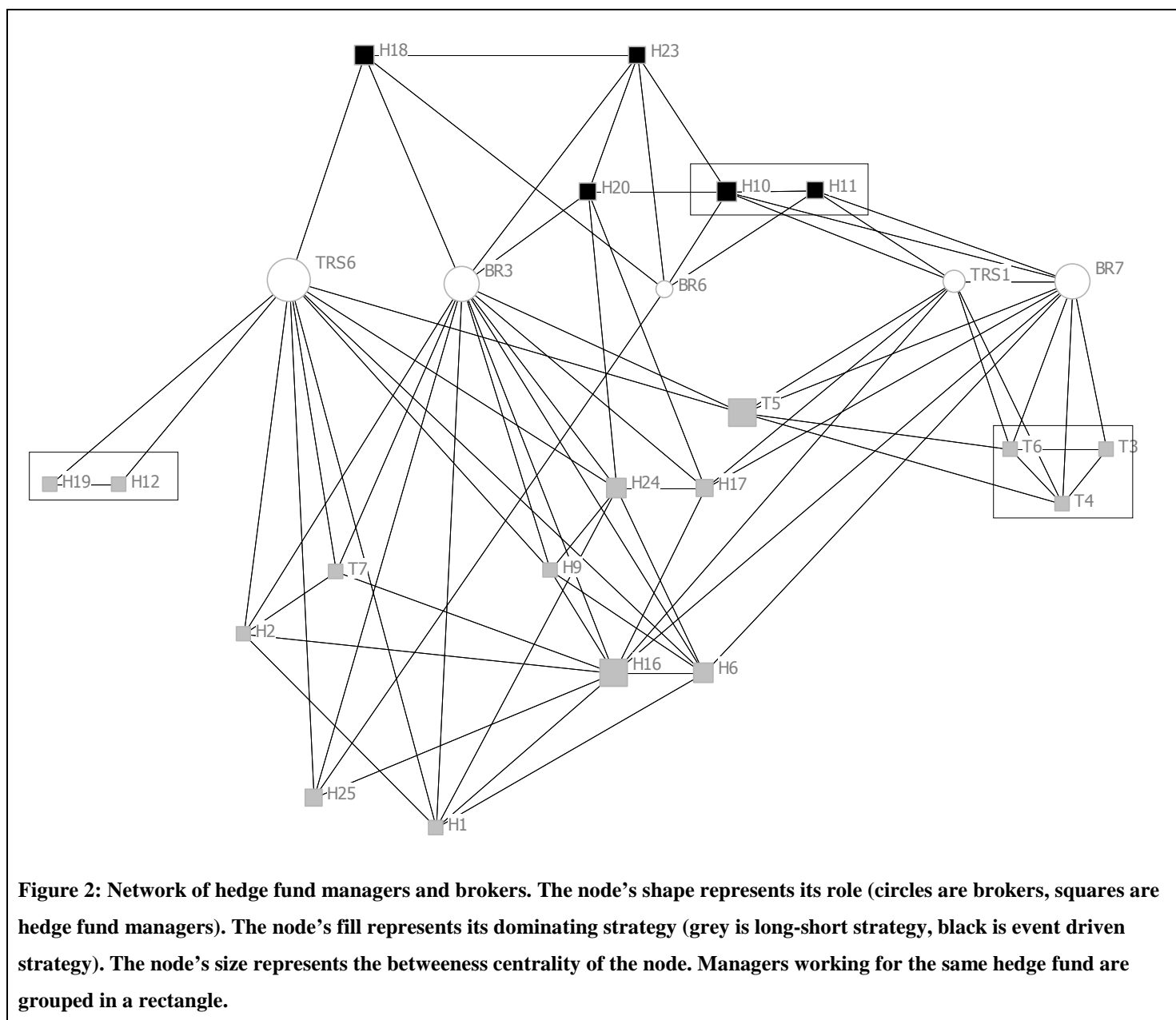
Cable which had held up for much of the morning on cross supply broke
 1.6580 and triggered a few stops but again macro names picking up
 sterling into the lows again

The protection buying of euro/\$ downside continuing albeit in smaller
 size still from leveraged players as belief in the possibility of
 Trichet comments re the Euros level / speed of appreciation grows

Figure 1: Bloomberg terminal screen shot from HFM7, May 19th, 2009 (the screenshot has been cropped for anonymity reasons).

Network measure	Average degree	Average aggregate dyadic constraint	Average betweenness centrality	Average eigenvector centrality
Brokers	9.4	0.215	34.83	0.24
Hedge fund managers	5.05	0.473	6.94	0.17

Table 1: Descriptive network statistics for the hedge funds – brokers' network



	Model 1: estimate (standard error)	Model 2: estimate (standard error)
edge effect	6.44 (3.69)	8.69 (3.71)*
alternating k-stars (lambda=2)	-3.14 (0.98)*	-3.95 (1.08)*
alternating k-triangles (lambda=2)	1.17 (0.26)*	0.17 (0.98)
alternating two-path (lambda=2)	-0.21 (0.09)*	-0.14 (0.11)
Triangle		2.01 (2.05)
two-triangle		-0.15 (0.17)
hedge fund manager triangles (hfm_t3u)		0.55 (0.46)
hedge fund manager activity	4.23 (1.39)*	5.53 (1.63)*
hedge fund manager interaction	-6.76 (1.65)*	-9.37 (1.95)*
long-short activity		-0.84 (0.35)*
long-short interaction		2.12 (0.74)*

Table 2: Two exponential random graph models of the hedge-fund broker network. Asterisks indicate effects for which absolute value of estimates are more than twice the standard error.

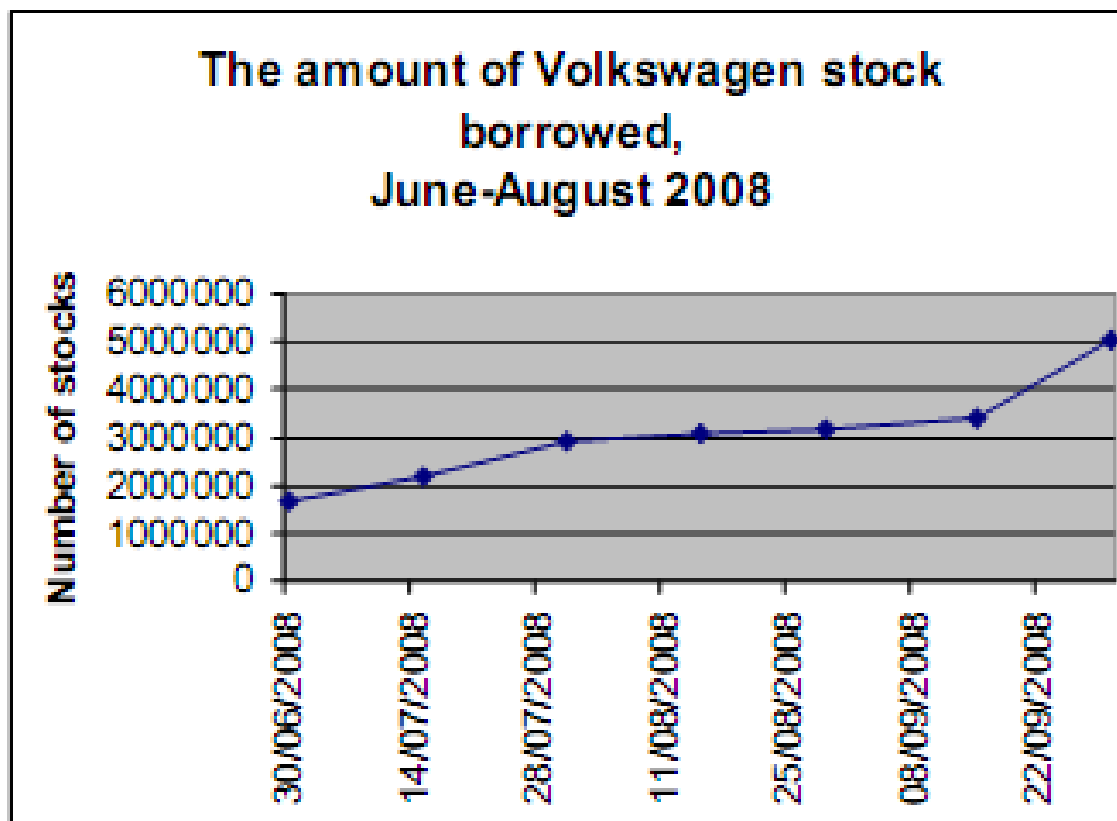


FIGURE 3: Amount of VW stock in short sales, June-August 2008 (Source: Data Explorers).



Figure 4: VW shares: lendable and on loan, April – October 2008 (Source: Data Explorers)

Appendix 1**Goodness of fit tests for ERGM**

Model 1: Goodness of fit is based on one million Monte-Carlo simulations with a burn-in of the first 100, 000 simulations and a sample of 1,000 networks. For a model to fit well, the measure observed in the network should be close to the mean of the sample. For example, the number of edges in the observed network is 70 and the mean of the MCMC samples is 69.896 with a standard deviation of 10.746. The t-ratio is the difference between the observed value and the mean divided by the standard deviation. The smaller the t-value, the better the model fit. The estimated parameters of the model (such as edge, alternating stars, alternating k triangles etc) are emphasized in the table and are expected to be below 0.1. The measure which has the worst t-value is HFM_t3u. This is the measure of the number of triangles in the network that consist of exactly three hedge fund managers.

<i>Effects</i>	<i>observed</i>	<i>mean</i>	<i>stddev</i>	<i>t-ratio</i>
Edge	70	69.896	10.746	0.01
2-star	435	436.972	134.273	-0.015
3-star	997	1024.706	483.472	-0.057
4-star	1803	1947.456	1301.148	-0.111
5-star	2585	3078.09	2823.336	-0.175
Triangles	50	47.558	17.72	0.138
4-clique	12	7.61	6.679	0.657
5-clique	0	0.275	0.742	-0.371
6-clique	0	0.001	0.032	-0.032
Isolates	0	0.498	0.697	-0.714
Triangle2	161	139.631	93.256	0.229
Bow_tie	351	409.148	335.056	-0.174
3Path	2409	2589.13	1189.089	-0.151
4Cycle	184	188.198	115.613	-0.036
AS(2.00)	187.274	186.747	39.893	0.013
AT(2.00)	91.906	91.631	24.825	0.011
A2P(2.00)	300.246	300.148	64.958	0.002
AC(2.00)	12	7.473	6.415	0.706
AET(2.00)	278	263.183	106.53	0.135
HFM_t3u	8	3.057	2.307	2.143
HFM_t2u	59	46.91	18.295	0.661
HFM_t1u	101	91.401	33.534	0.286
HFM_o3u	64	48.313	21.736	0.722
HFM_o2au	238	214.851	77.79	0.298
HFM_o2bu	273	253.102	77.649	0.256
HFM_o1au	209	209.362	68.023	-0.005
HFM_o1bu	673	646.917	197.706	0.132
HFM_interaction	23	22.849	4.679	0.032
HFM_activity	92	91.642	14.613	0.024
Std Dev degree dist	3.201	3.095	0.446	0.238
Skew degree dist	0.627	0.608	0.343	0.056
Global Clustering	0.345	0.321	0.038	0.619
Mean Local Clustering	0.393	0.404	0.061	-0.181
Variance Local Clustering	0.081	0.071	0.021	0.453

Model 2: Goodness of fit is based on one million Monte-Carlo simulations with a burn-in of the first 100, 000 simulations and a sample of 1,000 networks. The t-ratios have now improved by a factor of 10 from the goodness of fit values of model 1.

<i>Effects</i>	<i>observed</i>	<i>mean</i>	<i>stddev</i>	<i>t-ratio</i>
Edge	70	70.894	10.681	-0.084
2-star	435	449.286	125.088	-0.114
3-star	997	1049.073	408.655	-0.127
4-star	1803	1925.176	981.864	-0.124
5-star	2585	2849.174	1891.745	-0.14
triangles	50	49.986	17.889	0.001
4-clique	12	10.509	7.651	0.195
5-clique	0	0.648	1.324	-0.489
6-clique	0	0.009	0.114	-0.079
Isolates	0	0.368	0.587	-0.627
Triangle2	161	155.136	91.584	0.064
Bow_tie	351	426.793	317.1	-0.239
3Path	2409	2665.389	1126.094	-0.228
4Cycle	184	196.453	105.349	-0.118
AS(2.00)	187.274	190.559	39.526	-0.083
AT(2.00)	91.906	92.962	24.888	-0.042
A2P(2.00)	300.246	306.081	60.456	-0.097
AC(2.00)	12	10.187	7.158	0.253
AET(2.00)	278	278.496	108.194	-0.009
HFM_t3u	8	7.739	7.564	0.035
HFM_t2u	59	60.454	31.439	-0.046
HFM_t1u	101	102.698	41.774	-0.041
HFM_o3u	64	60.137	43.629	0.089
HFM_o2au	238	240.011	123.91	-0.016
HFM_o2bu	273	268.649	76.419	0.057
HFM_o1au	209	221.81	86.922	-0.147
HFM_o1bu	673	675.744	191.698	-0.014
HFM_interaction	23	23.307	7.067	-0.043
HFM_activity	92	93.243	17.167	-0.072
Std Dev degree dist	3.201	3.141	0.341	0.175
Skew degree dist	0.627	0.563	0.371	0.174
Global Clustering	0.345	0.328	0.044	0.381
Mean Local Clustering	0.393	0.4	0.061	-0.118
Variance Local Clustering	0.081	0.075	0.022	0.244

Appendix 2: Details of persons who were interviewed and/or observed

Person's code	Funcios (last is most current)	Years of experience in different roles
PBS1	PB	10
TRS1	TR	17
HFM1	HFM	10
TRB1	TR	3
HFM2	ANA/BR/HFM	4,6,5
BR1	BR	5
BR2	BR	5
ANAS1	ANA	9
HFM3	ANA/HFM	2,7
TRS2	TR	10
TRS3	ANA/TR	2,12
HFM4	TR/HFM	5,10
HFM5	ANA/HFM	7,10
BR3	BR	13
HFM6	TR/HFM	4,12
TRS4	TR	10
BR4	ANA/BR	15
HFM7	TR/HFM	10,13
TRB2	TR	15,10
HFM8	TR/HFM	12,10
HFM9	TR/HFM	6,6
TRB3	TR	12,10
BR5	BR	5
TRB4	TR	18
HFM10	HFM	15
HFM11	HFM	17
HFM12	TR/HFM	15,10
HFM13	TR/HFM	5,6
HFM14	BR/HFM	5,4
BR6	TR/BR	11,6
PBS2	PB	8
BR7	TR/BR	14,6
BR8	BR	11
HFM15	TR/HFM	15,5
PBS3	BR/PB	10,2
HFM16	TR/HFM	9,6
HFM17	ANA/BR/HFM	11,3,7
TRB5	TR/TR	16,8
TRB6	TR/TR	17,10
HFM18	HFM	10
HFM19	TR/HFM	10,10
HFM20	ANA/HFM	6,6
BR9	BR	23

HFM21	ANA/HFM	10,3
ANAS2	TR/ANA	10,5
ANAB1	ANA	5
BR10	BR	7
HFM22	TR/HFM	20,5
ANAB2	ANA	5,4
ANAB3	ANA	13,5
BR11	BR	9
TRS5	TR	10
BR12	BR	10
PBS4	PB	6
HFM23	ANA/HFM	6,5
HFM24	TR/HFM	5,4
TRB7	TR/TR	3,3
ANAB4	ANA	4
TRS6	TR	7
HFM25	BR/HFM	10,5

Functions' abbreviations:

PB: Prime Broker, TR: Trader, HFM: Hedge Fund Manager, ANA: Analyst, BR: Sales person or salestrader.