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Financial contagion: problems of proximity and connectivity in financial markets

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ABSTRACT

Financial contagion is often defined as the propagation of shocks among actors in markets, while excessive correlation and interconnectivity of markets, actors or investment strategies are seen as reasons for its spread. In this article, I examine uses of the concept of contagion across academic, practical and popular discourses on financial markets and speculation from the late nineteenth century through the first couple of decades of the twentieth: During this historical period the concept was frequently used about forms of allegedly irrational behaviour in financial markets. I argue that 'contagion' is used descriptively to capture behaviour and events that escape rational economic explanation and, more importantly, highlights problems of proximity and connectivity in financial markets. While the proximity and connectivity of actors enables market efficiency, they simultaneously increase the risk of contagion. In the latter part of the article, I use a contemporary example of liquidity contagion in model-driven financial investing – the so-called Quant Meltdown of August 2007 – to emphasise that problems of proximity and connectivity, described as instances of contagion, remain pertinent challenges for market actors to deal with.

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Introduction

As the COVID-19 pandemic rages and measures taken to contain its spread cause unease in markets, there is a risk that the devastating real viral contagion will morph into a metaphorical, yet very palpable, financial contagion wreaking havoc on markets. However, pandemics are fortunately rare, and thus, such events seldom trigger financial contagion. More often, financial contagion spreads as a consequence of a bubble of overvalued assets bursting as was the case during the 2008 global financial crisis (see, e.g. Sharma 2014). The interconnectedness and interdependence of actors and institutions in global financial markets allow almost frictionless and seemingly effortless flow of capital and assets through the financial system's physical and virtual infrastructures, while at the same time increasing the risk of financial contagion (Stiglitz 2010, Thompson 2011).

Although the notion of financial contagion has become increasingly prevalent in financial economics since the 1990s – Edwards (2000) deems it a 'relatively new concept in economics' (p. 873) – the term

'contagion' has been used frequently in discourses on finance for more than two centuries (Mitchell 2012, Besomi 2019). The metaphorical use of concepts like contagion, epidemic, virus, and infection has long played a prominent role in shaping perceptions of economically intangible market behaviours that are often disregarded as irrational, such as panics and crises (Mitchell 2012). The concept of contagion, as used in economic and financial contexts, has been criticised for being too vague to have any real explanatory power (Garber 2000, Forbes and Rigobon 2001). In that sense, the concept of contagion seems to have characteristics in common with that of crisis, which Koselleck (2006) argues 'has been transformed to fit the uncertainties of whatever might be favored at a given moment' (399) and Roitman (2013) considers a placeholder without positive content (9). It is exactly because of its ambiguousness and elusiveness that the concept of contagion, in the financial market context, is worthy of critical examination. My argument in this article is that the concept of contagion tends to surface in discourses on finance when events occur that escape rational economic explanation. Examining historical as well as more contemporary uses of 'contagion' in descriptions and explanations of certain market events, I seek to shed light on the way the concept of contagion helps writers ascribe meaning to volatile and uncertain situations that appear to be driven by irrational behaviour. Besides capturing such *uneconomic* behaviour, descriptions of financial contagion highlight problems of proximity and connectivity in financial markets; for while closeness and connectedness help the flow of information and assets in markets, they also enable contagion and risk amplifying its spread.

In this article, I take a conceptual history approach – the historical study of the fundamental concepts underlying and informing a distinctly historical 'manner of being in the world' (White 2002, see also, Koselleck 2002, 2004) – to the study of contagion in financial markets from the late nineteenth century through the first couple of decades of the twentieth. This period is rich with examples of the concept of contagion being used in descriptions of excessive speculation, panics and crisis, often casting such disruptive market events as outbreaks of collective irrationality caused by people being or becoming too closely interconnected. The conceptual history of contagion is examined through readings of academic, practical, and popular genres of financial writing (Poovey 2008; Hansen 2015). The archive comprises books and journal articles on political economy and sociology engaged with questions concerning financial markets, popular cultural accounts from magazines and books as well as prescriptive advice handbooks for aspiring investors and speculators. Tracing the concept of contagion in different genres of financial writing allows for examination of the circulation of the concept across genre divides and how the translation from one to another has shaped its meaning. The historical analysis suggests that the concept of contagion has been used not only in efforts to describe and explain market behaviour (mainly the academic literature) but also to pass moral judgment on certain practices (mainly the popular accounts) as well as to prescribe favourable economic conduct (the handbook literature).

One of the advantages of doing conceptual history is that it allows for shifts from the examination of a concept in a particular historical context to a 'diachronic review' that can disclose meanings that 'no longer correspond to reality, or realities that emerge through concepts whose meaning remains unrecognized' (Koselleck 2004, p. 90). Though this is not meant as a license to randomly shift perspective from one historical period to another, I do take it as an opportunity to compare findings in the historical analysis with contemporary ideas about financial contagion. More specifically, I draw on the case of the Quant Meltdown or Quant Quake, a one-week liquidity crisis in August 2007 that mainly hit model-driven hedge funds (Kirilenko and Lo 2013). In the sparse academic literature discussing the meltdown, the short-lived and relatively contained crisis has been referred to as 'a valuable example of contagion' (Glasserman and Young 2016, p. 785) and, as one market actor experiencing the events at close quarters noticed, was an instance of him and fellow quants 'creating our own contagion' (Rothman in Khandani and Lo 2011, p. 4). In examining the quant event, I draw on the few existing academic accounts of the event and on letters from a

handful of hedge fund managers to their investors; letters which were written during or in the immediate aftermath of the crisis. Additionally, I use financial newspaper articles and industry documents addressing the event as well as an interview I did with a quant working in one of the leading US quantitative hedge funds that took a significant hit in August 2007.¹ Like the texts comprised in the historical archive, this contemporary body of empirical material comprises different forms of financial knowledge and thus, different perspectives – from practitioners, academics and financial journalists – on the quant event.

The article consists of five sections, including this introduction. In section two, I present some contemporary takes on financial contagion, mainly associated with market integration, close-knit financial networks and correlation of markets as well as some critical concerns about the use of the concept of contagion in the context of financial markets. In the historical analysis that follows, I examine uses of the concept of contagion in academic, practical and popular financial writings from the turn of the nineteenth century through the first couple of decades of the twentieth. During this period, contagion is considered an inter-mental process intensified by physical and/or mental proximity and connectedness of market actors. On the backdrop of the historical analysis, I then go on to discuss how the concept of contagion was used in efforts to grasp what happened during the August 2007 Quant Meltdown, and how issues of market actors and strategies being too proximate, connected, and correlated were highlighted as reasons why the crisis erupted. The attempts to rationalise the Quant Meltdown proves that ideas of inter-mental, psychological contagion continue to be used in explanations of crises and panics, even in model-driven finance with little human intermediation. The final section concludes.

Contagion in close-knit financial networks

In 2011, *Nature* published a short discussion piece in which the Executive Director of Financial Stability in the Bank of England, Andrew G. Haldane, and Professor of Zoology at Oxford University, Robert M. May, proclaimed the systemic failure of the financial sector during the 2008 global financial crisis could be described and explained via an analogy to the epidemiological networks of the spread of infectious diseases (Haldane and May 2011). To develop a ‘realistic caricature of markets’ capable of accounting for the interlinkages, dependencies, and interaction dynamics in financial systems, Haldane and May believed it necessary to draw on theories and models from outside the realm of financial economics (Haldane and May 2011, p. 352). The crisis revealed, in their opinion, an urgent need for new approaches to the study, regulation, and organisation of financial markets, approaches mainstream economics simply was incapable of delivering.

This was not the first time Haldane and May had made the case for an epidemiological network-based approach to study of systemic events in financial markets. A few years prior to the publication of their *Nature* piece, Haldane gave a speech at the Financial Student Association in Amsterdam, in which he juxtaposed the SARS epidemic of 2002 and the financial crisis (Haldane 2009). He argued ‘the spread of epidemics and the disintegration of the financial system’ in times of crisis were essentially different branches of ‘the same network family tree’ (Haldane 2009, p. 3). Congruently, May et al. (2008, p. 894) asserted that studying systemic events in financial markets using epidemiological network models would render it possible to consider relevant social and political factors such as ‘the spread of rumours’ and ‘the “contagion dynamic” of public perceptions’. Here epidemiological, financial, social, and even mental contagions are mixed together as if they were interchangeable (see also May and Arinaminpathy 2010, Arinaminpathy et al. 2012).² Viewing financial markets through the epidemiological network lens, as Haldane and May do, allegedly sheds light on the ‘contagion dynamics’ that, in their opinion, are of tremendous importance to the dynamics and especially the malfunctioning and breakdowns of the complex global financial system.

Haldane and May's deliberately simple models and the policy lessons they derive from them have met criticism from many different sides (Cooper 2011, Johnson 2011, March 2011, Pryke 2011, Thompson 2011, Peckham 2013, 2014). Much of the criticism addresses the political and epistemological implications of mixing epidemiology and economics. Peckham (2013, pp. 235–6), for example, argues that the 'biologization' of financial crises shifts the notion of risk from something 'man-made' to a 'natural hazard'. Moreover, Peckham (2014, p. 16) notes that precision and contextual meanings risk being lost in translation when an epidemiological conception of contagion is dragged into a distinctively different scientific domain such as finance. Similarly, Cooper draws a parallel between Haldane and May's emphasis on complex financial ecologies and Friedrich Hayek's idea of markets as complex systems with an inherent natural spontaneous order (Cooper 2011). For Hayek, Cooper writes, 'the natural complexity of market phenomena was such that no central authority could hope to predict, much less control, the precise evolution of individual elements in the system' (Cooper 2011, p. 376). Hayek's disdain for regulation and fear of government aside, Cooper shows, like Peckham, that the 'naturalization' (Mayer and Weingart 2012) of markets has implications for how market dynamics are understood and acted on.

In her exploration of the language of finance around the 2008 financial crisis, Marsh (2011, p. 310) notes a shift towards a 'language of disease' with financial journalists frequently using metaphors of 'virus, infection, and contagion' as the toxicity of the US credit markets became increasingly obvious in the winter of 2008–2009. However, these metaphors were not so much used to describe shocks cascading through an overleveraged financial system, but rather to capture the moral contempt with the contagion effects felt by ordinary people. It was not the systematic effects but the appalling contagiousness of largely incomprehensible forms of financial speculation that these tropes were meant to describe.

The language of contagion used in these weeks is so compelling because it refers not to the systematic threats to the financial industry that was preoccupying governments and regulators but to a *moral* repulsion at the contamination of the body politic – of 'ordinary lives', of the 'frighteningly personal' – by the capriciously alien values of speculation. (Marsh 2011, p. 311)

In the crash's immediate aftermath, the so-called language of contagion was thus used to normatively describe how the contagion effects of bankers' and investors' reckless speculation and disregard for proper risk management rippled through society with dire consequences for ordinary people to follow. Interestingly, Marsh notes that Haldane initially shared this moral repulsion at the financial sectors' contamination of society, but soon reverted into a much less critical use of the language of contagion in analyses of the spread of systemic risk in financial ecosystems (2011, p. 311).

The Haldane and May story does not suggest that contagion cannot be a fitting metaphor for the spread of a panic or a speculative craze, or that epidemiological models might not prove valuable tools for capturing and tracking certain market dynamics. Rather, it implies that the concept of contagion is and never has been neither neutral nor innocent. This does not mean that the concept should be dismissed as jargon, as the economist Peter Garber does when he asserts that his colleagues' use of 'contagion' delivers nothing in terms of explaining excess volatility in markets than a 'confession of confusion' (Garber 2000, pp. 123–4). It is true that there does not seem to be a clear consensus on what contagion is (Forbes and Rigobon 2001), however, studying the history of financial contagion shows that the use of the concept in finance discourse is more variegated than Garber suggests, and that dismissing it as jargon leads to a neglect of important discussions of market dynamics and behaviour that escapes the common explanatory models of economics (Hansen and Borch 2019, Mitchell 2012).

But what is financial contagion then? It is most often defined as a 'shock' to one or a group of economic actors (individuals, institutions, countries, or markets) that spreads to other economic actors (Chen 1999, Allen and Gale 2000, Forbes and Rigobon 2001, Pritsker 2001, Boyson et al. 2010, Gai and Kapadia 2010).³

One definition from financial economics says that contagion is ‘correlation between markets in excess of that implied by fundamentals’ (Bekaert et al. 2005, p. 39). Hence, if markets are more correlated than fundamental economic factors imply then there is an increased risk of contagion. However, Bekaert et al. (2005) also note that it is not clear what exact fundamentals the excessive correlation needs to be measured against, which makes it difficult to identify financial contagion.

Economists often draw on the notion of contagion when they feel conventional economic wisdom is coming up short. The concept can be mobilised as both compensation for the alleged limits of economic theory in explaining certain phenomena in economic life and as a critique of these theories. An example of this is Stiglitz’s critique of market liberalisation and integration as a remedy against instability, in relation to which he draws on the idea of contagion to argue that liberalisation is not necessarily a risk-mitigating endeavour (Stiglitz 2010, cf. Bekaert et al. 2005). Regarding contagion, Stiglitz writes the following:

The word ‘contagion’ itself is associated with the transmission of diseases; and the traditional way of reacting to worries about contagion is ‘quarantining,’ that is, breaking the links between the diseased individual and the rest of society. The more integrated a society, the more rapid can the disease spread. A coherent analysis of the desirability of financial and capital market liberalization should, accordingly, take into account the benefits of risk sharing when things work—and the cost through contagion, when things don’t. Remarkably, most of the literature has not done so, treating the benefits of integration and the management of the risk of contagion as if they were separable. (Stiglitz 2010, p. 2)

Stiglitz argues the ‘standard models’ of economics are incapable of accounting for contagion because it defies their basic logic (Stiglitz 2010, pp. 2–3). Economic theory on market integration assumes more integration equals more risk dispersion, which is considered a good thing. However, the basic logic of contagion, if understood as the transmission of infectious diseases, says more or less the opposite, namely that proximity and frequent trans-/interactions equal increased contamination risk. Following Stiglitz’s argument, the concept of contagion thus helps shed light on a blind spot in economic theory and furthermore, it presents a description of market dynamics that seems to run counter to economic orthodoxy. Hence, market integration, which is supposed to help secure the smoothness of market transactions, arguably also enhances the risk of contagion in the system. In other words, when a shock to the system creates contagion, the connectivity enables and amplifies the transmission of ‘vulnerabilities’ in the network (Sampson 2012, p. 100).

While economists might favour treating issues of integration, proximity and connectedness separable from issues concerning contagion risk, as suggested by Stiglitz (2010, p. 2), uses of the concept of contagion around the turn of the nineteenth century through the first couple of decades of the twentieth present contagious market behaviour as inseparable from proximity and connectedness. In the section that follows, I examine the use of the concept of contagion in the given historical period and discuss how bursts of collective irrationality that writers tended to label ‘contagious’, were often intimately related to issues of psychical and mental proximity.

Mental contagion and the problem of proximity

The use of the concept of contagion in descriptions of financial panics, excessive speculation, and bank runs dates back at least to the early nineteenth century (Kelly and Gráda 2000, p. 1110, Besomi 2019). David Ricardo, for example, explained the crisis of 1797 by arguing that it was ‘the contagion of the unfounded fears of the timid part of the community, which occasioned the run on the Bank’ (1821 [1817], p. 430). Three decades later, Ricardo’s compatriot, John Stuart Mill described excessive speculation combined with a reckless extension of credit as a form of ‘contagion’ of the minds of both speculators and creditors. What drove such contagion, which tended to lead to a panic, was, Mill thought, ‘over-confidence’ and ‘unreasoning’ (Mill 1848, pp. 55–6). Both Ricardo and Mill employed the concept of contagion to capture

collective irrational behaviour among market actors, the obvious difference between the two was that whereas Ricardo linked contagion to the spread of irrational fear, Mill addressed the problem of speculative excitement.

Other sporadic uses of the concept of contagion can be found in popular and practical financial writing from the nineteenth century. In his novel *Little Dorrit* (1857), Charles Dickens associated the attraction of speculation with a kind of ‘moral infection’; a ‘contagion’ that ‘spread with the malignity and rapidity of the Plague’ (Dickens 1857, p. 386). Like Marsh’s analysis of the language of contagion, which was used in the immediate aftermath of the 2008 financial crisis, the moral contagion described in *Little Dorrit* spread well beyond the confines of high finance affecting people’s lives throughout society. In *Little Dorrit*, Dickens describe the unreasoned urge to pursue speculative investments as a communicable moral infection that everyone could catch (1857, p. 437). ‘No calling or profession escapes the contagion [of Wall Street speculation]’ as John F. Hume proclaimed years later in his investment handbook *The Art of Wise Investing* (1888, p. 148).⁴

While ‘contagion’ does occur in a couple of nineteenth century treatise on political economy and was used from time to time in popular and practical literatures on financial speculation, the concept appeared more frequently in academic, popular, and practical financial writing from around the turn of the century. Besides being an apt metaphor for the spread of excitement or panic on the exchange’s trading floor, the concept of contagion increased popularity in financial writing in the early twentieth century was due to its central role in theories on crowd psychology and crowd behaviour, which were inspiring financial writes across genre divides (see, e.g. Stäheli 2013; Hansen 2015, 2017).

The influence of mental contagion on market actors and the formation of prices was a main topic in the seventh chapter of Assistant Professor of Economics and Commercial Geography at the University of Wisconsin, Edward David Jones’s book *Economic Crises* (1900). While Jones’ ambition in the seventh chapter was to identify and outline the ‘chief psychological phenomena of crises’ (p. 181), the overall argument of the book is that economic crises are periodical or cyclical convulsions that paralyse trade, cause violent price fluctuations, and cripples industries (p. 1, paraphrase). Jones used the metaphors of the geyser and the intermittent spring to illustrate the periodicity of crises (1900, p. 132), yet less predictable than the geyser or intermittent spring was the panic, which Jones saw as the climax of a crisis (1900, p. 6). It was during this relatively brief and unpredictable culmination that collective psychology played a prominent role in determining the outcome of the crisis. One of Jones’s central claims in the seventh chapter on the psychology of crisis was that crises were amplified by the spread of sentiment among people physically and/or mentally connected in the financial markets. The severity of a panic was, he thought, conditioned by the communicability of emotions and opinions among market actors, and the exchanges constituted an ideal space for the effortless proliferation of sentiment and beliefs.⁵ Besides referring to this transmission of sentiment and beliefs as a process of ‘contagion’, Jones also used another concept that had grown popular in the field of psychology, namely that of ‘sympathy’ (Lanzoni 2009). The two terms – mental contagion and sympathy – were used almost interchangeably by Jones to explain the process by which market actors became carried away by emotion, resulting in loss of self-control and independent judgment. Right after having pointed to the relationship between connectedness and mental contagion, Jones went on to explain the transmission of emotions and opinions from one person to the next by means of sympathy:

States of mind, hopes and beliefs, are communicated from one to another by means of what is best described as sympathy. The intense feeling which can be produced in religious, political, or other assemblages, is something more than can be accounted for by the mere argument presented to the mind. The more intimate the association, the more will the common thinking process be influenced by the sympathetic force. The most extreme phase of the operation of this force is seen in the unthinking ferocity of mob action. (Jones 1900, pp. 203–4)

The idea that intimate association in certain social settings could be contagious and provoke ferocious mob action was not Jones's own. He borrowed it from the Harvard psychologist and protégé of William James, Boris Sidis. In the final third of his comprehensive doctoral thesis, *The Psychology of Suggestion: A research into the subconscious nature of man and society* (1919 [1898]) Sidis – drawing heavily on Charles MacKay's vivid descriptions of financial panics and frenzies in his *Extraordinary Popular Delusions and the Madness of Crowds* – extrapolated ideas on suggestibility in individuals to the societal plane (1919, p. 158). Suggestion – 'the impressing on the mind of an idea, image, movement, which the person reproduces voluntarily or involuntarily' (Sidis 1896, p. 849) – was, Sidis argued, both an individual and a collective psychological phenomenon. Like James, Sidis thought the feeling of individuality was conditioned by the ability to move freely. A limitation of the ability to move voluntarily meant a decrease in the feeling of individuality and an increase in suggestibility. According to Sidis, physical restraint automatically inhibits an individual's ability to think and act independently. In the *Century Magazine* article 'A Study of the Mob', which Jones drew upon, Sidis explained that the bodily squeeze in a crowd of people had a direct impact on the sensible selves of the crowd members, which would eventually become 'submerged in the fermenting spirit of the possible mob' (Sidis 1895, p. 190). From his studies of social suggestibility and mob action, Sidis concluded the gathering of people in limited spaces increased the risk of outbursts of irrational mob action through mental contagion.

Drawing on Sidis's idea about the direct connection between intimate physical association and the inhibition of individual judgment, Jones argued that not only did the proximity of people in a market ease the transmission and proliferation of hopes and beliefs, it also allowed 'erroneous beliefs' to be carried much further than in situations where people developed their beliefs and opinions separately. Jones noted that this 'accumulation of error' was tremendously important in the build-up and amplification of a financial crisis (Jones 1900, pp. 202–3). These assertions are reminiscent of the famous dictum of the figurehead of French crowd psychology, Gustave Le Bon, that 'in crowds it is stupidity and not mother-wit that is accumulated' (Le Bon 1896 [1895], p. 9). In addition to Sidis's reflections on mob action, it was, however, not Le Bon's crowd theory but instead the sociology of his compatriot, Gabriel Tarde that informed Jones's analysis of the psychological underpinnings of financial panics. From Tarde's theory of imitation, Jones borrowed the idea that the forces of imitation and contagion were intensified in urban settings due to people's physical closeness and their multiple relationships with one another. Jones expanded on Tarde's ideas on physical proximity, urbanisation, and imitation, arguing mental contagion was even stronger in the business centres of large cities, more specifically, in the exchanges. He considered the exchanges as concentrated versions of the urban settings described by Tarde.

The power of mental contagion is increased by such facilities for assemblage and communication as the railway, telegraph, and telephone. It is obviously enhanced by the practice of transacting business in industrial assemblages such as stock and produce exchanges. Attention may be called to the fact that in periods of unusual business success or depression, this physical concentration of traders in large markets is greatly increased. (Jones 1900, p. 405)

The conditions under which business was conducted in the financial markets, that is, on the trading floors of the stock or commodity exchanges, were therefore, according to Jones, ideal for mental contagion's infestation of the minds of market actors.⁶

A couple of years after *Economic Crises* was published, Tarde made his own analysis of financial markets, in which he described the stock exchanges as 'laboratories of collective psychology' (Tarde 1902a, p. 329). Tarde's economic psychology was laid out in a lecture series held at the Collège de France during 1900–1901 and published as the two-volume work *Psychologie Économique* in 1902 (Hughes 1961).

Concurrent with Tarde's lectures, a real instance of financial contagion occurred in the stock exchange in New York, an event Tarde would use as an example in his lectures.

On 8 May 1901, the New York Stock Exchange experienced a speculative panic caused by a standoff between some of the most renowned industrialists, bankers, and financiers in the United States. Some years later, the financial editor of the *New York Evening Post* and respected financial journalist, Alexander Dana Noyes, described the events that had unfolded on the stock exchange as 'rarely paralleled in the history of speculative manias' (Noyes 1909, p. 300). The panic was sparked by a struggle to gain control of the Northern Pacific Railroad Company, with the combatants being Edward H. Harriman, the director of the Union Pacific and Southern Pacific Railroad, on one side, and James Hill, the director of the Great Northern and Northern Pacific Railroad, on the other. John D. Rockefeller and Jay Gould backed Harriman, while J. P. Morgan and Cornelius Vanderbilt stood by Hill. When the price of Northern Pacific shares started soaring, every trader and investor wanted to buy the stock and started selling their stockholdings in other companies to mobilise funds to buy Northern Pacific. As a result, most stock prices, with the exception of Northern Pacific, started to decline rapidly, and as the 'contagion' – which was the term used in an article in *The New York Times* printed the following day on 9 May 1901 (The New York Times 1901) – began to spread, the market fell dramatically. Bearish speculators who had sold Northern Pacific short, hoping it would decline and not continue its upward surge, ended up losing everything.

The panic was covered thoroughly in the newspapers, including an *Evening News* article from 10 May 1901, which Tarde cited (1902b, p. 171). Using the panic of 1901 as an example, Tarde wanted to demonstrate that inter-psychological actions were influential factors when crowds of traders were cramped together buying and selling stocks on the exchange's trading floor. The excitement of intense speculation on the trading floor, Tarde argued, not only generated an increase in prices, but also created an 'ambience of confidence' that indiscriminately caught hold of almost everyone (Tarde 1902b, p. 172). This spread of excitement and confidence was perceived as amplifying and prolonging panics. Though such 'social contagion' was most pronounced during exceptional events such as a panic, it was not exceptional in itself (Tarde 1902a, p. 154, n. 1). According to Tarde, contagion and imitation dynamics were constitutive of the social as such, including in the stock exchange, and not simply exceptions to the rule of reasoned judgment and economic rationality (Tarde 1902b, p. 48, n. 1). In fact, Tarde found the idea that stock market prices were products of rational action an unlikely hypothesis made by economists with no knowledge of or interest in the inter-psychological dynamics of the stock exchange (Tarde 2007 [1902], p. 631).

[T]he market is, above all, dominated by psychological influences, by inter-mental actions, the current of which passes through all brains at the same time and a few spirits, who have serious reasons to be discouraged or filled with hope, spread their discouragement or confidence well beyond their group, to all the groups of the Stock Exchange; busy feverish, eminently able to exercise and suffer contagions of this kind. (Tarde 1902b, p. 197, my translation)

As people gathered closely together on the floor of the exchange, beliefs, feelings, views, and news would, according to Tarde, start to diffuse from one person to the next influencing their thinking and thus, their actions (Tarde 1902b, pp. 49–50). According to Tarde, inter-mental contagion was a fact of social life. It happened all the time, not solely in congested urban areas or on crowded trading floors, but the intensity of social interactions in such places accentuated its spread. However, when employed by financial writers, the concept of psychological contagion was almost exclusively used about instances where reason was thrown to the winds and irrationality was ruling the market.

Economists and writers of practical financial literature mostly viewed contagion as a trigger of irrational action that could get to even the most level-headed market actor. As noted by the handbook author, Thomas Gibson investors and speculators, who were otherwise 'capable of clear thinking, correct analysis, and

sound business judgment', could easily be let astray by 'contagious enthusiasm' (Gibson 1906, pp. 143–4). Some years later, the American economist, Wesley Clair Mitchell pointed out that the exercise of rational judgment was impaired when proper market information was not available. In such cases, market actors were left at the mercy of rumours, tips and hear-say, making them vulnerable to mental contagion. 'Even those who are looked to for advice', Mitchell argued, 'are not wholly immune from the contagion of emotional aberration (Mitchell 1913, p. 13). Mitchell's colleague, William Taussig made a similar assertion by stating that only a few very 'sagacious and sober' persons might remain unaffected by 'psychological contagion' (Taussig 1911, pp. 404–5). However, Taussig also stressed that market sentiment and the contagion it tended to generate was not the only reason why crises occurred. In fact, the connectedness and interdependence of economic actors was, according to Taussig, a structural fact of business that could lead to negative systemic effects if someone failed to meet their obligation to someone else in the chain of economic activities. 'This contagion is not merely contagion; it is real interdependence', as Taussig put it (Taussig 1911, p. 405). Hence, for Taussig it made little sense to decouple the risk of contagion from the interdependence and connectedness that he considered constitutive factors of the business and financial systems.

This association of contagion with the interconnectedness of actors in the financial markets is common in contemporary understandings of what constitutes financial contagion, although contagion is often reduced to an external shock rather than an effect of systematic vulnerabilities. In the following section of the article, I shift from the historical study of uses of the concept of contagion in different genres of financial writing to the 'diachronic review' (Koselleck 2004, p. 90) in which I examine and discuss how the concept is employed in efforts to make sense of the August 2007 Quant Meltdown.

Contagious quant strategies

In August 2007, about eleven months before Lehman Brothers' bankruptcy revealed to everyone the severity of the brewing global financial crisis, a much less detrimental yet still significant crisis unfolded in a corner of the equities markets heavily occupied by model-driven, data-reliant hedge funds (Khandani and Lo 2007, 2011, Kirilenko and Lo 2013, Pedersen 2009). Rumbles in the US sub-prime mortgage markets in July had forced two Bear Stearns hedge funds out of business, which added fuel to an already lingering unease among market participants. During the second week of August 2007, some of the most prominent and profitable hedge funds suffered unprecedented losses. Goldman Sachs' Global Equity Opportunities Fund lost more than 30%, James Simons' Renaissance Technologies' RIEF fund (not the famous Medallion fund) lost about 8,7% for the month, and AQR Capital Management funds also suffered significant losses, just to name a few of the marquee funds that were hit (Sender et al. 2007, Zuckerman et al. 2007). On aggregate, an estimated 300–400 billion dollar long and short positions in equities managed by quant funds by mid-2007 was allegedly cut by about half during the Quant Meltdown (Pedersen 2009, p. 8). Unlike the two Bear Stearns funds that crashed in July, the hedge funds that found themselves in trouble in August were not trading credit instruments, but equities. What made the event even more puzzling was that quantitative hedge funds committed to long-short market neutral equities strategies were the ones suffering the most significant losses, while funds in other markets were largely unaffected. Furthermore, equity prices rebounded almost completely on 10 August, making the meltdown a short but dramatic six-day crisis. Despite the rebound, most funds did not recuperate their losses, because they had sold off large chunks of their portfolio to reduce their risk exposure.

A quant, whom I interviewed on 11 November 2017 in London, shared his experience of working in the London offices of one of the top US quant hedge fund management firms during the very turbulent days in early August 2007.

There was uncertainty in the mortgage backed securities market, which resulted in many multi-strategy portfolios with all sorts of liquid instrument got called for a margin look on their positions [As a consequence] they had to liquidate the most liquid parts of their portfolios, which tended to be their equities. And some of these equities were invested in quant strategies, and then we started to see that impacting the markets. To the surprise of many systematic traders, it turned out that a lot of us were having similar models in play. If you look a little bit deeper at it, it was more of a liquidity value crisis than it was [a crisis] on all models.

What happened in the beginning of August 2007 was that our portfolio was running at its normal leverage, but as we saw the liquidity crisis coming—we were seeing some hits into the portfolio—and then quickly started to deleverage our portfolio. We were able to do that for a reasonable amount of cost. On Friday 9, we were down to one x leverage or something like that, but we were seeing a lot of pain across the portfolio. I think we were down just north of ten percent in August, which is our biggest loss to date.

The quant's rundown of the event is aligned with the so-called 'unwind hypothesis' which states that the crisis was triggered by the liquidation of one or more large equity portfolios, which then had an immediate price impact, causing funds with similar equities strategies to incur losses (Khandani and Lo 2007, 2011). In the plain language of AQR's founding principal Clifford S. Asness, the event boiled down to a case of 'widely traded popular strategies meeting hot money and trying to leave at once' (Asness 2007, p. 8).

The quant incident of August 2007 is described as 'a valuable example of contagion through correlated assets and strategies' (Glasserman and Young 2016, p. 785). This assertion is in line with the definition of financial contagion as 'the propagation of a shock to one security across other fundamentally unrelated securities' (Pasquariello 2007, p. 391). In the case of the quant event, the shock allegedly came from the credit market, which was troubled by the brewing housing crisis. However, the reason why the contagion caught on and proliferated rapidly between long-short equities quant fund was not the external shock from the toxic credit market, but rather that these funds' strategies and portfolios had become too much alike. Consequently, this specific corner of the hedge fund industry had, unwittingly, made itself vulnerable to a systemic risk of their own creation. The shock from the credit market was simply the trigger of an endogenously produced contagion risk; or as Danielsson et al. (2013, p. 73) put it, 'while the seeds of the volatility are exogeneous, a large part of its eventual realized magnitude is due to the amplification of endogenous news within the system'. In other words, the Quant Meltdown can be considered a crisis from within a system that inadvertently had become too homogenous.

Matthew S. Rothman, who was the global head of Lehman Brothers' Quantitative Equity Research at the time, argued, in a research note from late 2007, that quants 'understated the risks as they were not calibrated for quant managers/models becoming our own asset class, creating our own contagion' (Rothman in Getmansky et al. 2015, pp. 66–7). The hedge fund quant I interviewed in London seemed to agree with Rothman's assertion:

I think we need to be very humble and alert to these types of risks. They can certainly occur again, and whilst our research is designed to be uncorrelated to other market participants, we all know that might be all well and fine in normal situations, but when everything goes down, things become more correlated, and one of the most important ways to manage that [those types of risks] is not to take too much leveraged risk.

When the quant talks about 'our research', he is referring to the 'secret sauce' that differentiates the firm's strategies from other hedge funds' (albeit all being in the category, long-short market neutral equities). He argues that strategies and thus the behaviour of market actors become more alike when there is unease in a market. One could say that the market contracts, squeezing actors together, making the actions of others increasingly impact the actions and the realm of possible actions of the individual fund. Though the squeeze is not bodily, because market action is mediated electronically, the contagion was enabled by things

becoming ‘more correlated’, as the quant put it or, in other words, the quant funds’ niche had become too congested.

Besides the uniformity of the quant funds’ strategies in a bounded space, the great degree of financial market integration in recent decades, largely driven by technological and infrastructural progress, was perceived as having enabled the contagion. Like Stiglitz (2010), Khandani and Lo (2007, p. 19) accentuates the double-sidedness of market integration, when stating that ‘along with the many benefits of integration is the cost that a financial crisis in one sector can have dramatic repercussions in several others, i.e. contagion.’ Hence, the interconnectedness of financial markets, which allows market actors to be active in different markets and several asset classes at once, also creates vulnerabilities in the form of contagion risk. In August 2007 it seems to have been multi-strategy portfolios composed of a wide variety of instruments that connected the credit and equities markets: once the credit-part of the portfolio was hit, it forced the liquidation of the relatively easily-to-offload equities, thus igniting the unwind. As two Morgan Stanley quant researchers who had studied the Quant Meltdown quite intensely noted with reference to the event of August 2007, demand for liquidity goes from being one fund’s problem to being a systemic one, if there is ‘contagion of other market participants’ (Emrich and Crow 2010, pp. 7–8). The way one firm’s liquidity problem leads to ‘contagious behavior’ is ‘through the increase in haircuts and the implied curtailment of leverage by credit providers’ (Danielsson et al. 2013, pp. 76–7). A ‘haircut’ is the difference between an asset’s market value and its value as collateral for a loan. Investing with a certain amount of borrowed money (i.e. leveraged investing), obviously requires that someone is willing to provide a loan, and if credit providers curtail leverage for one firm, it spreads fear among other firms with similar positions, strategies and leverage.

What is characteristic of these descriptions of the quant event is that they do not present distinctively new perceptions of financial contagion, even though quant trading in many ways is a significantly different practice than trading of old. The use of the concept of contagion is reminiscent of early-twentieth century collective psychology-informed financial writing in which being cramped together or overly connected was perceived as increasing the risk of being swept away by mental contagion. In a Lehman Brothers research note, published 9 August 2007 (i.e. while the crisis was unfolding), Rothman compares the ongoing quant crisis to a classic panic situation of the kind seen throughout the history of modern financial markets and in popular depictions thereof.

The situation developing among quantitative fund managers has all the hallmarks of a classic “run on a bank” situation, such as the one depicted in the movie, “It’s A Wonderful Life”. Self-fulfilling prophesies of losses can come true if investors stampede and head for the door in unison. We certainly hope this situation does not materialize and stress the need for investor calm. We continue to see the situation for the facts we know are occurring rather than the speculation others are engaging in: there has been a systematic unwinding of factors bets as a few large investors need to reduce risk in highly liquid markets ... We believe that as more and more investors understand that what is occurring is not an idiosyncratic blow-up of their own quantitative models that a sense of calm and order can be restored. (Rothman 2007, p. 8)

Presumably affected by the uncertainty as to the cause and magnitude of the crisis, Rothman described the events unfolding before his eyes in real time as marked by profound irrationality and called for investors to calm their senses and realise that the market for quantitative equities investing was not broken. To slow down the mental contagion amplifying the crisis, Rothman encouraged those involved ‘to believe in the rationality of human beings (and particularly quants) and place our faith in the strong forces and mutual incentives we all have for orderly functioning of the capital markets’ (Rothman 2007, p. 8). Rationality, order and faith in the functioning of markets was thus regarded the most effective remedies against irrational contagious behaviour of market actors.

One of the lessons from the quant event seems to be that closeness and connectedness – like the proximity of market actors on a busy trading floor – can be contagious, and the concept of psychological contagion actually informs our understanding of structural problems despite the model-driven investment space largely is devoid of human intermediation in the actual trading process. Some scholars have studied the role of ‘affective contagion’ in algorithmic trading and argued that automated algorithmic finance can be a contagious space because it increasingly connects to and draws on information from distinctively human communicative spaces such as social media (Karppi and Crawford 2016, cf. Beverungen and Lange 2018). However, in efforts to make sense of the Quant Meltdown, practitioners, academics and financial journalists did not discuss contagion as a bi-product of model-driven or algorithmic investing. Instead, they revived the idea of self-perpetuating psychological contagion driving concerted action in environments where actors are closely interconnected due to their strategies and portfolio composition. ‘This isn’t about models,’ Asness wrote in a letter to AQR investors dated 10 August 2007, ‘it is about a strategy getting too crowded ... and then suffering when too many try to get out the same door’.

Concluding remarks

The concept of contagion is quite often employed in discourses on financial markets and speculation when the common economic theories tend to come up short. Be it financial panics, bank runs or the inflation of a speculative bubble, contagion is a go-to metaphor for financial writers attempting to capture the process through which such events build up and unfold. The concept of contagion thus helps make sense of market behaviour that appears to escape economic rationality (i.e. *uneconomic* behaviour). Moreover, it provides an understanding of economic behaviour counter to that of economics by obscuring ideas about how information propagates and how actors deliberately or unconsciously act upon this information. Hence, the notion of contagion destabilises and, at the same time, rearticulates markets and market phenomena in accordance with a relational and dynamic conception of sociality that does not necessarily discount rational economic action, but suggests certain underlying social and psychological logics can cause reason to be thrown to the winds at given moments.

At the turn of the nineteenth century and beginning of the twentieth, contagion in financial markets was intimately associated with collective psychology and the assumption that ideas, emotions, rumours, and opinions would easily transmit through a close gathering of people making them liable to irrational concerted action. The proximity of the exchange’s trading floor and the connectedness to the market via telegraph wires, price quotations printed on ticker tape, financial news, etc. were considered factors increasing the risk of mental contagion and thus, threatened to hamper individual reasoned judgment. While the concept of contagion was mainly used to frame irrational behaviour and to point out people’s gullibility when excitement or pessimism would start swirling around the market, it also directed attention toward issues of a more structural nature. If people’s minds could easily get contaminated and be led astray, especially during volatile stretches, alluding to contagiousness in markets helped shed light on endogenous risk factors associated with some of the underlying structures of financial markets.

Today, uses of the concept of contagion highlights the connectedness of financial markets – something which is generally perceived as a necessary condition of a well-functioning market – and the risks associated with being interlinked with numerous other actors in close-knit financial networks. The analysis of the 2007 Quant Meltdown associates financial contagion with structural issues of overt connectedness and conformity of investment strategies, but, at the same time, the accounts of the event echoes old ideas of irrational concerted action and people’s tendency to lose their heads when panic sets in. Financial contagion thus stands out as both a structural and a more impalpable psychological issue. While uses of the concept of contagion in the financial market context are in many ways problematic – in particular because of its conceptual ambiguousness and elusiveness, but also because of the different meanings that has been

ascribed and to some extent still stick to it –, the concept is also a prism through which some of the structural underpinnings of today's technically advanced, global, and thoroughly interconnected financial markets present themselves as vulnerabilities rather than prerequisites of stability and efficiency.

Notes

1. The interview with the hedge fund quant was conducted as part of a larger ethnographic study of the use of financial models and algorithms in contemporary finance. It is one out of 202 interviews with market participants done over the course of a three-year period from 2017 to 2020 by four researchers. Though the project's semi-fixed interview guide does not include questions about the Quant Meltdown, it just so happened to become a central discussion point in the interview I did with the hedge fund quant.
2. This interchangeability of epidemiological, financial, and social contagions – specifically with respect to the spread of rumours – is also evident in the Nobel Prize winning economist Abhijit V. Banerjee's paper, 'The Economics of Rumours', in which he studies how and to what extent rumours transmit among investors (Banerjee 1993). Banerjee argues 'a rumour process is formally very similar to contagion processes of the kind studied by epidemiologists and it shares with contagions the possibility that a deviation from the norm (say being infected by some new disease) by a few people can have an effect on the entire population' (Banerjee 1993, p. 310). To examine the spread of rumours (social contagion) in a financial market context, Banerjee thus makes a direct analogy between transmission of rumours and transmission of an infectious disease in a population.
3. For an in-depth review of the economic literature on contagion, see Edwards (2000), Sell (2001), and Kolb (2011).
4. The idea that some people were more at risk of catching the bug of speculation or to pursue an irrational urge to empty their bank accounts, as Ricardo alluded to in his explanation of the 1797 crisis (i.e. 'the timid part of the community'), was not uncommon in financial writings on financial contagion in the nineteenth century. In his biographic account of his time as a Wall Street investor, William Worthington Fowler, for instance, argued that women are highly susceptible to the contagion of speculation. He writes that 'the sympathetic female nature catches the contagion of speculation', and further imagines a horror scenario in with 'several hundred women interested in stocks, being present at a panic and giving way with feminine impulsiveness to the feelings of the hour' (Fowler 1870, p. 457). Examples of such gendering of financial speculation, based on the ascription of different natural propensities to women and men respectively, can be found in many popular and practical texts on speculation and investment from the nineteenth and early twentieth centuries (see, e.g. De Goede 2005, ch. 5, Stäheli 2013, ch. 6). Besides gender, nationality and cultural background were also on occasion brought up as reasons why some people allegedly were more susceptible to the contagion of speculation than others. In an article in *The Century Magazine* from 1914, the sociologist Edward Alsworth Ross argued that the German is 'hard-headed, and not easily borne off his feet by contagion of example', and went on pointing out that '[t]o speculative fever and to mad panic he is rather immune' (Ross 1914, p. 104). Ross had come to this conclusion reading a comparative study of Americans and Germans by the German Professor of Psychology at Harvard University, Hugo Münsterberg. What these examples show is that the concept of contagion did more than describe a process through which emotions spread among people, it also fuelled ideas about people's gender, cultural background, nationality, class affiliation, cultural background, race, etc. disqualifying them from participation in financial markets.
5. Other financial writers shared Jones's concern with the contagiousness of emotion and the negative impact it often had on the functioning of markets. In the investment advice handbook *How to invest in mines* (1901, p. 136), Walter William Wall stated that the moods of the individual and of a nation are 'undoubtedly contagious'. Wall further noted that when unrestrained 'exuberance' and 'animal spirits' takes over, the desire to speculate grows and spreads, and then more people join in on the bonanza 'without troubling to exercise their reason or common-sense' (1901, pp. 136–7). In the article 'The psychology of crazes' (1900), published in *Popular Science Monthly*, the psychologist George Thomas White Patrick also pointed to contagious emotions and the concerted action they tended to provoke as primary drivers of crazes and panics. Patrick described the panic as 'a reflex phenomenon consisting merely of contagious fear and precipitate, unintelligent flight' (Patrick 1900, p. 293).
6. Years later, Jones (1918) returned to the question of contagion in financial markets, stressing that 'the contagion of the crowd' was only one reason why markets were almost constantly being over-bought or over-sold. He argued that 'market rumors, tips and the desire to do something' tended to prevent active traders from doing proper calculus, resulting in inflated or deflated prices. Another reason why markets tended to be over-bought or over-sold was,

according to Jones, that those trading at a distance from the exchange were trading ‘on the basis of quotations a day or two old’ (Jones 1918, pp. 238–9). While acknowledging the importance of the contagiousness of rumours, tips, and desire, Jones clearly understood that crowd contagion was not the sole cause of panics.

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