
‘This time it’s different’ ... and why it matters: the shifting geographies of money, finance and risks

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6.1 INTRODUCTION

We live in world increasingly made through the practices and calculations of finance, as the build-up to and aftermath of the global financial crisis¹ (GFC) stand testament. Put slightly differently, the interconnectivities made through the processes of financial computation and measuring and their outcomes, are ‘world making’. What follows then is a small contribution to the larger, established arguments not simply about the relevance of geography to understanding how finance works (see for example Aalbers, 2008; Christophers, 2015; French, Leyshon and Thrift, 2009; French, Leyshon and Wainwright, 2011; Lee et al., 2010; Pani and Holman, 2014; Pike and Pollard, 2010; Wainwright, 2009), but how these complex financialized spatialities might be talked about and imagined. The spatial plays of the crisis have intrigued not just geographers but mainstream economists and others. Reinhart and Rogoff (2009: 240) for example ask how the subprime crisis morphed ‘from a local or regional crisis into a global one?’, while the Bank of England’s Andrew Haldane talks of the ‘changing shape and scale of the underlying topology the international monetary system’ dating from the late 1970s (Haldane, 2014: 6). Geography is inescapably

bound up in such observations about the spread and span as well as the intensity of modern finance, as the capture of value globally is organized through innovative connections spliced through financial markets. And it is the unexpected geographies described by the crisis and made through complex connections that mean that ‘this time it is different’. This difference arguably demands a fuller appreciation not simply that ‘space is not static’ but that the practices of financialization generate consequences that are perhaps better captured through financial topologies rather understood as involving an interplay of scales from the local to the national.² To argue this the chapter begins by setting out briefly the two distinguishing features of contemporary finance.

Financial crises are nothing new. Financial innovation, too, has a long history (Neal, 1990: 5). Yet there’s something distinctive both about the recent global financial crisis and the underlying innovative practices and processes that fuelled national and international financial ‘systems’ since the mid-1970s. The distinctiveness stems first from the sheer pervasiveness of finance in the years prior to the crisis, a pervasiveness achieved through the multiple links forged not just within the worlds of international financial markets, but between these markets and corporations, through to everyday finance and money such as savings products, mortgages, pensions, and the like. For those within centres such as Wall Street and the City, it is as if in the decade or so prior to the crisis, money and finance became a creative feedstock fuelling a ‘new’ imaginary amongst market participants. Though in many respects at odds with the cold rationalities of ‘finance’ and clinically precise calculation, this imaginary was able to infiltrate and inform so many aspects of the everyday precisely because of the passionate belief it engendered in what a highly financialized space–time could deliver (LiPuma and Lee, 2012). Innovative tricks in international markets tied together multiple financialized space–times, as financial organizations engaged in

imaginative calculations that in effect saw them connecting, storing, and exchanging ever growing multiples of what were thought to be manageable risks, rather than Knightian uncertainties.

This leads into the second distinctive feature of the crisis: the striking spatialities that emerged swiftly as the crisis unfolded (see French et al., 2009). Only when the crisis hit and promises of risk management and easy enrichment lay shattered, did the consequences of innovative connectivities dreamt up by financial organizations become apparent. The crisis thus lays bare contemporary financial innovation as a form of spatial innovation where the latter is understood as the myriad, novel, financialized connections that resulted from packaging and trading often complex finance related risks drawn from across a global playing field. The inevitable ‘spatial fix’ (Harvey, 1982) that shadows every crisis was given an added twist due to the seemingly improbable interconnections generated by the financial innovations that have been pushed enthusiastically into the heart of financial markets since the late-1970s. By the time of the crisis, finance was no simple servant of urban accumulation (Dymski, 2009: 434) but had become an independent, masterful conjurer of endless, innovative, and cynically profitable, linkages. Yet, to borrow from Mirowski (2013) we ‘should never let a serious crisis go to waste’. Indeed the crisis presents geographers with an opportunity to ‘realize the potential’ of financial geography at the present moment (Lee et al., 2010; Pike and Pollard, 2010), a moment that will not last for ever.

After all, the GFC now seems merely a rude interruption. Capitalism’s tendency to develop an occasional and dangerous financial lop-sidedness (Arrighi, 1994; see also Blackburn, 2008) got the better of the system, for short while at least, but now, supported by the taxpayer in the form of ‘quantitative easing’, the game continues and those still standing once again seek to fulfil their desire to possess the world in

‘financial garb’ (Buchan, 1997: 278). Equipped with the latest ICT, (still) highly leveraged hedge funds, pension funds, mutual funds, and the once triumphant but now ever so slightly more modest ‘large and complex financial institutions’ such as J.P. Morgan Chase and UBS³ continue to prowl the globe in search of an edge: world stock markets from Japan to London; any number of market indices such as the Dow Jones; energy markets; bond and money markets; metals from aluminium to zinc; markets in currencies; wheat and shrimp futures; the impact of bird flu and ‘mad cow’ on soy and corn demand; commodity futures; the growing interest in ethanol production and its effect on the demand for sugar – all and more are scanned constantly, day-in, day-out. Everything it seems, from a shrimp to the weather, stands in line waiting to be drawn into the processes that channel and connect investment ‘globally’. The materials of finance, from state of the art ICT, to research reports, to the daily sociocultural practices of interpreting and making sense of data flows that stream into dealing rooms, meld together constantly to make markets.

6.2 FROM ‘FLOW’ AND ‘CIRCULATION’ TO EMERGENT FINANCIAL TOPOLOGIES

Yet what can we make of all this, of the intensive movement and extensive interconnectivity achieved through financial flows and circulation, of that is, the spatial reach of financial market practices and their collective impact both immediately and in the near future? The ‘capitalization of almost everything’ (Leyshon and Thrift, 2007) goes some way but not far enough.

In the growing shadow of the GFC metaphors such as ‘flow’ and ‘circulation’ (or even ‘mercury’ (Clark, 2005) are found wanting; they capture neither the entangled

time–spaces that accompany the dynamic traffic in financial instruments, nor do such terms help make sense of the sheer spatial disruptiveness when things go wrong. When in other words the ‘interactive complexity’ (Bookstaber, 2007) of modern finance and its risks becomes too much for the system to cope with. As the authors of a recent Bank of England Working Paper put it:

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An astonishing feature of the 2008 financial crisis was how quickly and extensively the relatively small write-downs in US subprime mortgages spread to a situation where only two years later governments worldwide had to provide massive support to their banking systems. In the years prior to the crisis, large banking groups had become highly interdependent across national borders through a complex web of direct claims on each other, ownership structures and other risk transfers and also through participation in common markets. Because the system was so intertwined, the financial crisis was transmitted rapidly through default chains, funding squeezes, fire-sale externalities and a rash of counterparty fear. (Garratt et al., 2011: 5)

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Even as descriptors, flow and circulation join the story half-way through. They tend to omit first the formative stages where an increasingly coded landscape, amenable in turn to further mathematical calculations and imaginative socio-technical-cultural practices and processes, emerges; where, to echo Andrew Haldane (2009), the changing topology of the financial network is generated in centres of mathematized time–space such as London and New York. Second, such terms fail to grasp those later moments when risks intertwine and uncertainties prove unmanageable, when ‘fear’, ‘default’, and ‘funding squeezes’, and the like, take hold.

To talk of fear is also a reminder that the GFC demonstrates clearly why finance is not an exclusively technical field and also why its presumed authority should be questioned. As Bill Janeway (2009: 28) put it ‘modern finance theorists thought that they had tamed “risk” by treating it as a statistical attribute of time series of data. They thought that they had escaped the fundamental uncertainty that exists about the future results of present decisions. They have been proven stunningly wrong’. A significant reason why things turned out this way is because, as Janeway continues, in trying to ‘emulate the most mathematically rigorous of the natural sciences’ (Janeway, 2009: 31) financial economics forgot what Frank Knight pointed out many decades ago: ‘the sheer brute fact that the results of human activity cannot be anticipated’ (Janeway, 2009: 28). The brute fact becomes more brutal when the influence of mediating devices on human activity and human imagination is recognized. Financial markets and financial innovation do not just deal in ‘time alone’ (Adam, 2003: 70); like all financial innovations financial futures for example are a money culture’s way of reimagining how financialized space–times may be traded. A future made through today’s finance ceases to be something that can be understood as a neatly linear calendar time⁴ and becomes instead highly unpredictable, ‘intertwined’ relational space–times.

As this suggests, whilst finance is understood here as a combination of components, there is a need to recognize the seductive qualities of our present ‘money culture’. To acknowledge in other words the sensual side of finance that provides the flux enabling these components or devices to move amongst market cultures. Contemporary finance is just as much about the lure of a financialized time–space made ‘malleable’ by both imaginaries *and* energizing devices, as it is about the technicalities of financial modelling (which is itself dependent on imagination and narratives (see for example Morgan, 2001, 2004, 2012)). The processes of financial

innovation in the build-up to the crisis suggest an agreed sense of an imagined *simultaneous future* woven into the fabric of financial innovations and markets in them; devices and imaginations fused, to draw innovative financialized future time-spaces into an actionable present – albeit uncertainly.

To argue for a more spatially aware account of financial markets, one that makes more accessible the capacity of finance to spatialize, to *generate* emergent financial topologies, new and consequential connections and adjacencies, rather than deploy an arguably less appropriate scalar imaginary, calls for a quick run over familiar terrain.

6.3 A VERY QUICK REHEARSAL: ACKNOWLEDGING THE STUFF PRODUCING UNEXPECTED SPATIALITIES

Finance gains its capacity to perform through sets of tools that enable calculative agencies (Callon, 1998: 20–23; Barry and Slater, 2002: 182). The tools aren't just social relations of finance but the range of contrivances, such as finance theory and software, that give shape and meaning to what is framed as the 'market', be this a market in foreign currencies or so-called catastrophe bonds. In brief, these various financial gadgets 'do not merely record a reality independent of themselves; they contribute powerfully to shaping, simply by measuring it, the reality that they measure' (Callon, 1998: 23); the gadgets in other words contribute to 'financially relevant activity' (to adapt Law, 2002) all too easily overlooked in more orthodox approaches to finance.⁵

The work of Beunza, Hardie and MacKenzie (2006), Callon and Muniesa (2005), MacKenzie (2001, 2003a, 2003b, 2004a, 2004b) and Hardie and MacKenzie (2007)

for example argue that markets are actively made; they insist (in line with Callon's original thesis (1998)) that they are performed and that moreover this performance depends on the *materiality* of these markets – a materiality that includes finance theory itself (for example Maurer, 2005a, 2005b; Miyazaki, 2005; MacKenzie, 2009). In brief, financial markets are understood as hybrid collectives or *agencements*⁶ (Callon and Muniesa, 2005; Callon, Millo and Muniesa, 2007), that is 'hybrid collectives comprising human beings as well as material and technical devices' (Callon 2005: 4) . It is through such collectives that action is achievable. In a similar fashion John Law (2002) approaches economic calculation as 'materially heterogeneous practices'. In this and in Callon's sense it is acceptable to talk of the stuff and things of markets. Expressed in terms of cultural economy, culture is already distributed through the *agencement* that configures the realm of possible calculations.⁷ This body of work, I would argue, helps to make sense of just how a range of calculative tools at the heart of modern finance, and the calculative agencies they facilitate, enliven, spatialities. To explain.

To view a financial market as an *agencement*, as a 'socio-technical combination' (MacKenzie, 2009: 21), is to recognize it as a very particular congregation of the social, cultural and the technical. The trading floors of Wall Street, of Chicago and the City are a mix of human traders and sophisticated trading technologies. The screens, the mathematics, and so on, are active material components in the making financial markets; they do not collectively form a passive backdrop to human traders (Callon, 1998: 26). Instead they are understood to help expand and stake out a terrain of possibilities for market making. And because the material equipment is consequential, as Donald MacKenzie reminds us (2009: 19), it is important to recognize that far from being inert, when drawn into the social relations of finance, the devices contribute not only to 'making the world go around' they are part of the growing tendency for

‘finance’ to assemble the world through which it slides and worms its various routes. The move in the build-up to the crisis by the London based hedge fund, Titian, to combine a ‘fundamentals only’ approach with what they described as the ‘block box’ approach favoured by the ‘quant funds’, is perhaps illustrative of this point. The fund’s deliberate combination of approaches was driven by Titian’s attempt to implement long and short term investment strategies tailored to allocating funds across what they saw as the four ‘biggest investment themes’ that would drive global markets in the near future: clean energy, water, infrastructure and natural resources. As the Managing Partner and Portfolio Manager at Titian put it:

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We apply our fundamentals-based knowledge in the segmentation and the analysis of the long and short investment themes and the positions we like, and once we’ve pre-selected the underlying instruments we’re comfortable with, we then use models to guide us in the tactical allocation of capital across that pre-approved universe. (Fieldhouse, 2008)

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If to ‘trace the agencement making up an actor’ (MacKenzie, 2009: 22) is one of the chief tasks that the social studies of finance sets itself, and if the technical artefacts employed help market participants to see, understand, comprehend space anew – Titian’s pre-approved universe – then the spatial impact of such devices (such as Titian’s moves into and out of water, resources, infrastructure) should be traced too as part of that overall goal. This is because the devices, to include the ‘fundamentals only’ and ‘black box’ approaches, for example – help assemble innovative space–times through which market action is continually enacted. Spatiality, rather than being an inactive backdrop, a passive flatland,⁸ becomes entangled in market practices of financialization to impact not just outcomes but (as part of this) how we might

understand how financial risks move, mutate and complicate seemingly straightforward connections between investment decisions and markets within and across national borders. For such connections quickly become problematical because of the use of complex financial instruments designed, supposedly, to make risks more measurable, yet at the same moment introduce new risks due to the density of information required the characteristics of the very instrument tailored to lessen specific risks. The Bank of England's Andrew Haldane (2009: 17) estimates for example that 'an investor in a CDO squared would need to read in excess of 1 billion pages to understand fully the ingredients'. The regulatory system itself was after all ill-equipped to deal with such growing complexity introduced by hedge funds and the wider shadow banking system, with their emphasis on innovations such as credit default swaps and collateralized debt obligations (Pozsar et al., 2010: 1).

How well after all does 'flow' capture either, say, what is incorporated within a CDO squared, when, as a *Financial Stability Report* noted, a typical CDO could reference more than 100 residential mortgage-backed securities, each of which in turn could reference 5 000 underlying mortgages (*Financial Stability Report*, 2011: Box 1), or the sort of 'vehicular finance' described by the Bank of England's Paul Tucker, where 'SIVs (structured investment vehicles) may hold monoline-wrapped AAA-tranches of CDOs, which may hold tranches of other CDOs, which hold LBO debt of all types, as well as asset-backed securities bundling together household loans' (Tucker, 2007: 312). These are the sorts of development in finance which prompted Andrew Haldane (2009) to talk of the changing shape of the 'topology of the financial network'. Though not sharing all of the same theoretical roots as Haldane's approach to topology, the appeal to the of conceptual resource of emergent financial topologies and its employment, as it were, in amongst the *agencements* of financial markets, is an effort to redress what are often aspatial accounts offered by cultural economy and

the social studies of finance. At this point it is helpful to quickly rehearse the key features of financial innovation that came to mark the decade or more leading to the GFC.

6.4 FINANCIAL INNOVATION, SPATIAL INNOVATION

As the economic historian Youssef Cassis notes:

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The almost constant arrival of new financial products since the mid-seventies has been an unprecedented phenomenon in financial history. Until then, practices, services and activity, without being entirely static, had not fundamentally changed from one generation to the next. In this respect, innovation has been the most original aspect of recent times, especially because of its impact on the international financial centres' role. (Cassis, 2006: 248)

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As this quote suggests, and as is now common knowledge, innovation in financial market instruments grew at a meteoric rate from the mid-to-late-1970. By the mid-1980s worldwide trading volume in financial futures, swaps, and mortgage-backed securities, stood at \$10,000 billion, \$100–200,000 billion, and \$150,000 billion respectively; figures for 1975 would have been 'minute' (Cooper, 1986: 2). Innovative instruments grew phenomenally from the late 1980s onwards, a growth matched only by their complexity. The significance of this growth stems from what such innovation does to linkages amongst both financial organizations within financial centres and the connectivities sewn between these centres, intermediaries,

and the world outside. Financial innovation it should be remembered works along two main, often interrelated, ways. Financial innovation can refer to the engineering of a ‘new’ financial instrument (such as a swap or a mortgage-backed security), altering existing securities by adding innovative devices such as sophisticated options. Another related side to innovation focuses on the innovations in trading and market making designed to develop liquid markets for new instruments. For example, so-called pass-through securities – in essence, a tradeable claim on a pool loans (and at the core of the mortgage-back market) – offered an innovation in trading arrangements whereby individually untraded mortgages gained liquidity as a result of being packaged into tradeable securities. As the familiar story goes, the growth of financial innovation over the past few decades produced markets where markets previously did not exist (financial futures contracts, for example), turned the untradeable into something tradeable (mortgages, say), transforming the incommensurate into the commensurate, and sewing together objects (loans and mortgages, for instance) and places into increasingly complex connectivities.

The significance of financial innovation lies then not simply in the way the process allowed the imagining of new financial instruments and associated trading systems, but in the way that the balance sheets of a significant range of financial intermediaries, from banks to hedge funds, were complicated by these innovative connectivities (see *Financial Stability Report*, 2011; Haldane, 2009). As two Bank of England economists put it, innovations such as credit default swaps and collateralized debt obligations, and the interdependencies they produce, ‘created an environment for feedback elements to generate amplified responses to shocks to the financial system. They have also made it difficult to assess the potential for contagion arising from the behaviour of financial institutions under distress or from outright default’ (Gai and Kapadia, 2010: 5).

To illustrate let's take a still topical example, the piecing together of residential mortgage-backed securities (RMBS) to illustrate some of the points made so far. RMBS is less as a case of clean cut financial engineering and more of a collection of practices that reassembles the spatialities of financial risks amongst disparate agents in less than transparent ways. The starting point is simple but arguably significant (and often overlooked): to assemble a financial instrument nowadays is almost always to partake in the assembling of other instruments where the eventual distribution of risks and rewards amongst market participants is necessarily clouded but always inherently spatial. In the borderless world of abstract finance the current regulatory environment and significantly the presence of a key instrument, the financial derivative, free special purpose vehicles (such as those essential to RMBS) to choose the routes they travel untroubled by regulatory bodies for whom the task of detecting where the risks are would appear to be all but a lost cause. The routes chosen, the innovative spatialities, become clear(er) only when the overzealous calculations made within the ethereal world of abstract finance fall to earth – as exemplified in the recent subprime crisis and ensuing credit crunch, at the heart of which lie RMBS.

To reflect on the hybrid nature of the practices that work to put the flow into the flows of finance⁹ is to find a starting point to conceptualize the spatio-temporalities prepared and exchanged in the making of financial markets. The mathematical formulae and the assumptions they contain about space–time, the manner in which their assumptions become entwined in the workings of modern finance as a result of the increasing centrality of financial engineering based as it is upon such mathematical expressions, on streams of data, their manipulation and presentation on the screens in financial organizations, may now all be viewed as active players in the hybrid troupe called a financial market that, all together, produce ‘unimagined topologies’.¹⁰ But are we then still talking about the same old finance, the same old

connectivities, and the same old risks? And if not, then do the connectivities generated and the risks they channel suggest that ‘this time it’s different’?

6.5 SAME OLD FINANCE...?

If we attend to the make-up of markets, to the enabling financial agencements and what they assemble, then, contrary say to Paul Hirst and Grahame Thompson (1996), global finance today is not the same as say one hundred years ago. If, as Doreen Massey (2005: 85) points out, the analysis is less about *degree* – for instance, the volume of international capital flows a century ago against comparable figures for today – and more about *form* – just what are the characteristics of such flows and what components are involved in their design and movement? – then today’s financial markets are revealed as different in that they work through, to use Callon’s (2005: 4) words, a ‘reconfigured socio-technical agencement’ (hence the attraction of this concept). Such reconfiguration has effects both *within* market cultures (see for example Preda (2009); Zaloom (2003, 2006)) *and* in the worlds outside the exchanges. The capacity of finance to reconfigure space–time through processes of coding and coordination achieved through financial mathematical modelling and visualization software, for example, has altered and expanded to reflect changes in the constituent components of finance. Nowadays the markets are, Callon (1998) would say, prepared, configured, differently. The financial models, the latest forms of ICT, and so on, as well as the ‘money imaginary’ of the humans involved in these markets, an imaginary that weaves its way through and feeds on the possibilities of such materials, are all potentially capable of reworking the space–times drawn into financial flows, making things different, this time. And a significant part of the reason

why it's different lies in the creation of new forms of connectivity and the channelling of complex risks.

... Same Old Connectivities, Same Old Risks?

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So, where are the risks? They are all around us all of the time, of course. Some will crystallize. But that need not lead to disorder. Indeed, in most circumstances, global capital markets are deep and liquid enough – having a sufficiently wide range of participants able to trade with each other, and with different risk appetites and different actual risk exposures – to absorb shocks. But history suggests that strains can appear at times. And as the system develops, we need to be alive to whether cracks might show up in new places or old weaknesses manifest themselves in new ways. (Paul Tucker, Executive Director for Markets and a member of the Monetary Policy Committee, Bank of England, from a speech delivered at Euromoney Global Borrowers and Investors Forum, The London Hilton on 23 June 2005, emphasis added)

*... financial markets are very different today. They are more broad based and much more connected so that these assets that were created in the US also find their way into Germany; these assets that were created in the US find their way into different kinds of vehicles and different types of investment. It's much more broad based and much more international in scope because that's the nature of the markets. (Sam O'Neal, Chairman and CEO of Merrill Lynch, interviewed in *The Banker* October 2007, emphasis added)¹¹*

We are in a minefield. *No one knows where the mines are planted* and we are just trying to stumble through it. (Drew Matus, economist at Lehman Brothers, FT, 14 August 2007, emphasis added)

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The composition of financial markets is not the only way that contemporary finance differs from the past. As the above quotes suggest the *connections* between markets and territories differ, too, as do the *risks* they channel. Financial innovation is central to the new forms of connectivity that have come to characterize contemporary financial markets; such connectivity ‘breeds and multiples risk’ as LiPuma and Lee remarked pre-GFC (2004: 53). The ‘binding and blending’ that derivatives in particular enable, facilitates connectivity as such instruments are designed to price risk and blend previously separate markets (Bryan and Rafferty 2006: 5). In their recent study of financial derivatives Bryan and Rafferty (2006) underscore the points made above when they argue that the importance of today’s derivatives lies in two related spheres. First, is their role in binding, through options and futures, the present and the future. Second, and perhaps more pertinent to the arguments in this chapter, is their function of blending through swaps in particular to establish ‘*pricing relationships that readily convert between different forms of asset. Derivatives blend different forms of capital into a single unit of measure.* (They make it possible to convert things as economically nebulous as ideas and perceptions, weather and war into commodities that can be priced relative to each other and traded for profits.)’ (Bryan and Rafferty, 2006: 12; emphasis in original). The moves by investment banks and hedge funds say into the US Sulfur Allowances market in search of high yields in a low interest rate environment, is perhaps one example of the possibility of imagining the weather and, say, an emerging market bond as ‘commensurate’. That is, blending, as a process, involves the establishment of pricing relationships across any

number of entities that then makes compatible what were previously distinct and separate. Thus binding and blending are highly spatial acts, too (Pryke and Allen, 2000). Derivatives designed to deal with the risks of highly interconnected markets at the same time become the ‘authors’ of their own form of connectivity (LiPuma and Lee 2004: 150). One result (particularly post Basel II) is that such financial instruments serve to delocalize risk so much so that risk becomes the ‘general feature of financial activity’ as Randy Martin (2007) has argued.

As the present crisis and those preceding it over the past decade or so demonstrate only too clearly, linked to computers, and the ‘technologized mathematics’ (Rotman, 2008) that such technology enables, innovations such as derivatives re-energize the ‘idea of finance’ and transport this sign into ever-increasing number, connecting financialized space–times in original ways. Innovation always has a spatial dimension and that spatiality is present because the risks around which the innovations are wrapped are always in the end ‘of the world’ and thus consequential. The dreaming up and design of financial innovation is increasingly virtual but as the event of a crisis demonstrates only too clearly the outcomes have a very real materiality. Financial innovation composes, recomposes, blends old and new ‘objects and relations’ and produces interactions that are not all present at the moment of innovation itself but surface when a crisis strikes.

If financial innovation increasingly has been focused on ways to limit risk by discovering profitable ways to channel its distribution amongst a range of financial agents, then the spatialities of this process should be part of the narrative. The ‘spatial dynamics of risk’ (November, 2008: 1523) in other words need to be taken into account (see also Tellmann, 2009). Such processes are core to modern finance and are central to the ‘interactive complexity’ (Bookstaber 2007) of many key financial markets such as swaps. In a recent market-wise contribution to the current situation

the hedge fund manager and ex-quantitative researcher and prop trader with Morgan Stanley, Richard Bookstaber brings the language of ‘interactive complexity’ to bear on the design of complex financial instruments and consequences that unravel when such products start to go wrong. Of immediate interest is the way he draws attention to the source of complexity introduced by such instruments as options and swaps; their structure is non-linearly related, as he says, to the ‘prices of their underlying securities’. Significantly ‘Observing their day-to-day movements gives no inkling of what may be in store if the market moves dramatically.’ Moreover – and here there are echoes with the earlier insistence on foregrounding ‘emergence’ and spatialities – with swaps and other highly leveraged positions:

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the complexity arises because that leverage can link the market unexpectedly to events that are distant [in both time and space] and economically unrelated. A market can spiral out of control simply because there is some group of overextended investors who happen to have positions that for one reason or another they are forced to liquidate. These interrelationships cannot be anticipated in advance and will shift with the fortunes and market interests of the investors and speculators. (Bookstaber, 2007: 156)

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Moreover, as some have argued, the way the crisis mutated falls outside of the accepted currency of risk and volatility and perhaps more accurately captured by ‘turbulence’ (see for example Cooper, 2010; State Street Corporation, 2009)¹².

The intensive spaces of financial market making ‘perform temporal [and spatial] syntheses’ to produce spatialities – rather than *flat geographies* over which financial transactions take place – that extend through an ever increasing range of entities cum investment categories such as metals, grains, stock indices, currencies, money

markets, and now through derivatives, financial market making resonates through weather, floods, earthquakes – all are now on the investment radar of the asset allocators moving according to a 2005 estimate US\$45 trillion (that is 150 per cent of OECD GDP)¹³ around the globe.¹⁴ The weight of this money is not simply a *flow*. The asset allocation decisions that move potentially vast sums in and out of asset classes as situations change, increasingly ‘make markets’ as the International Monetary Fund has recognized (IMF, 2005: 65). ‘Institutional flows’ certainly flow, as they are moved from one asset class to another; those within financial centres after all spend a great deal of time organizing such movement. The simple point is that the range of decision-making that informs that movement and influences asset allocation – varying as it does in terms of, say, differing liability structures, tax exposure, accounting requirements, time horizons (IMF, 2005: 70–76),¹⁵ the emergence of new management styles – means that the complete process is not a dispassionate, smooth flow. It is a lively, unpredictable entanglement that generates financial topologies.

6.6 WHEN BALTIMORE CAME TO TOWN – TOPOLOGICALLY SPEAKING

If private finance is to remain central to ‘economic growth’, then the nature and qualities, the intensities, of space–times made through and enabling financial markets and the ‘instruments’ they trade in, all need to be part of theoretical approaches to modern finance, its workings and outcomes. As Doreen Massey wrote in her attack on aspatial globalization ‘We are constantly making and re-making the time–spaces through which we live our lives. And globalization, imagined through the lens of this conceptualization of space–time, the [financial] globalization which we are facing now, is a thoroughgoing, world-wide restructuring of those time–spaces, along

particular lines' (Massey, 1999: 23). I follow Massey's influence and argue for a 'different imagining' of financialization and its accompanying creative workshop in financial innovation and 'refuse to convene the spatial under the sign of temporality' and so move towards the 'beginnings of a fully spatialized understanding' of financial innovation and its consequences. To do or to perform financial economics is to 'geographize'; space-times are actively produced through practices of market making, central to which are technical artefacts – 'market devices' (Callon et al., 2007) or 'financial objects' (Muniesa, 2009), as noted earlier – and around which such practices gather in the form of *agencements* (Callon and Muniesa, 2005), and through which emergent financial topologies are generated. These topologies are not the same as the already etched networks linking Wall Street, the City – they are not existing but *emergent*. Financial topologies are emergent in the sense that outcomes are not foreseeable; what contemporary finance assembles through market making is unknowable precisely because it is such a heterogeneous mix. It is the interaction of the stuff of modern finance that makes the idea of emergent financial topologies potentially so useful.

From a geographical perspective, then, to approach the workings of finance and financialization via emergent financial topologies help to focus on the nature of interactions or connectivities that in large part can be traced back to financial centres and their official networks but are not reducible to them and, as such, topology, rather than say scale, offers a fruitful 'conceptual insight' (Amin, 2002: 386), opens up a better understanding (Allen, 2011: 318) of the dynamic, unexpected, real-time but future oriented character of financial connectivity, than is the idea of flow or an already etched in to the earth 'network'. Financial topologies emerge in an almost self-referential way through the 'connective capabilities' of technologized finance.

If ‘spacing financialization’ (French, Leyshon and Wainwright, 2011) is the task ahead, then the appeal of a financial topology is that it helps to grasp the interconnectivity produced through the contemporary financial markets in real time and the unexpected adjacencies that in a sense become visible only in the event of a crisis when for example the US subprime crisis turned-up in the ‘fair-weather’ balance sheet of Northern Rock in late 2007. Like so many other banks, Northern Rock’s balance sheet had been reshaped since its conversion from a mutual-form building society to a bank in 1997 and made fragile not simply by its use of securitization and other secured borrowing (see *Financial Stability Report*, 2007: 10–12) but by the associated adoption of a model of ‘initiate and distribute’, in which profits in the form of fees are made from initiating and servicing loans, whilst the risks attached to loans are (supposedly) passed through the financial markets (Chick, 2008: 117). Innovative techniques such as initiate and distribute, and the manner of Northern Rock’s balance sheet growth, generated risks that became apparent only when the new bank’s funding possibilities seized up to reveal the long and interconnected linkages made across the globe, and through the USA subprime market in particular; when, that is, at the moment of the funding crisis the long chains of counterparty exposures and credit claims swiftly traced their way back at the moment of crisis from ‘elsewhere’ to the financial heart of Northern Rock, with a vengeance.

To talk of Baltimore arriving suddenly in Newcastle, is a provocation to think topologically (rather than in scalar terms) about the subprime crisis, where attention is placed on the swift movements through interconnected financial markets and the unexpected consequences. When the subprime crisis hit, the miscalculations rapidly unfurled and the risks that were thought to have been long passed through to distant financial markets were quickly and uncompromisingly folded into Northern Rock’s balance sheet; in a sense, Baltimore, reduced to financial code, had come to town and

it and Newcastle (and a host of other places) were made financially adjacent. Such adjacency is always latent, for wrapped up in the preparation of innovations such as RMBSs and CDOs within the confines of financial centres, is also the potential for the sudden re-orchestration of spatialities that lie geographically far beyond the world's financial citadels but spatio-temporally within their ambit. What's more, and at the risk of labouring a simple point, what is produced through financial innovation is a financialized future that quite blatantly refuses to be corralled into neat national borders and thus be amenable to the regulatory discipline of nation states. What the present crisis highlights is the creation of risky spaces that, to use Ong's phrase, do not 'follow given scales or political mappings' (Ong, 2005: 338).

To take another example from the eye of the recent storm, Lehman Brothers, like other banks, cut and sliced MBS and CDOs which in the process multiplied the connectivities alive within the innovative instruments. Lehman had a large number of CDSs (credit default swaps) relative to its balance sheet and a significant number of counterparties. This significant number multiplied pricing distortions; true Knightian distortion, as Andrew Haldane (2009, 2014) has pointed out. The spatially dispersed counterparties, each with varying risk qualities, informed the pricing uncertainties undertaken in New York. When things went wrong, as it were, the extensive geographies of 'unknown unknowns' (also known as uncertainties) turned-up seemingly from nowhere on the balance sheet of Lehman Brothers – and others. As with Northern Rock, financial innovation produced unexpected geographies of financial risk and uncertainty; this was the outcome of what Haldane referred to as the fundamental change in the topology of the financial system that had begun to be generated decades before.

The linkages between the practices within financial centres, within organizations and exchanges, *and* the world 'outside' needs to be made more explicit. Specific place

based market makers generate spatialities through their market practices, that much is clear. Yet to approach finance as a technical process, that ‘flows’ and ‘circulates’, bypasses the politics of the socio-technical relations of finance, so usefully put on the agenda by Donald MacKenzie and others, and so quite often evades the question of the responsibilities that attach to making finance. Those responsibilities revolve, in part at least, around how a highly interconnected future is imagined and made through private sector markets.

6.7 TOWARD A CONCLUSION

Taken together, the above pointers suggest that in looking to find ‘what’s different’ and ‘what’s the same’ about the current crisis, as a recent BIS report posed the problem ahead, there is a need to recognize that through the generative capacities of innovative financial techniques, space is no mere flatland (if ever it was) but is an active ingredient in processes of financialization, understood here as novel ways to search out and extract value. Omitting space from accounts of such financial techniques is a conceptual failure, as well as a failure fully to recognize how, most notably in the event of a crisis, the seductive promises of a politics enacted through private sector financial markets, suddenly recomposed space–times with often dire consequences.

In the move from M-M’, where increasingly money seems to have an endless ability to create more money, a lot happens; people and market devices combine in sometimes extraordinary combinations to seek out market opportunities, new instruments, new ways to profitably exploit risk and to try and tame uncertainty. The innovative tactics of those within financial centres play out in the worlds outside (as if

these needs to said – but actually it does); innovation is consequential and it is consequential because increasingly the techniques of innovation – coding space and time, ways of calculating, ways of seeing, ways of drawing worlds into the calculative devices and practices of financial markets – have effects. A politics of financialized space must find ways to foreground the consequences of calculation and the spatialities of financial risk that such calculation seeks to tame yet at the same time inadvertently distributes.¹⁶ Hence the earlier emphasis placed on beginning the discussion before the flows start moving, as it were, asking what it is that puts the flow into ‘flow’¹⁷ and just what combines to make cotemporary finance.

The role of finance in geographies of political economy, as Christophers (2015) has persuasively argued, is an ongoing project. As part of this effort, financial economics must be engaged in ways that do not leave unquestioned the world-making that the circulation and imposition of such a discourse involves (see Gibson-Graham, 2006 for similar points). It’s not a case of simply making corrections to the pre-crisis models; that it’s just a case of the ‘right mathematics and enough information’ (Green, 2000: 86 cited in de Goede, 2005: 140) for such highly mathematical finance drapes the world in financial code – a ‘financial garb’ – in an effort to ensure that its models deliver according to its ‘metrological regime’¹⁸ (Barry, 2002: 273) (see also MacKenzie, 2001, 2003a, 2003b, 2005). To accept the world according to such technical (supposedly) apolitical finance¹⁹ is to be shielded from the very geopolitics and social relations of financial markets and the associated power to spatialize which (should) matter (see Massey, 2010). As the recent crisis and those before testify, the future is not linear, it is not simply temporal; the future imagined and enacted through the ‘socio-technical combinations’ of finance relies upon and produces a complex weave of spatialities, of consequential emergent financial topologies.

ACKNOWLEDGEMENTS

Many thanks to Jane Pollard for helpful comments on an earlier draft of this chapter.

The chapter draws in parts on a CRESC Working Paper 24 ‘Speculating on Geographies of Finance’.

NOTES

¹ See Christophers (2015: 210–211) for a cautionary note on the use of the term ‘crisis’.

² The engagement with topology in this chapter is exploratory and tentative and is part of the growing interest in topology more generally within geography (see for example the collection of papers in *Dialogues in Human Geography*, 2011.3: 283–318; Martin and Secor, 2014). The appeal of trying to think topologically about finance is that it offers another way to think about the geographies of finance, how these are produced and generated by the ‘stuff’ of finance and the consequences.

³ As Singh reported in 2010 five key LCFIs that are active in the OTC derivatives market in the United States (Goldman Sachs, Citi, J.P. Morgan, Bank of America, and Morgan Stanley) were jointly carrying almost \$500 billion in OTC derivative payables exposure as of Q3, 2009. In Europe, Deutsche Bank, Barclays, UBS, RBS and Credit Suisse are sizable players. These five largest European banks had about \$600–\$700 billion in under-collateralized risk (measured by residual derivative payables) as of December 2008 (Singh, 2010: 5–6).

⁴ This particular and pervasive sense of time as a straight line within economics/financial economics is summed up in a line from the leading economist Paul Davidson ‘The economic system is moving through calendar time from an irrevocable past to an uncertain and statistically unpredictable future’ (1994: 17 cited in Janeway 2009, no page number). Although see developments around non-linear systems within quantitative economics (e.g. Hommes, 2001).

⁵ See Sarah Hall’s (2010) excellent summary of the growing interface between cultural economy and economic geography.

⁶ On *agencement*/assemblage see for example John Phillips (2006: 108–109).

⁷ See Callon’s (2005) reply to reply to Danny Miller’s (2005) critique of *The Laws of the Markets* which clarifies his approach and draws attention to the all-important idea of *agencement*.

⁸ The sense of space I wish to subscribe to is, to borrow from Massey, ‘not static, not a cross-section through time; it is disrupted, active and generative. It is not a closed system; it is constantly, as space–time, being made’ (Massey, 1999: 274). Debates about the production of space, the multiplicity of time–spaces for instance seem to be absent from geographies of finance, as is a sense of the ‘ever-changing ways in which flows and territories are conditions of each other. It is the practices and relations which construct them both that demand address’ (Massey, 2005: 99). More broadly see Murdoch (2006) for an excellent summary of the rise of relational thinking within geography.

⁹ See Bill Maurer (2003: 73) for similar points. As he says, when it comes to capital mobility in particular, there is a need to investigate the nature of ‘movement and the objects being moved’.

¹⁰ As Brian Rotman has noted ‘the computer creates complex topological surfaces, fractal functions, and iteration based entities which were previously *not only invisible but unimagined, unconceived*’ (Rotman, 2008: 66; emphasis added).

¹¹ Sam O’Neal left Merrill in late 2007 for taking the investment bank into the RMBS market in the US at the peak of the housing boom with disastrous results; Merrill reportedly lost around US\$7.9 billion in mortgage-related losses. As he ‘retired’ rather than being ‘fired’ he received a reputed US\$160 million ‘golden parachute’.

¹² ‘Turbulence is not the same as volatility. It implies not only dynamic pricing activity but the arrival of statistically unlikely events – sometimes known as black swans – that signal the breakdown of fundamental assumptions. Importantly, turbulence operates on a continuum, with varying degrees of turbulence in the market over time, making it very difficult to predict. Therefore, while identifying turbulent periods isn’t strictly a binary, black and white matter, it is crucial to recognize shifts in market turbulence. Turbulence can best be understood as statistical unusualness, rather than as indicative of negative performance (*State Street*, 2009: 2).

¹³ These investors include insurance companies, pension funds, and investment companies including mutual funds and unit investment trusts, and hedge funds (IMF, 2005: 66–67).

¹⁴ The market in weather derivatives, for example, in the build-up to the crash attracted the attention of leading hedge funds such as DE Shaw and Co., as well as specialist hedge funds, such as Takara (now part of Renaissance Reinsurance), which were set up specifically to facilitate private investor and fund investment in weather and weather-related products. Indeed, hurricane Katrina boosted hedge fund interest in weather derivatives – trade volume was up fivefold in 2005 on the previous year (*The Economist*, 2005).

¹⁵ Even within ‘hedge funds’ strategies vary to include for instance ‘global macro’, ‘equity hedge’, ‘high yield’, ‘emerging markets’ and ‘fixed-income arbitrage’ (see IMF, 2005: 50–51).

¹⁶ Erica Pani and Nancy Holman (2014) go some way to doing this in their detailed account of Norwegian municipalities’ entanglement in global finance.

¹⁷ There are some lovely points in Coutin, Maurer, and Yngvessen (2002) to help in thinking about flows and globalization – amongst others things.

¹⁸ Andrew Barry uses the notion of ‘metrological regime’ (Barry, 2002: 273) – making things measurable and thus calculable – to highlight the importance of measurement to framing and thus the performance of calculation. As he says ‘metrology puts new objects into circulation ... metrology creates new objects that make a difference in the world’.

¹⁹ See de Goede (2005: 121–143) for strong argument that helps to show the gradual depoliticization of financial practices in the twentieth century and the rise of ‘scientific finance’, particularly post 1960s, as part of this process.

<A>REFERENCES

Aalbers, M.B. (2008), ‘The financialization of home and the mortgage market crisis’,

Competition and Change, **12** (2), 148–166.

Adam, B. (2003), ‘Reflexive modernization temporalized’, *Theory, Culture and*

Society, **20** (2), 59–78.

Allen, J. (2011), ‘Topological twists Power’s shifting geographies’, *Dialogues in*

Human Geography, **1** (3), 283–298.

Amin, A. (2002), ‘Spatialities of globalisation’, *Environment and Planning A*, **34**,

385–399.

Arrighi, Giovanni (1994), *The Long Twentieth Century*, London: Verso.

Barry, A. (2002), ‘The anti-political economy’, *Economy and Society*, **31** (2), 268–

284.

Barry, A. and D. Slater (2002), ‘Introduction: the technological economy’, *Economy*

and Society, **31** (2), 175–193.

Beunza, D., I. Hardie and D. MacKenzie (2006), ‘A price is a social thing: towards a

material sociology of arbitrage’, *Organization Studies*, **27** (5), 721–745.

Blackburn, R. (2008), ‘The subprime crisis’, *New Left Review*, **50**, 63.

- Bookstaber, R. (2007), *A Demon Of Our Own Design*, Hoboken, NJ: John Wiley and Sons.
- Bryan, D. and M. Rafferty (2006), *Capitalism with Derivatives: A Political Economy of Financial Derivatives*, Basingstoke: Palgrave Macmillan.
- Buchan, J. (1997), *Frozen Desire: Meaning of Money*, New York: Farrar Straus Giroux.
- Callon, M. (1998), 'Introduction: the embeddedness of economic markets in economics' in M. Callon (ed.), *The Laws of the Markets*, London: John Wiley and Sons/Sociological Review Monograph, pp 1–57.
- Callon, M. (2005), 'Why virtualism paves the way to political impotence: a reply to Daniel Miller's critique of the laws of the markets', *Economic Sociology: European Electronic Newsletter*, **6** (2) (February), 3–20.
- Callon, M. and F. Muniesa (2005), 'Peripheral vision economic markets as calculative collective devices', *Organization Studies*, **26** (8), 1229–1250.
- Callon, M., Y. Millo and F. Muniesa (eds) (2007), *Market Devices*, Oxford: Blackwell/Sociological Review.
- Cassis, Y. (2006), *Capital of Capitals: A History of International Financial Centres, 1780–2005*, Cambridge. Cambridge University Press.
- Chick, V. (2008), 'Could the crisis at Northern Rock have been predicted?: An evolutionary approach', *Contributions to Political Economy*, **27** (1), 115–124.
- Christophers, B. (2015), 'The limits to financialization', *Dialogues in Human Geography*, **5** (2), 183–200.
- Clark, G.L. (2005), 'Money flows like mercury: the geography of global finance', *Geografiska Annaler: Series B, Human Geography*, **87** (2), 99–112.
- Cooper, I. (1986), 'Innovations: new market instruments', *Oxford Review of Economic Policy*, **2** (4), 1–17.

- Cooper, M. (2010), 'Turbulent worlds, financial markets and environmental crisis', *Theory, Culture and Society*, **27** (2–3), 167–190.
- Coutin, S., B. Maurer and B. Yngvessen (2002), 'In the mirror: the legitimation work of globalization', *Law and Social Inquiry*, **27** (4), 801–843.
- de Goede, Marieke (2005), *Virtue, Fortune, and Faith: A Genealogy Of Finance*, Minneapolis: University of Minnesota Press.
- Dialogues in Human Geography (2011), 'Article Forum 1' **1** (3), 283–318.
- Dymski, G.A. (2009), 'Afterword: mortgage markets and the urban problematic in the global transition', *International Journal of Urban and Regional Research*, **33** (2), 427–442.
- Fieldhouse, S (2008), 'Tackling global change: Titian's founders see opportunities in macro themes', retrieved on 12 October 2016 from www.thehedgefundjournal.com/node/7407.
- Financial Stability Report* (2007), October, 22 'Box A The funding crisis at Northern Rock' pp.10–12. Retrieved on 13 October 2016 from www.bankofengland.co.uk/publications/Documents/fsr/2007/fsrfull0710.pdf.
- Financial Stability Report* (2011), 'Risks from the international financial system', 29 June, pp.6–16. Retrieved on 13 October 2016 from www.bankofengland.co.uk/publications/Documents/fsr/2011/fsrfull1106.pdf.
- French, S., A. Leyshon and N. Thrift (2009), 'A very geographical crisis: the making and breaking of the 2007–2008 financial crisis', *Cambridge Journal of Regions, Economy and Society*, **2**, 287–302.
- French, S., A. Leyshon and T. Wainright (2011), 'Financializing space, spacing financialization', *Progress in Human Geography*, **35** (6), 798–819.

Gai, P. and S. Kapadia (2010), 'Contagion in financial networks', Bank of England Working Paper No. 383, March. Retrieved on 9 November 2016 from www.bankofengland.co.uk/research/Pages/workingpapers/2010/wp383.aspx.

Garratt, Rodney J., Lavan Mahadeva and Katsiaryna Svirydzenka (2011), 'Mapping systemic risk in the international banking network', Bank of England Working Papers (413), 1–43.

Gibson-Graham, J.K. (2006), *A Postcapitalist Politics*, Minneapolis: University of Minnesota Press.

Green, S. (2000), 'Negotiating with the future: the culture of modern risk in global financial markets', *Environment and Planning D*, **18** (1), 77–90.

Haldane, A.G. (2009), 'Rethinking the financial network', Speech delivered at the Financial Student Association, Amsterdam, April, 1–26.

Haldane, A.G. (2014), Managing global finance as a system. The Maxwell Fry Annual Global Finance Lecture, 29 October 2014, Birmingham University.

Hall, S. (2010), 'Geographies of money and finance I: cultural economy, politics and place', *Progress in Human Geography*, **35** (2), 234–245.

Hardie, I. and D. MacKenzie (2007), 'Assembling an economic actor: the agencement of a hedge fund', *The Sociological Review*, **55** (1), 57–80.

Harvey, D. (1982), *The Limits to Capital*, Oxford: Basil Blackwell.

Hirst, P. and G. Thompson (1996), *Globalisation in Question: The International Economy and the Possibilities of Governance*, Cambridge: Polity.

Hommes, C.H (2001), 'Financial markets as nonlinear adaptive evolutionary systems', *Quantitative Finance*, **1** (1), 149–167.

IMF (2005), 'Global financial stability report: market developments and issues', International Monetary Fund Washington, DC September.

- Janeway, W. (2009), 'Six impossible things before breakfast', *Significance*, **6** (1), 28–31.
- Law, J. (2002), 'Economics as interference', in P. Du Gay and M. Pryke (eds), *Cultural Economy: Cultural Analysis and Commercial Life*, London: Sage, pp. 21–38.
- Lee, Roger, Gordon L. Clark, Jane Pollard and Andrew Leyshon (2010), 'The remit of financial geography – before and after the crisis', *Journal of Economic Geography*, **9**, 723–747.
- Leyshon, A. and N. Thrift (2007), 'The capitalization of almost everything: the future of finance and capitalism', *Theory, Culture and Society*, **24** (7–8), 97–115.
- LiPuma, E. and B. Lee (2004), *Financial Derivatives and the Globalization of Risk*, Durham, NC: Duke University Press.
- LiPuma E. and B. Lee (2012), 'A social approach to the financial derivatives markets' *South Atlantic Quarterly*, **111** (2), 289–316.
- MacKenzie, D. (2001), 'Physics and finance: s-terms and modern finance as a topic for science studies', *Science, Technology and Human Values*, **26** (2), 115–144.
- MacKenzie, D. (2003a), 'An equation and its worlds bricolage, exemplars, disunity and performativity in financial economics', *Social Studies of Science*, **33** (6), 831–868.
- MacKenzie, D. (2003b), 'Long-term capital management and the sociology of arbitrage', *Economy and Society*, **32** (3), 349–380.
- MacKenzie, D. (2004a), 'The big, bad wolf and the rational market: portfolio insurance, the 1987 crash and the performativity of economics', *Economy and Society*, **33** (3), 303–334.
- MacKenzie, D. (2004b), 'Models of markets: finance theory and the historical sociology of arbitrage', *Revue d'histoire des sciences*, 407–431.

- MacKenzie, D. (2005), 'Opening the black boxes of global finance', *Review of International Political Economy*, **12** (4), 555–576.
- MacKenzie, D (2009), *Material Markets: How Economic Agents Are Constructed* (Clarendon Lectures in Management Studies), Oxford: Oxford University Press.
- Martin, R. (2007), *An Empire of Indifference*, Durham, NC: Duke University Press.
- Martin, R. and A.J. Secor (2014), 'Towards a post-mathematical topology', *Progress in Human Geography*, **38** (3), 420–438.
- Massey, D. (2005), *For Space*, London: Sage.
- Massey, D. (1999), 'Imagining globalisation: power-geometries of time–space', Power-geometries and the politics of space–time, Hettner-Lecture 1998 Department of Geography. University of Heidelberg.
- Massey, D. (2010), *World City*, Cambridge: Polity.
- Maurer, B. (2003), 'International political economy as a cultural practice: the metaphysics of capital mobility', in R. Warren Perry and B. Maurer (eds), *Globalization under Construction: Governmentality, Law and Identity*, Minneapolis: University of Minnesota Press, pp. 71–97.
- Maurer, B. (2005a), *Mutual Life, Limited*, Princeton and London: Princeton University Press.
- Maurer, B. (2005b), 'Does money matter? Abstraction and substitution in alternative financial forms?' in D. Miller (ed.), *Materiality*, Durham and London: Duke University Press, pp. 40–164.
- Miller, D. (2005), 'Reply to Michel Callon', *Economic Sociology: Electronic Newsletter*, **6** (3), 3–13.
- Mirowski, Philip (2013), *Never Let a Good Crisis go to Waste*, London: Verso.
- Miyazaki, H. (2005), 'The materiality of finance theory' in D. Miller (ed.), *Materiality*, Durham and London: Duke University Press, pp. 165–181.

- Morgan, M.S. (2001), 'Models, stories and the economic world', *Journal of Economic Methodology*, **8** (3), 361–384.
- Morgan, M.S. (2004), 'Imagination and imaging in model building', *Philosophy of Science*, **71** (5), 753–766.
- Morgan, M.S. (2012), *The World in the Model: How Economists Work and Think*, Cambridge: Cambridge University Press.
- Muniesa, F. (2009), 'The description of financial objects: a comment on Hart/Ortiz (AT 24 [6])' *Anthropology Today*, **25** (2), 26–27.
- Murdoch, Jonathan (2006), *Post-structuralist Geography: A Guide to Relational Space*, London: Sage.
- Neal, L. (1990), *The Rise of Financial Capitalism: International Capital Markets in the Age of Reason*, Cambridge: Cambridge University Press.
- November, Valerie (2008), 'Spatiality of risk', *Environment and Planning A*, **2008**, 40, 1523–1527.
- Ong, A (2005), 'Ecologies of expertise: assembling flows, managing citizenship' in A. Ong and S.J. Collier (eds), *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems*, London: John Wiley, pp. 337–353.
- Pani, E. and N. Holman (2014), 'A fetish and fiction of finance: unravelling the subprime crisis', *Economic Geography*, **90** (2), 213–235.
- Phillips, J. (2006), 'Agencement/assemblage', *Theory, Culture and Society*, **23**, 108–109.
- Pike, A. and J.S. Pollard (2010), 'Economic geographies of financialization', *Economic Geography*, **86** (1), 29–51.
- Pozsar, Z., T. Adrian, A. Ashcraft and H. Boesky (2010), 'Shadow banking'. Federal Reserve Bank of New York, Staff Report No. 458. July

- Preda, A. (2009), *Framing Finance: The Boundaries of Markets and Modern Capitalism*, Chicago, IL: University of Chicago Press.
- Pryke, M. and J. Allen (2000), 'Monetized time-space: derivatives – money's' new imaginary'?', *Economy and Society*, **29** (2), 264–284.
- Reinhart, Carmen and Kenneth Rogoff (2009), *This Time is Different: Eight Centuries of Financial Folly*, Princeton, NJ: Princeton University Press.
- Rotman, Brian (2008), *Becoming beside Ourselves: The Alphabet, Ghosts, and Distributed Human Being*, Durham, NC: Duke University Press.
- Singh, Manmohan (2010), 'Collateral, netting and systemic risk in the OTC derivatives market' International Monetary Fund Working Paper, no. WP/10/99.
- State Street Corporation (2009), 'Turbulence' in *State Street Vision Focus*, State Street Corporation: Boston, MA. September, pp. 2–4.
- Tellmann, U. (2009), 'Foucault and the invisible economy', *Foucault Studies*, **6**, 5–24.
- The Economist* (2005), 'Weather risk: natural hedge', 29 September. Retrieved on 9 November 2016 from www.economist.com/node/4465927.
- Tucker, P. (2007), 'Speech to Merrill Lynch Conference: A perspective on recent monetary and financial system developments', 26 April *Bank of England Quarterly Bulletin*. Retrieved on 9 November 2016 from www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2007/speech308.pdf.
- Wainwright, T. (2009), 'Laying the foundations for a crisis: mapping the historico - geographical construction of residential mortgage backed securitization in the UK', *International Journal of Urban and Regional Research*, **33** (2), 372–388.
- Zaloom, C. (2003), 'Ambiguous numbers: trading technologies and interpretation in financial markets', *American Ethnologist*, **30** (2), 58–272.

Zaloom, C. (2006), *Out of the Pits: Traders and Technology from Chicago to London*,
Chicago, IL: University of Chicago Press.