

Contents lists available at [ScienceDirect](#)

## Technological Forecasting & Social Change



# Creative destruction in Wall Street's technological arms race: Evidence from patent data



Stephan Essendorfer, Ivan Diaz-Rainey, Michael Falta \*

*School of Business, Department of Accountancy and Finance, University of Otago, Dunedin, New Zealand*

### ARTICLE INFO

#### Article history:

Received 4 February 2014

Received in revised form 29 September 2014

Accepted 16 November 2014

Available online 9 January 2015

#### Keywords:

Capital markets

Patents

High frequency trading

Financial innovation

### ABSTRACT

Technology and policy have transformed the market infrastructure of trading in capital markets and have helped financialize other markets, such as commodities trading. The associated 'technological arms race' has created a new market ecology which has made trading cheaper and faster but more volatile and fragmented. This paper charts the technological roots of this transformation from a conventional measurement of innovation perspective. We do so by employing content analysis techniques and extracting market infrastructure patent counts from the USPTO (United States Patent and Trademark Office) database for the period January 1976 to October 2013. From the resulting time series and a qualitative examination of patents we find that (1) the number of market infrastructure patents has dramatically increased since 1999, as confirmed by an associated structural break; (2) the new market ecology has, in true Schumpeterian style, been associated with a new breed of firms, most notably software firms and historically smaller brokerage firms that have invested heavily in technology internally and through strategic acquisitions; and (3) some incumbent firms have responded aggressively to the new market ecology, most notably the Chicago Mercantile Exchange and Goldman Sachs. We conclude that policymakers, regulators and academics wishing to further investigate the technological roots of recent changes in capital should refer to patent data. Our principal contribution is to highlight that Wall Street has been actively patenting market infrastructure innovations in a pattern consistent with claims that an associated 'technological arms race' started in the late 1990s.

© 2014 Elsevier Inc. All rights reserved.

## 1. Introduction

"... the U.S. equity market today represents a vast, decentralized electronic network that is critically dependent on technology to generate and match order flow at great speed."

[CFA Institute (2012, p. 8).]

Commentators claim that Wall Street and financial markets more generally are in the midst of a costly 'technological arms

race' (Harris, 2013; Patterson, 2012).<sup>1</sup> It is suggested that this 'arms race' was induced by the application of cutting-edge information and communication technologies (ICT) and by a liberalizing policy environment (Johnson et al., 2013; CFA Institute, 2012; Diaz-Rainey and Ibikunle, 2012; Patterson, 2012; Werthamer and Raymond, 1997). In this new market ecology, algorithmic and high-frequency trading is increasingly

<sup>1</sup> The expression 'technological arms race' is being used widely in the financial press when describing the competitive innovation driving changes to how trading happens in capital markets and in particular in relation to the rise of high frequency trading. Examples include Popper (2013) and Ostand (2013). Our focus here is on this segment of finance which we term market infrastructure. This does not preclude the possibility that more open and collaborative types of innovation are occurring in other parts or subsectors of finance and banking.

\* Corresponding author: Department of Accountancy and Finance, University of Otago, PO Box 56, Dunedin 9054, New Zealand. Tel.: +64 3 479 9268; fax: +64 3 479 8171.

E-mail address: [michael.falta@otago.ac.nz](mailto:michael.falta@otago.ac.nz) (M. Falta).

replacing human traders, resulting in trading speeds that are measured in nanoseconds and are, hence, well beyond the response time of any human (Johnson et al., 2013). Further, ICT technologies have facilitated financial innovations such as Exchange Trades Funds, meaning that investors can cost-effectively take positions in virtually any asset class that they wish to gain exposure to (Diaz-Rainey and Ibikunle, 2012). What is clear is that this new market ecology has transformed the ‘market infrastructure’<sup>2</sup> (MI) of capital markets and has helped to ‘financialize’<sup>3</sup> other markets, such as commodities trading (Diaz-Rainey et al., 2011; Patterson, 2012).

In summarising the effect of this transformation, an influential CFA Institute report noted that

“[t]he main trends characterizing the evolution of the market over the past decade include a decrease in average trade sizes and a significant increase in overall quote traffic and transaction volumes (largely owing to the adoption of electronic systems that have improved operational efficiency and network capacity); a reduction in trading costs (both bid–ask spreads and commissions); some pronounced periods of volatility; and increasing fragmentation of liquidity.”

[CFA Institute (2012, p. 8)]

The assertion that Wall Street’s ICT-driven transformation has made transacting in financial and financialized markets quicker, easier (through greater liquidity) and less expensive is confirmed in the academic finance literature (Hendershott et al., 2011; Angel et al., 2011). So, unquestionably, this transformation has come with benefits; however, this new market ecology has also heralded new risks.

Some commentators have issued warnings about potential crashes of this new ultra-fast decentralized electronic network (Patterson, 2012) and have raised concerns that the focus on speed in trading has engendered myopia in the core function of finance — that is, to raise capital for long-term entrepreneurial ventures (Haldane, 2010). The former risks were highlighted by the “Flash Crash” on the 6th of May 2010 when USD trillion was wiped off US equity markets in a few minutes (Easley et al., 2011). Although the incident was not triggered by high-frequency traders, it demonstrated how reliant markets have become on the liquidity that they provide — in effect, they have replaced traditional market makers, and unlike their predecessors, high-frequency traders have no obligation to continuously provide liquidity (Diaz-Rainey and Ibikunle, 2012). Indeed, Johnson et al. (2013) find that there has been a large rise in the number of sub-second extreme events, resulting in a market ecology where new behaviours, not just accelerated versions of

old ones, have been created by high-speed finance. Further, improvements in ICT technologies have resulted in increasingly fragmented markets as new electronic trading venues and systems<sup>4</sup> have emerged to challenge, and blur the lines between, traditional (stock) exchanges and off-exchange, bilateral ‘over-the-counter’ transactions. There are concerns that this decentralization is decreasing transparency in markets and is allowing some high-frequency traders to employ predatory practices (see Johnson et al., 2013; Diaz-Rainey and Ibikunle, 2012; and CFA Institute, 2012); however, not all analyses concur that fragmentation has harmed market quality (O’Hara and Ye, 2011).

From the discussion above, it is apparent that finance is a techno-social system that is in a state of flux. The financial system is increasingly reliant on technology, and associated financial innovations have added to the complexity of the system to the point that governments and regulators are struggling to keep pace with the risks that these changes bring (Johnson et al., 2013; Linstone and Phillips, 2013; Diaz-Rainey and Ibikunle, 2012). Academic efforts to understand this transformation have focused on the performance of markets, as reflected in the growth of the market microstructure literature in finance (for instance, Easley et al., 2011; O’Hara and Ye, 2011) and the intensified interest in high-speed financial markets from statistically and mathematically adept disciplines such as physics (for instance, Johnson et al., 2013). To date, however, the claims that Wall Street is experiencing a ‘technological arms race’ leading to transformative change have not been scrutinized from an innovation research perspective.

Accordingly, the technological roots of Wall Street’s ICT-driven transformation have not been well understood in the academic literature. In this paper, we address this gap. We chart the emergence of this new market ecology as a technologically-driven Schumpeterian process of creative destruction by using an established measure of innovation and technological change, namely, patent data and associated patent counts (Griliches, 1990; Hagedoorn and Cloodt, 2003). We do so by employing content analysis techniques and extracting MI patent counts from the USPTO database for the period 1976 to October 2013 in order to answer a number of related research questions (RQ):

**RQ1.** What can patent data tell us, if anything, about the new market ecology?

**RQ2.** When did this transformation start and at what stage is this process of change — in its early stages or close to its climax?

**RQ3.** Which firms have led this transformation and to what extent have new firms and firms outside finance contributed to it?

**RQ4.** How have Wall Street’s powerful and established players responded to these changes?

<sup>2</sup> The definition of MI is discussed in detail in Section 3.2. We broadly define it as *innovation that facilitates between-agent (or counterparties) trading and processing, and settlement of securities, commodities or currencies*. This is essentially software or the combination of software and ICT hardware in the trading of securities, commodities and currencies.

<sup>3</sup> Financialization refers to a transition in which any tangible or intangible value is exchanged through a financial instrument or its derivative. Put differently, it is the process whereby markets of a financial nature play an increasing important role at various levels of the economy. The term has been used widely in policy contexts’ and in various academic literatures (see for instance Krippner, 2005; Silvennoinen and Thorp, 2013; UNCTAD, 2011).

<sup>4</sup> These new trading venues and systems come in a range of configurations as reflected in the terminologies used to describe them. These include *alternative trading systems (ATS)*, *electronic communications networks (ECNs)*, *dark pools* and *internalization*. For an accessible description of these systems and their related terminologies, see CFA Institute (2012).

Download English Version:

<https://daneshyari.com/en/article/7256510>

Download Persian Version:

<https://daneshyari.com/article/7256510>

[Daneshyari.com](https://daneshyari.com)