Centre for Banking & Finance Law
Faculty of Law

Working Paper

The Mechanisms of Derivatives Market Efficiency

Dan AWREY

Adjunct Researcher, Centre for Banking & Finance Law, Faculty of Law, National University of Singapore

daniel.awrey@law.ox.ac.uk

6 February 2016

http://law.nus.edu.sg/cbfl/

Centre for Banking & Finance Law
Faculty of Law
National University of Singapore
Eu Tong Sen Building
469G Bukit Timah Road
Singapore 259776
Tel: (65) 66013878
Fax: (65) 6779 0979
Email: cbfl@nus.edu.sg

The Centre for Banking & Finance Law (CBFL) at the Faculty of Law, National University of Singapore focuses broadly on legal and regulatory issues relating to banking and financial services. It aims to produce research and host events of scholarly value to academics as well as of policy relevance to the banking and financial services community. In particular, CBFL seeks to engage local and international banks, lawyers, regulators and academics in a regular exchange of ideas and knowledge so as to contribute towards the development of law and regulation in this area, as well as to promote a robust and stable financial sector in Singapore, the region and globally.

The Mechanisms of Derivatives Market Efficiency

Dan AWREY

Adjunct Researcher, Centre for Banking & Finance Law, Faculty of Law, National University of Singapore

6 February 2016

ABSTRACT:

Gilson and Kraakman (1984) put forward a causal framework for understanding how information becomes incorporated into security prices. This framework has gone on to play an influential role in public policy debates surrounding securities fraud litigation, mandatory disclosure requirements, and insider trading restrictions. It has also provided a basis for understanding the economic role of securities underwriters and other reputational intermediaries. Yet despite its enduring influence, there have been few serious attempts to extend Gilson and Kraakman's framework beyond the relatively narrow confines in which it was originally developed: the highly regulated, order-driven, and extremely liquid markets for publicly-traded stocks.

This paper examines the mechanisms of derivatives market efficiency. These mechanisms respond to information and other problems not generally encountered within public equity markets. These problems reflect important differences in the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity. Predictably, these problems have lead to the emergence of very different mechanisms of market efficiency. This paper describes these problems and identifies and examines four mechanisms of derivatives market efficiency. It then explores the implications of this examination in terms of the current policy debates around derivatives trade reporting and disclosure, the push toward mandatory central clearing of standardized derivatives, the prudential regulation of derivatives dealers, and the optimal balance between public and private ordering within derivatives markets.

The Mechanisms of Derivatives Market Efficiency

Dan Awrey[*]

(14 September 2015)

[Very preliminary discussion draft – please do not cite without the author's permission]

[*] Associate Professor of Law and Finance, University of Oxford; Adjunct Senior Research Fellow, Centre for Banking and Financial Law, National University of Singapore.

The Mechanisms of Derivatives Market Efficiency

Dan Awrey

Gilson and Kraakman (1984) put forward a causal framework for understanding how information becomes incorporated into security prices. This framework has gone on to play an influential role in public policy debates surrounding securities fraud litigation, mandatory disclosure requirements, and insider trading restrictions. It has also provided a basis for understanding the economic role of securities underwriters and other reputational intermediaries. Yet despite its enduring influence, there have been few serious attempts to extend Gilson and Kraakman's framework beyond the relatively narrow confines in which it was originally developed: the highly regulated, order-driven, and extremely liquid markets for publicly-traded stocks.

This paper examines the mechanisms of *derivatives* market efficiency. These mechanisms respond to information and other problems not generally encountered within public equity markets. These problems reflect important differences in the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity. Predictably, these problems have lead to the emergence of very different mechanisms of market efficiency. This paper describes these problems and identifies and examines four mechanisms of derivatives market efficiency. It then explores the implications of this examination in terms of the current policy debates around derivatives trade reporting and disclosure, the push toward mandatory central clearing of standardized derivatives, the prudential regulation of derivatives dealers, and the optimal balance between public and private ordering within derivatives markets.

Table of Contents

1. INTRODUCTION

In their influential 1984 article *The Mechanisms of Market Efficiency*[1], Ron Gilson and Reinier Kraakman put forward a causal framework for understanding how new information becomes incorporated into the price of publicly-traded equity securities. Gilson and Kraakman's framework was grounded in the observation that the efficiency of public equity markets is a function of the market for information: how costly it is to acquire, process, and verify and, accordingly, its distribution within the marketplace. For any initial distribution of information, Gilson and Kraakman then offer an account of how the trading activities of one or more species of market participants served to ensure that this information ultimately found its way into security prices.[2] Amongst its many contributions, this framework provided an institutional explanation for the empirical observation underpinning the Efficient Market Hypothesis (EMH) that prices within U.S. equity markets fully reflected all publicly available information.[3]

Gilson and Kraakman's framework has gone on to play an influential role in public policy debates surrounding securities fraud litigation, mandatory disclosure requirements, and insider trading restrictions. It has also provided a basis for understanding the economic role of securities underwriters, venture capital firms, auditors, credit rating agencies, and other reputational intermediaries. Yet despite its enduring influence, relatively few scholars have attempted to extend this framework beyond the relatively narrow confines in which it was originally developed: the highly regulated, order-driven, and extremely liquid markets for publicly-traded stocks. This dearth of scholarship is especially puzzling given the Cambrian explosion of new financial markets, institutions, and instruments which has taken place since Gilson and Kraakman published their seminal article. Moreover, many of these new markets, institutions, and instruments bear little resemblance to the conventional stock markets at the heart of Gilson and Kraakman's original framework.

---

[1] Ron Gilson and Reinier Kraakman, "The Mechanisms of Market Efficiency" (1984), 70:4 Virginia Law Review 549.

[2] *See infra* Part 2 for a more detailed description of Gilson and Kraakman's framework.

[3] *See infra* Part 2 for a more detailed discussion of the EMH.

This paper examines the mechanisms of *derivatives* market efficiency.[4] More specifically, it examines the mechanisms of market efficiency within bilateral or 'over-the-counter' (OTC) derivatives markets.[5] These markets include the $US630 trillion dollar global markets for equity, credit, foreign exchange, interest rate, and other swaps.[6] They also include the myriad of smaller markets for other more exotic swaps, options, and structured products based on, for example, physical commodities, emissions rights, bandwidth, macroeconomic variables, the volatility of financial instruments or indices, and even Acts of God. These derivatives share three common features.[7] First, unlike equity securities, derivatives are executory contracts which contemplate the performance of obligations by one or both traders over a potentially significant period of time. The introduction of time brings with it idiosyncratic counterparty credit risk, making the identity of each trader highly relevant from a contracting perspective. This idiosyncratic credit risk also contributes to the economic and legal heterogeneity of many derivatives contracts. Second, derivatives markets do not benefit from a centralized coordination mechanism equivalent to a stock exchange which serves to bring together prospective buyers and sellers, regulate the trading environment, or ensure the widespread dissemination of price, volume, and other trading information. Third, trading within

[4] Ultimately, there are at least three reasons why we might theoretically care about derivatives market efficiency. First, insofar as prices within derivatives markets incorporate new information faster than other markets, derivatives prices may be used to inform prices in these other markets. However, if derivatives markets are vulnerable to distortions not present in these other markets, the use of derivatives prices in this way may contribute to inaccurate prices. Second, the faster derivatives markets incorporate new information into prices, the less likely it will be that any given trader will be able to exploit an informational advantage vis-à-vis other traders. Derivatives market efficiency can thus be understood as performing an indirect investor protection function (although, as we shall see, this may also have negatively impact market efficiency in other ways). Third, a number of recent regulatory proposals have suggested using derivatives prices – and specifically credit default swaps (CDS) – as a market-based proxy for the microprudential stability of banks and other financial institutions; *see infra* Part 5. The degree to which we can be confident that any change in CDS prices signals new information about the creditworthiness of the underlying issuer and not other (exogenous) factors has a direct bearing on the desirability of these proposals.

[5] Accordingly, this paper does not directly examine the mechanisms of market efficiency within exchange-traded option or futures markets. However, as we shall see, a number of the mechanisms of derivatives market efficiency – and specifically contractual standardization and clearing houses – perform a similar role within these markets.

[6] In its simplest form, a swap is a series of mutual forward obligations whereby two counterparties agree to periodically exchange cash flows over a specified period of time. Perhaps the most straightforward example is an interest rate swap pursuant to which one counterparty agrees to make payments at a fixed interest rate to another counterparty who in turn agrees to pay the borrower a variable (or 'floating') rate. The fixed rate borrower receiving the floating rate thus stands to benefit from any subsequent increase in interest rates, whereas its counterparty receiving the fixed rate will benefit from any decline. The periodic payments due under a swap are calculated with reference to what is known as the 'notional amount.' The resulting obligations are then netted out against one another so that only one counterparty is required to make payment in any given period.

[7] *See infra* Part 3 for a more detailed discussion of these features and how they serve to distinguish derivatives from public equity securities.

derivatives markets instead revolves around a relatively small network of large financial intermediaries known as 'dealers'. These dealers quote bid and asking prices to other traders on the basis that they are willing to take either side of a possible trade. Dealers thus represent the primary sources of liquidity within derivatives markets.

Together, these three features of derivatives markets pose information, coordination, agency, and other problems not generally encountered within public equity markets. These problems include the high initial costs of identifying potential traders willing to take the opposite side of a trade, along with the subsequent costs of engaging in both *ex ante* screening and *ex post* monitoring of their creditworthiness. They also include the costs of determining the prevailing market price in the absence of a centralized coordination mechanism which aggregates and disseminates pricing and other market information. Compounding matters, even if traders were able to observe the market price, idiosyncratic credit risk and the economic and legal heterogeneity of many derivatives would make it difficult for them to disentangle the constituent elements of price reflecting market, counterparty credit, and other risks. In effect, these features introduce potentially significant price distortions: undermining the ability of traders to distill the informational signal embedded within any changes in the market price of a derivatives contract from the noise generated by idiosyncratic counterparty credit risk and economic and legal heterogeneity. Finally, there are the information and agency problems stemming from the dealer-intermediated structure of derivatives markets and the fact that liquidity within these markets is ultimately a function of the capacity and incentives of dealers to perform this important market making role.

Predictably, these problems have lead to the emergence of very different mechanisms of market efficiency than those described by Gilson and Kraakman.[8] Perhaps unsurprisingly, the first mechanism consists of the small network of dealers which reside at the center of global derivatives markets. These dealers use their client networks and relationships in order to identify and match traders looking to take the opposite sides of a derivatives trade. They also typically possess significant expertise in screening and monitoring counterparty credit risk. Perhaps most importantly, by contractually interposing themselves between traders, dealers play an important role as reputational intermediaries: using their status as repeat players to enhance the credibility of the long-term commitments underpinning derivatives trades. This market making role places

[8] *See infra* Part 4 for a more detailed examination of these mechanisms.

dealers in an advantageous position to aggregate market information and, insofar as it is in their economic interest to do so, to share this information with other traders.

Dealers are supported in their market making role by a second mechanism of market efficiency: interdealer brokers and electronic trading networks (ECNs). Interdealer brokers are intermediaries which act as conduits for the exchange of market information between dealers looking to enter into specific derivative trades, whether for the purposes of hedging existing exposures or engaging in proprietary trading. ECNs, meanwhile, enable dealers to communicate and trade directly with one another via dedicated web-based trading portals. Interdealer brokers and ECNs thus perform a role for dealers analogous to the one which dealers perform for their clients: aggregating market information, matching dealers looking to take the opposite sides of a trade, and thus lowering search costs within derivatives markets. Interdealer brokers and ECNs can also act as both formal or informal channels for the dissemination of private trading information.

The final two mechanisms of derivatives market efficiency take us in a somewhat different direction. The third mechanism consists of the highly specialized and intertwined set of contractual and legislative mechanisms governing the enforceability of closeout netting and the related treatment of financial collateral in the event of a derivative counterparty's default or insolvency. Under certain conditions, these mechanisms can combine to render derivatives traders economically indifferent to the creditworthiness of their counterparties, thereby eliminating idiosyncratic counterparty credit risk as a source of potential price distortions. The fourth mechanism, meanwhile, is embodied by the highly successful efforts of organizations such as the International Swaps and Derivatives Association (ISDA) in promoting greater contractual standardization within many derivatives markets. Like specialized netting and collateral mechanisms, the legal homogeneity generated by this standardization has served to reduce a potentially significant source of price distortions.

As we shall see, each of these mechanisms holds the potential to make a meaningful contribution to the efficiency of derivatives markets. At the same time, significant questions remain regarding the effectiveness of these mechanisms and whether their benefits outweigh the associated costs. Moreover, this examination of the mechanisms of derivatives markets efficiency raises a host of important and timely policy questions.

The most important of these questions revolve around the potential impact of recent regulatory reforms requiring mandatory derivatives trade reporting and disclosure, incentivizing the central clearing of standardized derivatives, and imposing new and more onerous prudential requirements on derivatives dealers.[9] More broadly, this examination raises important questions about the optimal balance between pubic and private ordering within derivatives markets.

This paper proceeds as follows. Part 2 provides an overview of Gilson and Kraakman's framework and briefly describes its influence, major criticisms, and enduring insights. Part 3 describes why Gilson and Kraakman's original framework does not offer a compelling account of the mechanisms of derivatives market efficiency, looking specifically at the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity. Part 4 then identifies and examines four mechanisms of derivatives market efficiency: dealers, interdealer brokers and ECNs, specialized netting and collateral mechanisms, and the ongoing efforts of ISDA to promote contractual standardization within derivatives markets. Part 5 explores some of the important policy implications which flow from this examination, with particular focus on the potential impact of post-crisis regulatory reforms targeting derivatives markets and dealers on market efficiency. Part 6 concludes.

This examination of the mechanisms of derivatives market efficiency yields a number of important insights. First, recent regulatory reforms designed to enhance the transparency of derivatives markets by introducing mandatory trade reporting and disclosure requirements may not have a significant impact on market efficiency. Simultaneously, however, the regulatory push toward mandatory central clearing of standardized derivatives may have a previously underappreciated impact on market efficiency by reducing idiosyncratic counterparty credit risk and economic and legal heterogeneity. Second, new prudential requirements introduced in the wake of the financial crisis may serve to undercut the incentives of dealers to perform their important market making role, thereby reducing market liquidity and, ultimately, efficiency. Given this prospect, it may be worthwhile rethinking the optimal balance between public and private ordering within derivatives markets with a view to promoting the development of alternative market structures. Finally, and more broadly, this examination suggests that

[9] *See infra* Part 5 for a more detailed exploration of these policy questions.

conventional wisdom about what works in securities laws may at best offer an incomplete framework for understanding the regulation of modern derivatives markets.

2. THE MECHANISMS OF MARKET EFFICIENCY: GILSON AND KRAAKMAN'S FRAMEWORK AND ITS INFLUENCE

There are few concepts in financial economics which have attracted more attention – or controversy – than 'market efficiency'.[10] The concept of market efficiency is grounded in the Efficient Market Hypothesis or EMH. First articulated by Eugene Fama, the basic prediction at the heart of the EMH is that trading strategies based on available information will not yield risk-free profits within an efficient market.[11] Put simply, traders should not be able to beat the market by trading on information which is already available within the marketplace. This 'no arbitrage' hypothesis is often reformulated into the statement that security prices in an efficient market will fully reflect all available information.[12] An 'efficient' market can thus be understood as one in which new information is rapidly incorporated into security prices.

Fama broke the EMH down into three sub-hypotheses.[13] The 'weak' form hypothesis predicts that all *historical* trading and other information will be incorporated into prices. The 'semi-strong' form hypothesis, in contrast, predicts that all *new* and *publically available* information will be incorporated into prices. Thus, for example, by the time a trader reads in *The New York Times* or *Wired* that Apple Inc. has announced the launch of its new Apple Watch, the semi-strong form hypothesis would predict that this information will already be reflected in the price of Apple's shares – thereby depriving the trader of any profitable trading opportunities. The 'strong' form hypothesis then extends this prediction to all *private* information. It would thus predict that the expected impact of the Apple Watch on Apple's future cash flows will be reflected in its share price before the launch announcement, when only a small group of insiders are aware of its existence, product features, and other relevant information. As the Apple Watch example

[10] For a synthesis of this controversy, as well as a useful survey of the empirical research testing the EMH, *see* Burton Malkiel, "The Efficient Market Hypothesis and Its Critics" (2003), 17:1 Journal of Economic Perspectives 59. For a post-crisis update, *see* Burton Malkiel, "The Efficient-Market Hypotheses and the Financial Crisis", in Alan Blinder, Andrew Lo, and Bob Solow, *Rethinking the Financial Crisis: New Perspectives on the Crisis* (Russell Sage Foundation, New York, 2012). As Malkiel suggests, much of the controversy surrounding the EMH stems from a misunderstanding of its core predictions.

[11] *See* Eugene Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work" (1970), 25:2 Journal of Finance 383 at 384-5.

[12] Indeed, this is how Fama himself framed the EMH in the introduction to his seminal article; id. at 383.

[13] Id. at 388.

illustrates, these sub-hypotheses are ordered on the basis of the relative strength of their predictions: while the inability of a trader to extract profitable trading opportunities from historical information would seem unremarkable to all but the most devout technical analysts, the inability of a trader with material private information to profit from this advantage would seem very remarkable indeed.[14] The EMH thus views a market in which private information fails to generate profitable trading opportunities as demonstrably more efficient than a market in which such opportunities continue to exist.

In 1978, economist Michael Jensen boldly stated that "there is no other proposition in economics which has more empirical evidence supporting it than the efficient market hypothesis."[15] Subsequent theoretical and empirical scholarship has put a significant dent in – if not altogether punctured – the validity of this claim.[16] For the present purposes, however, the more important point is that, despite the general consensus amongst financial economists at the time, neither Fama nor any of his contemporaries put forward a compelling *causal* explanation for the observation that new information was rapidly incorporated into security prices.[17] Indeed, it would fall to two legal scholars, Ron Gilson and Reinier Kraakman, to articulate a theoretical framework for understanding *how* information found its way into prices. This framework centered around what Gilson and Kraakman characterized as the "mechanisms of market efficiency".[18]

Gilson and Kraakman's framework rests on three fundamental building blocks.[19] First, the 'availability' of information for the purposes of the EHM is a function of the costs incurred by traders in order to acquire, process, and verify it.[20] The higher these costs,

---

[14] Gilson and Kraakman (n 1) at 558.

[15] Michael Jensen, "Some Anomalous Evidence Regarding Market Efficiency" (1978), 6 Journal of Financial Economics 95 at 95.

[16] Indeed, there is now an enormous body of scholarship in the fields of economics, psychology, law, and other fields dedicated to the study of these and other anomalies. *See* for example, Daniel Kahneman, *Thinking, Fast and Slow* (Penguin Group, London, 2011); Roman Frydman and Michael Goldberg, *Beyond Mechanical Markets: Asset Price Swings, Risk, and the Role of the State* (Princeton University Press, Princeton, 2001); Robert Shiller, *Irrational Exuberance, 3rd ed.* (Princeton University Press, Princeton, 2015), and Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (Oxford University Press, Oxford, 2000).

[17] *See* William Beaver, "Market Efficiency" (1981), 56 Accounting Review 23.

[18] Gilson and Kraakman (n 1) at 549.

[19] As Gilson and Kraakman observe, these building blocks are in many respects clarifications or refinements of Fama's original framework; id. at 558.

[20] Id. at 594.

the narrower the initial distribution of this information is likely to be within the marketplace, and the longer and potentially more circuitous the route this information must take before it becomes reflected in security prices.[21] Hence, the efficiency of the market for *information* will have a direct impact on the efficiency of the market for *capital*.[22] Second, and as a consequence, a market which efficiently incorporates one piece of information into security prices may not do so with respect to other pieces of information.[23] How efficiently a market incorporates a new piece of information will instead be determined by the costs of acquiring, processing, and verifying that specific piece of information. Finally, the concept of market efficiency as envisioned by the EMH is premised on an inherently relative benchmark: the *speed* with which new information is reflected in security prices.[24] Accordingly, we must be careful to distinguish between the 'informational' efficiency of a market as measured by the EMH and the 'accuracy' of the prices observed within that market.[25]

Gilson and Kraakman use these building blocks to construct a causal framework for understanding an important puzzle at the core of the EMH: how do we square the empirical observations of Fama and others that public equity markets rapidly incorporate new information into prices with the fact that most information is not costlessly and instantaneously available within the marketplace? Put differently: how does information which may initially be available to only a very small number of traders become reflected in security prices? Gilson and Kraakman's answer to this question revolves around four

---

[21] Id. at 558, 567 and 593. For a case study demonstrating how long and circuitous this route can be, *see* Robert Bartlett III, "Inefficiencies in the Information Thicket: A Case Study of Derivatives Disclosures During the Financial Crisis" (2010), 36 Journal of Corporation Law 1. Bartlett's case study examines the share price of Ambac Financial, a mono-line insurance company which insured multi-sector collateralized debt obligations (CDOs). Despite a considerable amount of publicly available information about Ambac's exposure to certain CDOs, news that these CDOs had experienced multiple notch credit rating downgrades was not reflected in Ambac's share price until they were 'revealed' in subsequent quarterly earnings announcements. Bartlett attributes this inefficiency to the low salience of individual CDOs within Ambac's portfolio and the costs of processing CDO disclosures.

[22] Gilson and Kraakman (n 1) at 597.

[23] Id. at 559. As examined in greater detail in subsequent sections, the fact that a market can be relatively efficient with respect to one piece of information but not another has important implications in terms of the mechanisms of derivatives market efficiency.

[24] Id. at 560. As Gilson and Kraakman observe, this maps squarely on to Fama's three sub-hypotheses; id. at 608. The difference between the strong, semi-strong, and weak form hypotheses is essentially the difference between markets which incorporate information *before* it becomes public, *as soon as* it becomes public, and at some – potential long – point *after* it becomes public.

[25] Indeed, this distinction has been a constant source of friction in academic debates around market efficiency; *see* for example Jeff Gordon and Lewis Kornhauser, "Efficient Markets, Costly Information, and Securities Research" (1985), 60 New York University Law Review 761 (observing that lawyers have often misunderstood this and other aspects of the EMH).

distinct types of trading activity which, together, act as the mechanisms of market efficiency.

The first mechanism is what Gilson and Kraakman describe as "universally informed trading".[26] Universally informed trading includes trading which takes place on the basis of new information which is simultaneously disseminated to the entire marketplace.[27] Writing over 30 years ago, Gilson and Kraakman gave as examples trading activity in response to news about the results of U.S presidential elections or Federal reserve policy announcements.[28] Today, of course, new forms of electronic communication mean that there is a far greater volume of information which – technically at least – is costlessly and instantaneously available to the entire marketplace. Intuitively, then, the information which provides the basis for universally informed trading must also satisfy some sort of additional thresholds in terms of both its prominence within the universe of available information and, ultimately, its salience in terms of the pricing of the relevant security.[29]

The second and in many respects most important mechanism of market efficiency identified by Gilson and Kraakman is "professionally informed trading".[30] Even where information is widely available within the marketplace, traders may not all possess the same ability to effectively *process* it. Professionally informed trading is undertaken by firms and individuals who have made the human capital and other investments necessary to develop the expertise to identify which pieces of information are relevant to the pricing of a given security, along with the likely impact of this information on its market price.[31] These traders include broker-dealers, research analysts, portfolio managers, and other institutional investors. Gilson and Kraakman see the defining characteristic of these professionally informed traders as being the comparative advantage they possess in terms of the production of "soft"[32] information: forecasts, estimates, and other forward

---

[26] Id. at 568.

[27] Id. Universally informed trading also includes trading on the basis of historical information.

[28] Id. at 569.

[29] Indeed, Gilson and Kraakman's examples of information which might provide the basis for universally informed trading activity suggest as much. *See* also Dan Awrey, "Complexity, Innovation, and the Regulation of Modern Financial Markets" (2012), 2:2 Harvard Business Law Review 235, and Bartlett (n 21).

[30] Gilson and Kraakman (n 1) at 569.

[31] Id. at 569 and 594.

[32] Id. at 561.

looking information and analysis.[33] This advantage means that such soft information may initially be distributed to a relatively small fraction of the marketplace – and perhaps even just a single trader. Nevertheless, where these traders account for a critical volume of trading activity, their trading can result in the dissemination of this information within the marketplace and, thus, its incorporation into security prices.[34] Importantly, however, because the requisite investments in expertise are themselves costly, professionally informed trading will only take place where traders expect to generate a profit from these investments.[35]

A question which logically flows from this is how the information possessed by professionally informed traders becomes incorporated into prices when these traders do not themselves account for a significant proportion of overall trading activity in a security. According to Gilson and Kraakman, the answer resides in a third mechanism of market efficiency: "derivatively informed trading".[36] Derivatively informed trading takes two forms.[37] The first form – "trade decoding"[38] – takes place when traders observe and mimic the trading activities of other traders perceived as enjoying higher levels of information or expertise.[39] Trading which takes place after an announcement that Warren Buffett has bought or sold an equity stake in a firm is thus an example of trade decoding.[40] As this example illustrates, trade decoding relies on the *identity* of the traders, along with the details of their trading activity, as an indirect means of signaling information to the marketplace. The second form of derivatively informed trading –

---

[33] Gilson and Kraakman's definition of 'soft' information – which essentially focuses on whether the information is about the past or future – is somewhat different from the one used elsewhere in the financial intermediation literature. This literature often defines 'hard' information as being easily captured and transmitted in numerical form, in contrast with 'soft' information which is not; *see* Mitchell Petersen, "Information: Hard and Soft", Working Paper (July 2004).

[34] As Gilson and Kraakman explain: "Subgroups of informed traders, or even a single knowledgeable trader with sufficient resources, can also cause prices to reflect information by persistent trading at a premium over 'uninformed' price levels."; id. at 570.

[35] *See* Paul Mahoney, "Market Microstructure and Market Efficiency" (2002-2003), 28 Journal of Corporation Law 541 at 544.

[36] Gilson and Kraakman (n 1) at 572.

[37] Excluding direct, inadvertent revelation of information by professionally informed traders; id.

[38] Id. at 573.

[39] Id.

[40] *See* Gerald Martin and John Puthenpurackal, "Imitation is the Sincerest Form of Flattery: Warren Buffett and Berkshire Hathaway", Working Paper (15 April 2008), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=806246. Interestingly, Martin and Puthenpurackal find that the market does not fully incorporate these announcements into prices, with the effect that investments in portfolios which mimic Buffett earn abnormal returns of 10.75% over the S&P 500 Index.

"price decoding"[41] – takes place when traders observe and respond to anonymous price and other trading information.[42] In contrast with trade decoding, price decoding does not demand that traders know the identity of other traders. What it does demand, however – perhaps heroically – is that traders successfully break down all the constituent elements of price in order to determine which price movements are driven by new information and which are driven by other (exogenous) factors.[43]

Gilson and Kraakman's final mechanism of market efficiency is "uninformed trading".[44] The idea that uninformed traders can contribute to market efficiency may seem somewhat counterintuitive. Nevertheless, Gilson and Kraakman argue that in certain circumstances uniformed trading can generate aggregate forecasts which over the long term may be better than those of any single trader.[45] As Gilson and Kraakman explain:

> "Although each trader's own forecasts are skewed by the unique constraints on his or her judgment, other traders will have offsetting constraints. As trading proceeds, the random biases of individual forecasts will cancel one another out, leaving price to reflect a single, best-informed aggregate forecast."[46]

In effect, Gilson and Kraakman view these aggregate forecasts as a new and potentially valuable piece of information.[47] Inevitably, however, the value of this information rests on the assumption that biases in individual forecasts are indeed random and, thus, cancel each other out.[48] Where the aggregate forecasts of uninformed traders remain biased, in contrast, the presence of uninformed traders in the marketplace may actually serve to impede the process by which new information becomes incorporated into security prices.[49]

---

[41] Id. at 574.

[42] Id. at 575.

[43] Id. *See* also Sanford Grossman and Joseph Stiglitz, "On the Impossibility of Informationally Efficient Markets" (1980), 70 American Economic Review 393.

[44] Gilson and Kraakman (n 1) at 580.

[45] Id.

[46] Id.

[47] Id.

[48] Gilson and Kraakman acknowledge that this is a demanding assumption; id. at 584.

[49] Uninformed trading is the least developed and convincing of Gilson and Kraakman's fours mechanisms, especially in light of the subsequent theoretical and empirical literature exploring various biases in human decision-making. However, as will become apparent, understanding the role of uninformed trading is largely irrelevant for the purposes of examining the mechanisms of derivatives market efficiency.

Together, Gilson and Kraakman regard these four mechanisms as performing distinct but ultimately complimentary roles in the promotion of market efficiency.[50] The precise combination of mechanisms will depend on the type of information in question and the extent of its initial distribution within the marketplace. Where information is widely available, for example, universally informed trading will act to incorporate this information into prices. Where information is technically available but costly to process, meanwhile, or where it is initially available to only a narrow subset of traders, professionally informed trading will play an important role. Derivatively informed trading may then also act to ensure that this information becomes incorporated into prices. The net effect, according to Gilson and Kraakman, is that "for any initial distribution of information in the market, including an initial distribution to no one in the case of optimal aggregate forecasts, one or more efficiency mechanisms facilitate the eventual 'reflection' of information into price".[51]

Gilson and Kraakman's framework has gone on to play an influential role in the policy debates around the development of fraud-on-the-market theory under Securities and Exchange Commission (SEC) Rule 10b-5[52], the SEC's integrated disclosure and shelf prospectus regimes[53], insider trading restrictions[54], and the regulation of the market for corporate control.[55, 56] Gilson, Kraakman, and others have also used this framework as a basis for examining the role of underwriters as "reputational intermediaries"[57] in the

[50] Gilson and Kraakman (n 1) at 589.

[51] Id. at 589-90.

[52] *See* for example, Daniel Fischel, "Efficient Capital Markets, the Crash, and Fraud on the Market Theory" (1998), 74 Cornell Law Review 907 and Jonathan Macey and Geoffrey Miller, "Good Finance, Bad Economics: An Analysis of Fraud-on-the-Market Theory" (1990), 42:4 Stanford Law Review 1059.

[53] *See* for example, Gordon and Kornhauser (n 25) and Merritt Fox, "Shelf Registration, Integrated Disclosure, and Underwriter Due Diligence: An Economic Analysis" (1984), 70:5 Virginia Law Review 1005.

[54] *See* for example, Howell Jackson, "To What Extent Should Individual Investors Rely on the Mechanisms of Market Efficiency: A Preliminary Investigation of Dispersion in Investor Returns" (2002-2003), 28 Journal of Corporation Law 671; Nicholas Georgakopoulos, "Why Should Disclosure Rules Subsidize Informed Traders?" (1996), 16 International Review of Law and Economics 417; Donald Langevoort, "Investment Analysts and the Law of Insider Trading" (1990), 76:5 Virginia Law Review 1023, and Macey and Miller (n 52).

[55] *See* for example, Guhan Subramanian, "The Drivers of Market Efficiency in *Revlon* Transactions" (2002-2003), 28 Journal of Corporation Law 691.

[56] Indeed, this impact has in many respects outlived that of the EMH; *see* William Allen, "Securities Markets as Social Products: The Pretty Efficient Capital Markets Hypothesis" (2002-2003), 28 Journal of Corporation Law 551.

[57] Gilson and Kraakman (n 1) at 620.

context of both initial public offerings and the marketing of new financial products.[58] Subsequent scholarship has expanded on this concept to examine the economic functions of venture capital firms[59], auditors[60], and credit rating agencies.[61] Indeed, Gilson and Kraakman's framework has even been used as a basis for exploring the mechanisms of market *inefficiency*.[62]

As with any influential theory, Gilson and Kraakman's framework has also been subject to significant criticism. Alon Brav, J.B. Heaton, Lynn Stout, and others, for example, have argued that the framework's grounding in the EMH led Gilson and Kraakman to discount the potential impact of heterogeneous expectations, decision-making biases, and other behavioral 'anomalies'.[63] Paul Mahoney has argued that the framework fails to account for how the institutional structure of the trading environment can promote or impede market efficiency.[64] Alan Ferrell, meanwhile, has criticized the framework on the basis that it fails to provide a more precise account of how different mechanisms contribute to market efficiency.[65] Other scholars have raised more fundamental questions about the effectiveness of Gilson and Kraakman's mechanisms. Jonathan Macey, for example, has observed that both business school students and journalists –

---

[58] In the context of public offerings of equity securities, for example, Gilson and Kraakman view the status of underwriters as repeat players as enabling them to rent their reputations to issuers as a means of credibly signaling private information; id. at 613-621. *See* also, Randolph Beatty and Jay Ritter, "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings" (1986), 15 Journal of Financial Economics 213 and James Smith and Richard Booth, "Capital Raising, Underwriting, and the Certification Hypothesis" (1986), 15 Journal of Financial Economics 261. For a more skeptical perspective on the role of underwriters as reputational intermediaries, *see* Saul Levmore, "Efficient Markets and Puzzling Intermediaries" (1984), 70:4 Virginia Law Review 645 at 657-658 and 667. *See* also, Anita Anand, "The Efficiency of Direct Public Offerings" (2003), 7:3 Journal of Small and Emerging Markets 433.

[59] *See* Bernard Black and Ron Gilson, "Venture Capital and the Structure of Capital Markets: Banks Versus Stock Markets" (1998), 47 Journal of Financial Economics 243.

[60] *See* James Cox, "The Oligopolistic Gatekeeper: The US Accounting Profession" in John Armour and Joseph McCahery (eds.), *After Enron: Improving Corporate Law and Modernizing Securities Regulation in Europe and the US* (Hart Publishing, Portland, 2006) and Frank Easterbrook and Daniel Fischel, "Mandatory Disclosure and the Protection of Investors" (1984), 70:4 Virginia Law Review 669 at 675.

[61] *See* Jack Coffee, *Gatekeepers: The Professions and Corporate Governance* (Oxford University Press, Oxford, 2006), ch. 8.

[62] Lynn Stout, "The Mechanisms of Market Inefficiency: An Introduction to the New Finance" (2002-2003), 28 Journal of Corporation Law 635.

[63] *See* for example, Alon Brav and J.B. Heaton, "Market Indeterminacy" (2002-2003), 28 Journal of Corporation Law 517 and Stout (n 62).

[64] Mahoney (n 35). Notably, Mahoney identifies specialists and other market makers as a fifth mechanism of market efficiency which he labels "order flow informed price setting"; id. at 542. As we shall see, Mahoney's mechanism shares a number of characteristics with the structurally informed traders described in Part 4.

[65] Alan Ferrell, "If We Understand the Mechanisms, Why Don't We Understand Their Output?" (2002-2003), 28 Journal of Corporation Law 503 at 512-513.

not professionally informed traders – were the first to detect possible fraud at energy trading firm Enron.[66] Bradford De Long, Andrei Shleifer, Lawrence Summers, and Robert Waldmann, on the other hand, question whether professionally informed traders are likely to engage in informationally efficient arbitrage in the presence of significant levels of so-called "noise trading"[67]: trading strategies based on beliefs, sentiments, and other irrational considerations not driven by new public or private information.[68]

Despite these and other criticisms, Gilson and Kraakman's basic framework has endured as an example of the important insights which can potentially be gained by looking beyond securities prices as a benchmark of market efficiency and instead examining the institutional arrangements within which these prices are formed and adjust over time.[69] It is in pursuit of this same objective that this paper employs and, very modestly, expands upon Gilson and Kraakman's framework to evaluate the mechanisms of derivatives market efficiency.

3. WHY DERIVATIVES ARE DIFFERENT

The theoretical and empirical literature examining the EMH revolves almost exclusively around the highly regulated, order-driven, and extremely liquid markets for publicly-traded stocks.[70] This same equity-centric view is reflected in both Gilson and Kraakman's original framework and the scope of its subsequent influence.[71] Ultimately, however, publicly-traded equities are only one of the many species of financial instruments which inhabit modern financial markets. As of June 2015, global public

---

[66] Jonathan Macey, "A Pox on Both Your Houses: Enron, Sarbanes-Oxley, and the Debate Concerning the Relative Efficiency of Mandatory and Enabling Rules" (2003), 81 Washington University Law Quarterly 329. *See* also Langevoort (n 54).

[67] Bradford De Long, Andrei Shleifer, Lawrence Summers and Robert Waldmann, "Noise Trader Risk in Financial Markets" (1990), 98 Journal of Political Economy 703.

[68] *See* Fischer Black, "Noise" (1986), 41:3 Journal of Finance 529 and Andrei Shleifer and Lawrence Summers, "The Noise Trader Approach to Finance" (1990), 4:2 Journal of Economic Perspectives 19.

[69] *See* Allen (n 56) at 556.

[70] In a 2003 survey by Burton Malkiel, for example, 51 of 55 cited papers on the EMH examined its application within public equity markets; Malkiel (n 10). *See* Part 4 for a survey of the relatively small body of scholarship focusing more specifically on the informational efficiency of derivatives markets.

[71] Notably, Gilson and Kraakman do extend their framework into debt markets – and specifically the market for retail mortgage-backed securities (RMBS) – in a 2014 paper in response to the financial crisis; *see* Ron Gilson and Reinier Kraakman, "Market Efficiency After the Financial Crisis: It's Still a Matter of Information Costs" (2014), 100 Virginia Law Review 313. However, as we shall see, this extension did not seek to comprehensively examine the important differences between equity and fixed income markets.

equity market capitalization stood at approximately $U.S.68.6 trillion dollars.[72] While significant, this figure nevertheless renders public equity markets smaller than both the global markets for bonds, notes, and other fixed income securities ($U.S.76.1 trillion[73]) and exchange-traded options and futures ($U.S.68.9 trillion[74]). While apples-to-apples comparisons are difficult, this figure also pales in comparison to the $U.S.630 trillion dollar global swaps market.[75]

Crucially, public equity markets are also significant outliers in terms of the nature of the underlying contracts, the structure of the markets in which they trade, and the sources of market liquidity. This section examines the differences between public equity and derivatives markets across each of these three dimensions. As we shall see, these differences have important implications in terms of the information, coordination, agency, and other costs which traders in derivatives markets are likely to encounter. Predictably, these costs have lead to the emergence of very different mechanisms of market efficiency.

(a) The Nature of the Contracts

The first important difference between equity securities and derivatives resides in the nature of the contracts which create these instruments and which define the relationship between two traders on opposite sides of a trade.[76] While these contracts vary in enumerable ways, there are two differences which stand out as being particularly relevant from an information cost perspective. The first is *time*. The transfer of legal ownership and economic risk from one trader to another within public equity markets takes place

[72] *See* World Federation of Exchanges, *Monthly Reports* (June 2015), available at http://www.world-exchanges.org/statistics.

[73] *See* Bank for International Settlements, *Debt Securities Statistics* (8 June 2015), available at http://www.bis.org/statistics/secstats.htm.

[74] *See* Bank for International Settlements, *Derivatives Statistics* (8 June 2015), available at http://www.bis.org/statistics/derstats.htm?m=6|32.

[75] Id. While the notional amount provides a conventional measure of the *size* of OTC derivatives markets, it does not capture the attendant *risks*. A more useful measure or size is 'gross market value', which reflects the current exposures of counterparties under open contracts assuming that these contracts were all settled immediately. As of December 2014, the Bank for International Settlements estimated the gross market value of all outstanding OTC derivatives at $U.S.20.9 trillion dollars; id.

[76] Notably, in the case of equity securities, the contract creating the legal instrument is separate from the contract which facilitates its transfer from one trader to another. In the case of derivatives, in contrast, a single contract both creates the instrument and, conceptually at least, facilitates the 'transfer' of economic risk.

on the basis of something approaching a classical 'spot' contract.[77] At the moment of execution, these contracts envision no contractual future beyond a very brief settlement period – typically no more than 48-72 hours after the trade is executed.[78] The relationship between the buyer and seller is thus entirely extinguished within a matter of days. As a result, the identity of the traders within public equity markets is essentially irrelevant from a contracting perspective.[79]

In sharp contrast, one of the defining features of derivatives is that they are 'neoclassical' executory contracts which contemplate the performance of obligations by one or both traders over time.[80] Under a typical swap contract, for example, both traders will owe contingent obligations toward one another over a period which may span several years. Importantly, the duration of these contracts introduces the risk that a trader may become insolvent or otherwise default between the moment of execution and the complete performance of its contractual obligations. The prospect of insolvency or default, in turn, makes the creditworthiness – and thus the *identity* – of the traders highly relevant from a contracting perspective. Accordingly, while we might not care very much about the identity of the buyer when we sell 100 shares of Apple Inc. on the NASDAQ, we might care very deeply about the identity of the trader with whom we enter into a 5-year total return swap for the purposes of taking a short position in the very same shares.

The second important difference in terms of the nature of the contracts is the degree of *heterogeneity*. Each common share of Apple is legally and economically identical. At the same time, stock exchanges such as the NASDAQ can be understood as having historically provided a form of standardized private law governing, for example, issuer disclosure obligations, capital structure, governance, and the transfer of securities.[81]

---

[77] *See* Ian Macneil, "The Many Futures of Contract" (1974), 47 Southern California Law Review 691.

[78] *See* for example, Euronext, "Introduction of T+2 Settlement Lifecycle" (14 January 2014), available at http://www.nyxdata.com.

[79] *See* Oliver Williamson, "Transaction-Cost Economics: The Governance of Contractual Relations" (1979), 22:2 Journal of Law and Economics 233 at 236, discussing the implications of Macneil's (n 77) typology from a transaction cost perspective. This is not to suggest that the identity of the traders may not be relevant from a *pricing* perspective. As described in Part 2, the identity of a trader is very relevant indeed for the purposes of effective trade decoding.

[80] *See* Williamson (n 79) at 237-238 for a description of the characteristics of such neoclassical contracts.

[81] *See* Jonathan Macey and Maureen O'Hara, "The Economics of Stock Exchange Listing Fees and Listing Requirements" (2002), 11 Journal of Financial Intermediation 297; Jonathan Macey and Maureen O'Hara, "Regulating Exchanges and Alternative Trading Systems: A Law and Economics Perspective" (1999), 28 Journal of Legal Studies 17, and Paul Mahoney, "The Exchange as Regulator" (1997), 83 Virginia Law Review 1453.

While much of this private law has now been supplanted by public regulation, the effect has nevertheless been to inject a fairly high degree of standardization or homogeneity into both publicly-traded shares and the legal and institutional environment in which they trade.[82] Many derivatives, in contrast, exhibit a relatively high degree of economic and legal heterogeneity. From an economic standpoint, derivatives can be engineered by traders to create any conceivable combination of risk and return: from the price of Apple shares, to the price of apples. From a legal standpoint, meanwhile, the existence of idiosyncratic counterparty credit risk, differences in legal rules across jurisdictions, and the absence of a coordinating mechanism equivalent to an exchange might be expected to lead to considerable divergence in terms of the underlying contractual architecture.

Both time and heterogeneity have an important impact on the information costs encountered by derivatives traders. First, the duration of derivatives contracts – along with the corresponding possibility of insolvency or default – generate powerful incentives for traders to invest in *ex ante* screening in order to determine the creditworthiness of their prospective counterparties. It also incentivizes them to engage in *ex post* monitoring of their counterparties over the life of a derivatives contract. These investments in screening and monitoring can be very costly. The idiosyncratic nature of these investments means that they may also be largely non-recoverable.[83] Intuitively, we might expect these investments to be particularly costly where the counterparties are large, complex financial institutions. This intuition finds support in the empirical research of Donald Morgan, who finds an unusual pattern of disagreement – or 'splits' – between credit rating agencies over the ratings given to banks and insurance firms.[84] Morgan attributes this disagreement to the high costs of observing the quality of these firms' assets and the nature of their trading activities.[85]

Second, contractual heterogeneity means that it may be difficult to disentangle the *stated* price of a derivatives contract from its full *economic* price. In this context, the full

---

[82] Notably, elements of this homogeneity – and specifically the institutional environment in which trading takes place – are in the process of being eroded by the emergence of alternative trading systems as important competitors to conventional stock exchanges. For an overview of these systems and their impact on the equity trading environment, *see* Merritt Fox, Lawrence Golsten, and Gabriel Rauterberg, "The New Stock Market: Sense and Nonsense" (2015), Duke Law Journal [forthcoming].

[83] *See* Williamson (n 79) at 239-245.

[84] *See* Donald Morgan, "Rating Banks: Risk and Uncertainty in an Opaque Industry" (2002), 92:4 American Economic Review 874.

[85] Id. at 874.

economic price can be understood as incorporating any non-monetary terms which impose opportunity or other costs on contracting parties. An example may help illustrate this point. A derivatives dealer may quote Apple Inc. and Diana's Homemade Apple Pie Stand the same price on a 5-year interest rate swap. Reflecting the significant difference in counterparty credit risk, however, the dealer may require Diana to post more or higher quality collateral as security against the performance of her obligations.[86] The dealer may also subject Diana to more intensive monitoring, or impose stricter contractual triggers governing, for example, the circumstances in which she will be required to post additional collateral.

The imposition of these more burdensome contractual terms clearly serves to increase the economic price of the contract from Diana's perspective, even though the stated price may be identical to that between the dealer and Apple Inc. Matters become even more complicated once we introduce the perhaps more realistic possibility that the dealer might initially quote Diana a higher stated price on the basis of its initial evaluation of her creditworthiness, or its expectations in terms of the volume of future business likely to be generated by this new relationship. Similarly, it may be possible for Diana to negotiate less onerous contractual terms in exchange for agreeing to an increase in the stated price, or by moving her savings account, commercial loans, or insurance to the dealer or its affiliates.[87] At the same time, if Diana and Apple Inc. enter into contracts with the dealer at different times, differences in the stated price may reflect changes in the dealer's assessment of *market risk* and not the relative creditworthiness of its counterparties.

What this example illustrates is that – in the absence of relatively granular information about the identity of the counterparties, their creditworthiness, broader relationship, and economically important contractual terms – it can be difficult for traders to isolate whether observed changes in the market price of a derivatives contract are being driven by changes in market risk, counterparty credit risk, bargaining power, or other (potentially exogenous) factors. As depicted in Figure 1, the full economic price of a derivatives contract is thus analogous to an iceberg: with a number of potentially significant pricing variables hidden or distorted beneath the surface.

---

[86] These differences in contractual terms may also reflect relative differences in bargaining power between Diana and Apple Inc.

[87] Especially where this results in the dealer being able to secure more collateral against Diana's obligations under the swap; *see infra* Part 5.

Figure 1

Movements in the stated price of a derivatives contract can thus be understood as sending an extremely ambiguous or – 'noisy' – signal to other traders. This noise adds to the already significant obstacles to efficiency enhancing trade and price decoding, thus rendering such decoding more costly, and ultimately less likely, within derivatives markets.

As described in greater detail in Part 4, the information costs generated by time and heterogeneity can help us better understand the role of dealers as reputational intermediaries within derivatives markets, along with the role played by organizations such as ISDA in promoting greater contractual standardization. These costs can also help us understand the drivers behind the development of specialized netting and collateral mechanisms which, by minimizing the exposure of traders in the event of counterparty default, serve as potential substitutes for investments in counterparty screening and monitoring.

(b) The Structure of the Markets

The second important difference between equity securities and derivatives relates to the structure of the markets in which they trade. Historically, the vast majority of trading within public equity markets has taken place on order-driven exchanges such as the New York, London, or Tokyo Stock Exchanges. In recent years, a significant fraction of trading has also taken place on so-called 'alternative' trading platforms such as BATS,

Turquoise, and Chi-X.[88] Exchanges and alternative trading platforms perform an important role in the aggregation and dissemination of information about the prevailing 'bid' and 'asking' prices for different equity securities[89], along with the publication of information about the price and volume of executed trades. NASDAQ's public website, for example, provides real time information about the best available bid and asking prices for shares of Apple Inc., in addition to price and volume information for individual trades.[90] Exchanges and alternative trading platforms also play an important role in establishing the rules pursuant to which these trades takes place. Stock exchanges, for example, typically impose order matching and trade pricing rules. Order matching rules ensure that the best (highest) bid is matched with the best (lowest) asking price, thereby incentivizing both buyers and sellers to submit competitive orders and ensuring that no traders receive preferential treatment. Trade pricing rules then determine the price at which the resulting trades are executed, cleared, and settled. Exchanges and alternative trading platforms can thus be viewed as valuable coordination mechanisms: aggregating and disseminating information about security prices and other trading information, bringing together buyers and sellers in the marketplace, and providing a common legal and institutional environment for trading in equity securities.

One of the defining characteristics of derivatives markets, in contrast, is the absence of a centralized coordination mechanism equivalent to an exchange or alternative trading platform. Unlike equity markets, there is no publicly available source where Diana of the eponymous apple pie stand, for example, could go to find the current bid and asking prices for a 5-year interest rate swap, or information regarding recently executed trades. In theory, Diana would therefore need to somehow construct her own dataset of historical prices. She would also need to interact with a number of other traders in order to aggregate information about the range of current bid and asking prices. Compounding matters, in the absence of a market structure which brought together prospective buyers and sellers, Diana would need to take it upon herself to identify other traders willing and able to take the opposite side of the trade. Depending on how

[88] As of 2013, the U.S. Securities and Exchange Commission estimated that 11.31% (by dollar volume) and 12.12% (by share volume) of trading in U.S. public equities had migrated to such alternative trading platforms; *see* Laura Tuttle, SEC Division of Economic and Risk Analysis, "Alternative Trading Systems: Description of ATS Trading in National Market System Stocks" (October 2013), available at http://www.sec.gov/marketstructure/research/alternative-trading-systems-march-2014.pdf.

[89] The 'bid' price represents the maximum price that a buyer is willing to pay for an asset. The 'ask' price represents the minimum price at which a seller is willing to sell it.

[90] *See* http://www.nasdaq.com/symbol/aapl/time-sales.

idiosyncratic her needs were in terms of the denominated currency of the swap, its duration, and other features, the costs of identifying these traders could be very significant. Viewed in isolation, then, the absence of an exchange or equivalent coordination mechanism can be seen as increasing the search and other information costs for Diana and other traders within derivatives markets.

The comparison with exchange-traded equity markets is useful as a means of understanding the information costs which traders might be expected to encounter within derivatives markets. At the same time, this comparison risks giving the misleading impression that derivatives markets are somehow completely unstructured. In reality, derivatives markets are loosely organized around a relatively small group of large traders known as 'dealers'. Prominent derivatives dealers include Citigroup, JP Morgan, Goldman Sachs, Deutsche Bank, and HSBC. These dealers quote bid and asking prices to other traders on the basis that they are willing to take either side of the contemplated trade.[91] For example, JP Morgan might quote Diana a bid of 5.00% and an ask of 5.05% on the fixed leg of a 5-year U.S. dollar interest rate swap. In this example, the bid represents the gross interest rate Diana would receive if she were to elect to take the fixed leg of the swap, and the ask represents the rate she would pay if she were to take the variable or 'floating' leg.[92] Dealers will then typically look to hedge their exposures under the resulting trade by seeking out and entering into one or more offsetting swaps with other traders or, in many cases, other dealers. In theory at least, dealers thus attempt to profit not by placing bets on the future direction of prices, but by charging a fee – typically embedded in the spread between the quoted bid (e.g. 5.00%) and asking (e.g. 5.05%) prices – for their willingness to stand on the opposite side of the trade. In practice, of course, dealers may also enter into proprietary trades on the basis of their expectations regarding future price movements.[93]

The important role played by dealers in reducing search and other information costs within derivatives markets is examined in greater detail in Part 4. At the same time, the dealer-intermediated structure of derivatives markets is also the source of potentially

[91] *See* Dan Awrey, "The Limits of Private Ordering Within Modern Financial Markets" (2015), 34:1 Review of Banking and Financial Law 183. These quotes can take the form of either binding or indicative (non-binding) quotes.

[92] In this example, the floating leg would typically be fixed at a benchmark rate (e.g. Libor) plus a specified number of percentage points (e.g. +2.0%).

[93] In the absence of regulatory constraints on their ability to do so; *see* Part 5 *infra* for a brief discussion of the potential impact of the so-called 'Volcker Rule' in this regard.

significant costs.[94] Perhaps most importantly, the absence of a mechanism for aggregating and publicly disseminating prices and other trading information has historically presented a significant obstacle for traders such as Diana's Homemade Apple Pie Stand seeking to determine the best available price. The resulting market opacity puts dealers in an advantageous informational position vis-à-vis their clients, thus exposing these clients to potential opportunism.[95] The prospect of opportunism is compounded insofar as dealers are compelled to make relationship specific investments in understanding their clients' business and evaluating counterparty credit risk. These investments can be understood as giving incumbent dealers a comparative advantage over other dealers (which would theoretically need to factor these investments into their quoted price), thereby potentially undermining vigorous price competition.

(c) The Sources of Market Liquidity

The divergent structures of public equity and derivatives markets expose a third important difference: the sources of market liquidity. The concept of liquidity is extremely abstract and, thus, difficult to define with any real precision.[96] At a very basic level, however, liquidity can be understood as a measure of a trader's ability to execute a trade rapidly and with minimal price impact.[97] It is thus a function of both the amount of *time* it takes to buy or sell a security and the effect of the trade on that security's *price*. Conventional measures of market liquidity include the number (or 'depth') of buyers and sellers in the marketplace, the number (or 'volume') of executed trades, and the size of the prevailing spread between bid and asking prices.

---

[94] For a more in-depth theoretical exploration of these potential costs, *see* Darrell Duffie, Nicolae Garleanu, and Lasse Pedersen, "Valuation in Over-the-counter Markets (2007), 20 Review of Financial Studies 1865; Darrell Duffie, Nicolae Garleanu, and Lasse Pedersen, "Over-the-counter Markets" (2005), 73 Econometrica 1815, and Bruno Biais, "Price Formation and Equilibrium Liquidity in Fragmented and Centralized Markets" (1993), 48 Journal of Finance 157.

[95] For a sense of some of the ways in which this opportunism might manifest itself, see for example the U.K. Financial Conduct Authority's recent review uncovering widespread mis-selling of certain interest rate derivatives; *see* http://www.fca.org.uk/consumers/financial-services-products/banking/interest-rate-hedging-products.

[96] *See* Sanford Grossman and Merton Miller, "Liquidity and Market Structure" (1988), 43:3 Journal of Finance 617.

[97] Markus Brunnermeier and Lasse Pedersen refer to this type of liquidity, which essentially measures the ease with which a financial instrument can be traded, as "market liquidity"; *see* Markus Brunnermeier and Lasse Pedersen, "Market Liquidity and Funding Liquidity" (2009), 22:6 Review of Financial Studies 2001.

Stock exchanges promote market liquidity in two primary ways.[98] First, the very *existence* of an exchange can be understood as an important source of market liquidity. The aggregation and dissemination of trading information, combined with the production of rules governing the trading environment, serve to reduce information costs and ameliorate potential adverse selection and agency problems. The amelioration of adverse selection and agency problems increases the confidence of traders in the integrity of the marketplace, thereby attracting buyers and sellers and increasing the depth and volume of trade. Greater depth and volume of trading activity then serves to enhance the process of price formation[99], resulting in narrower spreads between bid and asking prices. Almost by definition, more traders, executing more trades, at narrower bid-ask spreads can then be understood as generating greater market liquidity. Greater liquidity, in turn, attracts more market participants – increasing the depth and volume of trade, enhancing price formation, reducing spreads, and generating still greater liquidity.[100]

Stock exchanges also utilize more bespoke mechanisms to promote market liquidity.[101] For example, many exchanges use call market auctions at the start of a trading session or following a halt in trading. Rather than matching orders as they are entered, call markets allow for the accumulation of buy and sell orders for a specified period of time before they are matched, priced, executed, cleared, and settled. By allowing order flow to build up in this way, call markets can be understood as aggregating market liquidity. For this reason, some exchanges also use call markets for trading in thinly-traded stocks.[102] Along a similar vein, many exchanges impose an affirmative obligation on designated exchange members – historically referred to a 'specialists'[103] – to maintain fair and orderly markets

---

[98] *See* Lawrence Harris, *Trading and Exchanges* (Oxford University Press, New York, 2003); Harold Mulherin, Jeffrey Netter, and James Overdahl, "Prices are Property: The Organization of Financial Exchanges from a Transaction Cost Perspective" (1991), 43:2 Journal of Law and Economics 591, and Daniel Fischel and Sanford Grossman, "Customer Protection in Futures and Securities Markets" (1984), 4 Journal of Futures Markets 273.

[99] Distilled to its essence, price formation is the process by which buyers and sellers determine the price of an asset in the marketplace.

[100] For this reason, it is often said that 'liquidity begets more liquidity'; *See* John Armour, Dan Awrey, Paul Davies, Luca Enriques, Jeff Gordon, Colin Mayer, and Jennifer Payne, *Principles of Financial Regulation* (Oxford University Press, Oxford, forthcoming), ch. 6.

[101] Harris (n 98).

[102] Id.

[103] Notably, the lexicon of equity market making is changing. The New York Stock Exchange (NYSE), for example, has recently replaced 'specialists' with Designated Market Makers (DMMs). Like specialists, DMMs have an affirmative obligation to maintain fair and orderly markets in their designated securities. The NYSE has also recently introduced a new category of market maker known as Supplemental Liquidity

in specific securities. These specialists use their own balance sheets to intervene in the marketplace during periods of illiquidity: buying where there is a scarcity of demand (bids), and selling where there is a scarcity of supply (asks). Exchanges can thus be viewed as important sources of market liquidity. Importantly, this liquidity exists independently of the traders which collectively make up the marketplace. As a result, we would not generally expect the failure of one or more important traders – or their unwillingness to trade – to have a material impact on market liquidity.

The sources of liquidity within derivatives markets, in contrast, are the largest and most important market participants: *dealers*. As of June 2010, the fourteen largest derivatives dealers – the so-called 'G14' – were counterparties to swaps representing approximately 82% of the global notional amount outstanding.[104] Given this concentration of trading activity, liquidity within derivatives markets is essentially a function of the capacity and incentives of this relatively small network of traders to perform this important market marking role. This leaves derivatives markets acutely vulnerable to the withdrawal of liquidity by traders. Broadly speaking, there are at least three reasons why dealers might conceivably withdraw from derivatives market making. First, where a dealer's balance sheet is under pressure, it may withdraw from market making on the basis that it is not presently able to bear the relevant counterparty credit, market, or other risks.[105] Insofar as this pressure is isolated to a single dealer, however, we would not expect this to undermine broader market liquidity as other dealers will likely stand ready to absorb this dealer's market share. Second, during periods of broader market disruption, dealers may take the view that it is not prudent to enter into new derivatives trades: either because they think they cannot effectively price or manage the relevant risks, or because they wish to insulate their balance sheets from the effects of a possible crisis. Third, dealers may withdraw from derivatives market making where these activities no longer generate a sufficient return on capital. This reduction in profitability could be attributable to either a change in technology or market conditions or, importantly, the prevailing regulatory

---

Providers (SLPs). SLPs receive financial incentives from the NYSE in exchange for creating liquidity in their designated securities. *See* https://www.nyse.com/market-model/overview.

[104] *See* ISDA, "Concentration of OTC Derivatives Among Major Dealers", ISDA Research Note, Issue 4 (2010), available at www.isda.org. The G14 is comprised of Bank of America, Barclays, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan Chase, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS, and Wells Fargo.

[105] Although this may actually exacerbate balance sheet problems insofar as it sends a signal to the market that the dealer's balance sheet is under pressure.

environment. As examined in Part 5, the correlated withdrawal of liquidity by dealers could have a significant impact on the informational efficiency of derivatives markets.

There are perhaps many other reasons why we might view publicly-traded equity securities and derivatives as fundamentally different. The pricing models used to value derivatives, for example, are often far more sophisticated than those used to value equity securities. For this and other reasons, many jurisdictions significantly restrict the extent to which the general public can directly participate in derivatives markets. These other differences may have important implications in terms of the relative information, agency, and other costs encountered by traders within these markets. In the next section, however, we confine our examination to four mechanisms of market efficiency which have emerged in response to the unique costs stemming from the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity.

4. THE MECHANISMS OF DERIVATIVES MARKET EFFICIENCY

As described in the previous section, traders within derivatives markets face potentially significant information, coordination, agency, and other costs not generally encountered within public equity markets. These costs stem from the need to identify potential counterparties and then screen for and monitor counterparty credit risk over the life of a derivatives contract. They also stem from the economic and legal heterogeneity of derivatives contracts, and the opaque dealer-intermediated structure of derivatives markets. Yet despite these costs, available empirical evidence suggests that derivatives markets may in fact be relatively informationally efficient. Indeed, at least with respect to some types of information, derivatives markets appear to be more sensitive to the revelation of new information than public equity markets. Using news reflected in stock prices as a benchmark for publicly available information, Viral Acharya and Timothy Johnson, for example, find that credit default swap (CDS) prices react to negative credit information in a manner consistent with the use of non-public information by relationship or 'insider' banks.[106] Lars Norden and Martin Weber similarly find that CDS

[106] Viral Acharya and Timothy Johnson, "Insider Trading in Credit Derivatives" (2007), 84 Journal of Financial Economics 110.

markets react more rapidly to potential credit rating downgrades than equity markets.[107] Other studies have found that CDS markets lead both bond markets[108] and credit rating agencies[109] in reacting to negative news about the creditworthiness of corporate debt issuers. The salient question thus becomes: how does new information become incorporated into derivatives prices?

This section identifies and examines four mechanisms of derivatives market efficiency: dealers, interdealer brokers and ECNs, specialized netting and collateral mechanisms, and contractual standardization under the aegis of organizations such as ISDA. Importantly, these mechanisms are not put forward as substitutes for those identified by Gilson and Kraakman. Indeed, in many cases, these mechanisms may work in tandem with the mechanisms of equity market efficiency. This is particularly the case where institutional investors – Gilson and Kraakman's professionally informed traders – use derivatives as a more cost effective way of creating an exposure to an underlying equity security. At the same time, however, the mechanisms of derivatives market efficiency often operate in very different ways from the mechanisms which Gilson and Kraakman argue serve to incorporate new information into prices within public equity markets. These differences reflect the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity.

(a) Dealers

As described in Part 3, derivatives markets are loosely organized around a relatively small network of global dealers. In order to better understand the central role of dealers within derivatives markets, it may be useful to take a step back and examine the emergence of these markets in historical context. The origins of modern derivatives markets can be traced back to the introduction of the Bretton Woods system of monetary and exchange rate management.[110] Established in 1944, the Bretton Woods

[107] Lars Norden and Martin Weber, "Informational Efficiency of Credit Default Swap and Stock Markets: The Impact of Credit Rating Announcements" (2004), 28 Journal of Banking and Finance 2813. However, *see* also Lars Norden and Martin Weber, "The Co-movement of Credit Default Swap, Bond and Stock Prices: An Empirical Analysis" (2009), 15:3 European Financial Management 529.

[108] Roberto Blanco, Simon Brennan, and Ian Marsh, "An Empirical Analysis of the Dynamic Relation between Investment-Grade Bonds and Credit-Default Swaps" (2005), 60 Journal of Finance 2255.

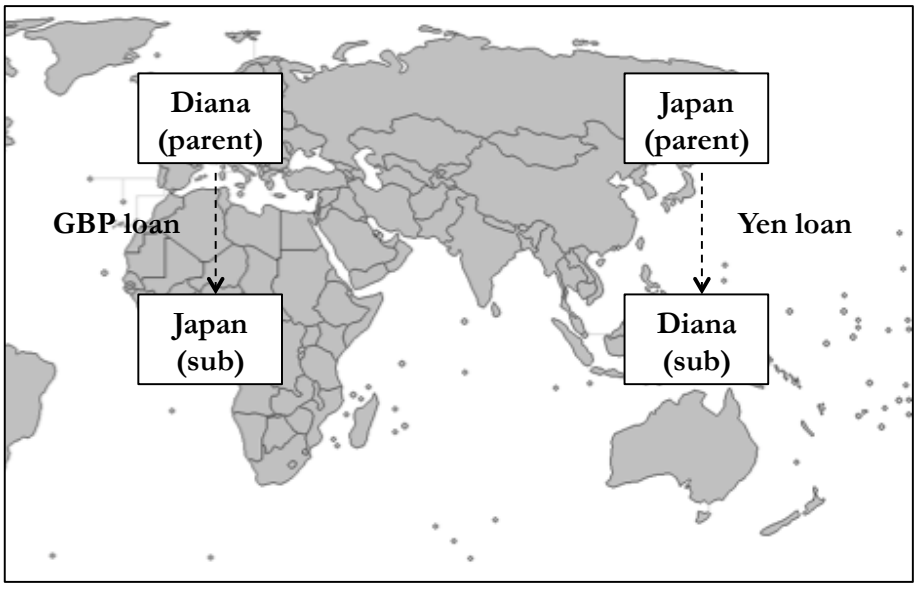
[109] John Hull, Mirela Predescu, and Alan White, 'The Relationship between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements" (2004), 28 Journal of Banking and Finance 2789.

[110] For a more detailed history, *see* Perry Mehrling, *The New Lombard Street: How the Fed Became the Dealer of Last Resort* (Princeton University Press, Princeton, 2013) at 71-75.

system imposed strict capital controls designed to prevent the flight of capital from jurisdictions pursuing relatively tight monetary and macroeconomic policies to jurisdictions pursuing more accommodating policies.[111] In effect, these capital controls restricted the amount of money which could be moved across international borders.

So-called 'parallel loans' – the predecessor of modern swaps – emerged as a means of circumventing these controls. Parallel loans worked as follows. Imagine that Diana's Homemade Apple Pie Stand, domiciled in the U.K., required Yen in order to finance the expansion of its burgeoning Japanese subsidiary. Under the Bretton Woods system, Diana's ability to make this investment directly would be severely restricted. However, if Diana could find a Japanese firm which needed Pound Sterling, she could arrange for two *parallel* loans: one from the Japanese firm to Diana's Japanese subsidiary denominated in Yen, and the other from Diana to the Japanese firm's U.K. subsidiary denominated in Sterling (*see* Figure 2).[112] While these parallel loans would together be economically equivalent to foreign direct investment, no money would cross international borders – thus ensuring that the letter of Bretton Woods, if not its spirit, was strictly observed.

Figure 2



[111] The rationale being that, in the absence of such controls, capital would flow to whichever jurisdictions offered the best investment prospects as measured by future growth potential and the cost of capital. While in a floating exchange rate regime we might expect such international capital flows to be reflected in prevailing exchange rates, the Bretton Woods' pegged exchange rate regime prevented currencies from adjusting to fully reflect these flows.

[112] In reality, the funds for these loans would typically be borrowed by the parent firm from a financial institution located in the relevant jurisdiction.

Dealers performed two important roles in the market for parallel loans. First, dealers assisted clients like Diana in identifying potential counterparties willing to take the opposite side of a trade. Dealers were in an advantageous position to perform this role for several reasons. As a preliminary matter, dealers were typically large commercial and investment banks whose business it was to understand their clients' business models, financing needs, and creditworthiness. This included understanding the geographic footprint of their clients' commercial activities and their corresponding demand for financing in foreign currencies. Dealers could then leverage their large client networks in different jurisdictions to match firms whose demand for financing in foreign currency corresponded with one another. Dealers thus played a central role in the aggregation of information about the supply and demand for foreign currency financing in the form of parallel loans, thereby significantly reducing the search costs for firms looking to identify potentially suitable counterparties. As reflected in the composition of the current G-14[113], the resulting economy of scope gave large, cross-border banks a comparative advantage in making markets in parallel loans.

Second, dealers played a crucial role in the intermediation of parallel loans. In our example, both Diana's Homemade Apple Pie Stand and the Japanese firm may initially possess very little information about one another. They may also not have the expertise or other resources necessary to effectively screen or monitor the creditworthiness of their counterparties. These problems leave both parties extremely vulnerable to counterparty default and opportunism. Perhaps most importantly, in the event that one of the counterparties were to become insolvent, or if it were to opportunistically seek to prematurely terminate one side of the parallel loan, the other counterparty would potentially be left struggling to find a replacement counterparty before it ran out of Yen or Pound Sterling liquidity. The possibility that any new parallel loan entered into under these adverse circumstances might be on less advantageous terms than the original contract is often referred to as 'replacement risk'.

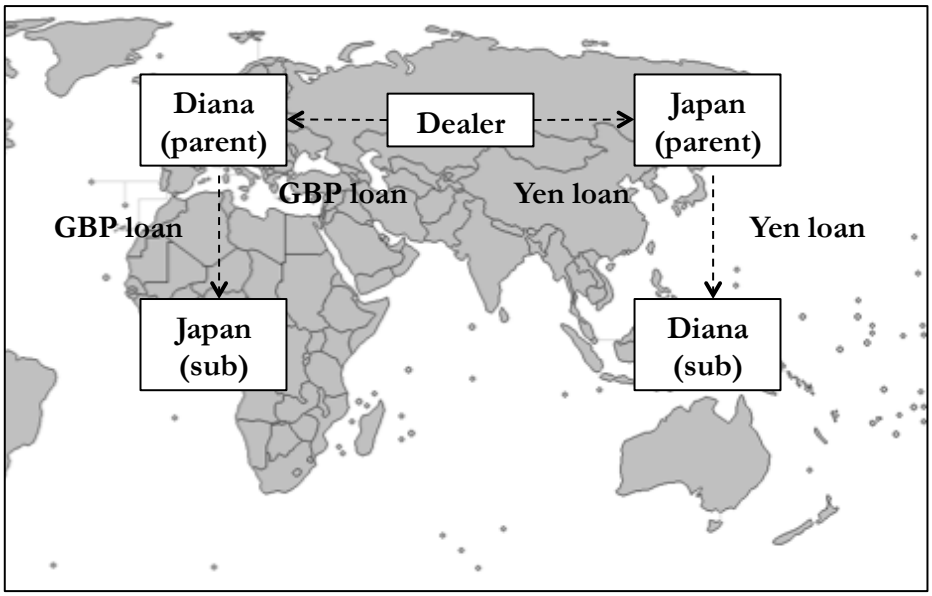
One way to address these problems is by contractually interposing a dealer which would then lend the U.K. and Japanese parents the Pound Sterling and Yen necessary for the purpose of extending the loans to each subsidiary (*see* Figure 3).[114] While the dealer is still

[113] *See* n 104.

[114] In practice, the dealers would technically have to extend the loans via their domestic subsidiaries in order to comply with the Bretton Woods capital controls.

exposed to counterparty credit and replacement risk, its balance sheet is also likely to be more diversified and enjoy access to more sources of Pound Sterling and Yen liquidity. As sophisticated financial institutions, dealers are also likely to have specialist expertise in screening and monitoring the creditworthiness of their counterparties, and be in a better position to hedge any residual exposures. Perhaps most importantly, the status of dealers as repeat players in the marketplace theoretically imposes reputational constraints which arguably make them less likely to engage in opportunistic behavior. In Gilson and Kraakman's terms, this enables dealers to function as reputational intermediaries: renting their reputations to their clients as a means of lowing information, agency, and other costs and enhancing the credibility of the commitments underpinning parallel loans. In effect, the reputation of dealers acts as a substitute for investments in information about the creditworthiness of potential counterparties.

Figure 3



While the Bretton Woods system was incrementally dismantled during the 1970s, the financial innovation which it spawned would eventually evolve to become what we now know as foreign exchange or currency swaps.[115] And like their forebears, modern

[115] Once the Bretton Woods capital controls were removed, parallel loans were no longer required in order to inject capital into foreign subsidiaries. At the same time, the dismantling of the Bretton Woods pegged exchange rate regime meant that many currencies now floated against one another on the basis of market forces. Accordingly, firms needed to manage the foreign exchange risk associated with their foreign operations. By eliminating the requirement to make the actual loan – which had always been costly for dealers because they had to keep it on their books – and focusing instead on exchanging cash flows on the basis of fluctuations in the two currencies, parallel loans thus evolved into the first currency swaps; Mehrling (n 110).

derivatives markets continue to rely on dealers as the primary source of market information, access, and liquidity.[116] As we have seen, the central position of dealers within the structure of derivatives markets puts them in an advantageous position to acquire and aggregate private information about the creditworthiness of their clients, historical prices, prevailing bid-ask spreads, market standard contractual terms, and other trading information. In effect, dealers acquire and aggregate this information as a natural byproduct of their interactions with clients and other dealers as part of the market making process. Dealers thus represent a new and distinct form of market mechanism: the *structurally informed trader*.

Theoretically, the position of dealers as structurally informed traders should enable them to extract informational rents from their clients. These rents would likely be embedded in the bid-ask spreads quoted by dealers on different derivatives instruments. The information obtained by dealers as part of their derivatives market making activities may also be of value to them in other areas – e.g. equity and debt underwriting, fixed income market making and, where permitted, proprietary trading.[117] This gives dealers powerful incentives to protect the economic value of the information obtained as a result of their position as structurally informed traders. In the absence of intellectual property rights, the most straightforward way to protect the value of this information is to ensure that it is not widely disseminated.

This presents us with something of a familiar puzzle. How does information which is initially distributed to such a narrow group of traders – who are all likely to possess powerful incentives not to share it – become reflected in derivatives prices? The first part of the answer is that, in order to profit from this private information, dealers need to *trade* on it. As we have seen, traders within derivatives markets will invariably know both the identity of their counterparties and the direction of their exposure to the underlying (at least with respect to that specific trade). Moreover, as described above, a significant volume of derivatives trading takes place *between* dealers. Thus, for example, JP Morgan will know when it enters into a 5-year total return equity swap on Apple shares that its counterparty is Goldman Sachs. It will also likely know that Goldman Sachs was the co-

[116] Awrey (n 91).

[117] *See* Part 5 *infra* for a discussion of recent restrictions which impact on the ability of some dealers to engage in proprietary trading.

lead underwriter on Apple's $USD17 billion sale of floating rate notes in April 2013[118] and, accordingly, that it may possess private information about the firm's creditworthiness and future prospects. The fact that Goldman Sachs takes a long or short position in shares of Apple under the swap thus potentially serves to signal valuable private information to JP Morgan. Such signalling may help explain Acharya and Johnson's findings that the pattern of information revelation within CDS markets is consistent with trading by insider banks on the basis of private information.[119]

It is worth briefly considering what types of private information can be effectively signalled in this way. Intuitively, the strength of the signal will be a function of the recipient's ability to correctly identify which traders are likely to be in possession of private information. It will also be a function of whether the information itself is 'hard' financial or strategic information, versus 'soft' forecasts or other forward looking information. Trading by relationship banks, for example, is likely to send a relatively strong signal about the creditworthiness of corporate debt issuers – both because of the certainty surrounding the bank's insider status, and because their assessments are likely to be based on hard financial information. It is thus not surprising that the available empirical evidence suggests that CDS markets rapidly incorporate negative credit information into prices.[120]

In many other contexts, however, it may be far more difficult to determine whether a trader possesses private information. The information they possess may also consist of soft information such as forecasts, and thus inherently subject to disagreement and divergent interpretations. It seems highly unlikely, for example, that a trader would possess hard private information about future movements in foreign exchange or interest rates.[121] Moreover, even if they did, it is unlikely that other traders would know that the trader was in possession of this information such that they would be able to identify the

[118] *See* Prospectus filed 29 April 2013, available at http://www.sec.gov/Archives/edgar/data/320193/000119312515028777/d861669d424b2.htm#toc.

[119] Acharya and Johnson (n 106).

[120] *See* Norden and Weber (n 107); Blanco, Brennan and Marsh (n 108); Hull, Predescu, and White (n 109), and Acharya and Johnson (n 106).

[121] At least in the absence of market manipulation with respect to the setting of these rates as occurred in the case of the London Interbank Offered Rate (Libor).

insider's trades as signalling private information.[122] *Ceteris paribus*, it would thus seem far less likely that signalling of this variety would play an important role in the incorporation of new information into prices within currency or interest rate swap markets.[123] Accordingly, insofar as existing empirical evidence is largely confined to studies of the CDS market, we must be careful not to overstate claims regarding the informational efficiency of derivatives markets.

Theoretically, then, trade decoding can help disseminate information within dealer-intermediated derivatives markets. At the same time, the idea that dealers can signal private information through their trading activities raises a host of other important questions. Without being a counterparty to a trade, how can dealers observe the trading activities of other dealers? How can they distinguish between trades designed to offset exposures taken on behalf of clients versus those designed to make a directional bet on the basis of private information? And how do they overcome the signalling problems generated by the economic and legal heterogeneity of derivatives contracts? For answers to these questions, we must look to other mechanisms of derivatives market efficiency.

(b) Interdealer Brokers and Electronic Trading Platforms

As described above, dealers play an important role in the intermediation of derivatives markets. As part of this role, dealers will often seek to hedge client exposures by entering into offsetting trades. Dealers may also engage in proprietary derivatives trading. Many of these trades will be entered into with other dealers. Interdealer brokers are intermediaries which enable dealers to exchange information with other dealers regarding their desire to buy or sell various derivatives and other financial instruments. The largest interdealer brokers are ICAP, Tullett Prebon, Tradition, BCG Partners, and GFI Group.[124] As their name suggests, the services of interdealer brokers are available only to dealers. Institutional and other 'buy-side' investors thus do not generally enjoy

[122] The notable exception in this regard being central banks, which may be both active participants in interest rate or currency swap markets and possess inside information about impending policy decisions likely to have an impact on the price of the relevant underlying.

[123] Equity derivatives such as total return swaps present an interesting case study. On the one hand, it is clearly possible for traders to possess hard private information about the issuer of a public equity security. On the other hand, in the absence of an unambiguous signal analogous to that of the relationship banks used by Johnson and Acharya, it may be difficult for traders to successfully identify whether another trader is acting on the basis of private information.

[124] *See* "Interdealer Brokers: At the Sharp End", *The Economist* (17 November 2012), available at www.economist.com.

access to their full range of services. Simultaneously, however, interdealer brokers will often make anonymized composite data such as the average quoted bid-ask spread on various derivatives available to the broader marketplace.[125] This composite data is accessible through market data providers such as Bloomberg and Reuters.

Historically, interdealer brokers have conducted the majority of their business over the telephone. Pursuant to this 'voice brokerage' model, individual brokers are responsible for trading a specific instrument and have a direct line with the relevant traders at one or more of the firm's clients. As trade requests are received, these brokers then confer with their colleagues with the objective of identifying another of the firm's clients willing to take the opposite side of the trade. ECNs, in contrast, enable dealers to communicate with other dealers via dedicated web-based trading portals. Once they have identified a potential counterparty, ECNs then enable dealers to execute the trade electronically or engage in further negotiations over the telephone. Some electronic trading platforms also facilitate trading between dealers and buy-side investors. These dealer-to-client platforms enable clients to access quoted bid-ask spreads and other information from either a single or multiple dealers. These quotes will often include different price bands depending upon the client's profile and previous trading history with the specific dealer. Major multiple dealer-to-client platforms include those offered by TradeWeb and Bloomberg.

Interdealer brokers and ECNs play a number of roles in supporting derivatives market efficiency. First, interdealer brokers and ECNs perform a function for dealers broadly analogous to one which dealers perform for their clients: aggregating information about supply and demand, matching buyers and sellers, and thus lowering search costs within derivatives markets. Second, multiple dealer-to-client ECNs enable clients to compare quotes from different dealers, thereby enhancing competition and ameliorating potential adverse selection and agency problems. Third, by aggregating and disseminating composite market data, interdealer brokers provide dealers and clients with valuable information about prevailing market conditions. Importantly, this composite data can serve as a benchmark against which traders can determine whether another trader may be in possession of insider information. Returning to our previous example, if Goldman Sachs is quoting a price which deviates significantly from the reported average for total

[125] The production of this composite data often involves significant interpolation. In many cases, it also does not include information about the size/notional amount of the relevant trades. The informational content of this data is thus open to debate; although *see* MarkitWire, Rates Transparency Study (July 2010).

return swaps on shares of Apple Inc., this may signal to JP Morgan that its counterparty is trading on the basis of private information.[126] Finally, while interdealer brokers typically offer dealers full pre-trade anonymity, they may nevertheless serve as informal conduits for the transmission of market intelligence regarding, for example, whether a dealer has a large open position in a given derivative or other security.[127]

(c) Netting and Collateral Mechanisms

As we have seen, idiosyncratic counterparty credit risk is a potentially important source of economic and legal heterogeneity within derivatives markets. This heterogeneity may or may not be reflected in the stated price of a derivatives trade, thereby rendering efficiency enhancing trade and price decoding more costly. Counterparties use two primary mechanisms to address counterparty credit risk.[128] The first is closeout netting. Closeout netting involves the termination, valuation, and netting out of contractual obligations in the event of a counterparty's default or insolvency. Where the netted closeout amount puts the *non-defaulting* counterparty in the money, closeout netting entitles this party to immediately seize any collateral posted by the defaulting counterparty in satisfaction of this amount.[129] Where the *defaulting* counterparty is in the money, in contrast, closeout netting entitles the non-defaulting party to set off against the amount it owes to the defaulting counterparty any amounts owed to it by the defaulting counterparty. This set off is available irrespective of whether the amounts owed to the non-defaulting counterparty are derived from derivatives trades or other obligations. Importantly, the enforceability of closeout netting in most jurisdictions relies on carve outs from the automatic stay and fraudulent preference rules under applicable insolvency laws.[130]

---

[126] Of course, the strength of this signal will be a function of how closely the reported average tracks the actual price of executed trades.

[127] To prevent this, dealers may of course break up their trades amongst multiple interdealer brokers and counterparties.

[128] *See* Armour et al. (n 100).

[129] With any residual amounts owed generally being treated as an unsecured claim in the defaulting counterparty's estate.

[130] For further information about these carve outs under U.S. bankruptcy law, *see* Mark Roe, "The Derivatives Market's Payment Priorities as Financial Crisis Accelerator" (2011), 63 Stanford Law Review 539; Frank Partnoy and David Skeel, "The Promise and Peril of Credit Derivatives" (2007), 75 University of Cincinnati Law Review 1019, and Franklin Edwards and Edward Morrison, "Derivatives and the Bankruptcy Code: Why the Special Treatment?" (2005), 22 Yale Journal on Regulation 91. For further information about the equivalent carve outs in the U.K. and E.U., *see* Alistair Hudson, *The Law on Financial Derivatives*, 5th ed. (Sweet and Maxwell, London, 2012).

The second mechanism used to minimize counterparty credit risk is *collateral*. Dealers and other counterparties may seek to minimize their residual net exposures after closeout netting by requiring their counterparties to post collateral – typically cash or highly liquid securities – at the outset of trade. This collateral, often referred to as 'initial margin' or the 'independent amount', is theoretically designed to reflect each counterparty's exposure to the default of the other counterparty over the duration of the trade. Thereafter, counterparties may also periodically recalculate the amount of collateral one or both counterparties are required to post. This 'variation margin' is designed to reflect changes in the market price of the relevant underlying. Changes in variation margin may take place in accordance with predetermined contractual triggers – e.g. adverse price movements or a downgrade in a counterparty's credit rating – or be negotiated on a more *ad hoc* basis in response to market developments. Like closeout netting, the enforceability of these collateral arrangements relies on carve outs from applicable insolvency laws.

Together, closeout netting and collateral can potentially transform a trader's exposure to counterparty credit risk into an exposure to the market risk – or price volatility – of the underlying collateral. In order for this transformation to take place, a derivatives trade must meet three conditions. First, the value of the collateral must at least equal the amount owed to the non-defaulting counterparty after the application of closeout netting. Second, the non-defaulting counterparty must be able to costlessly seize the collateral. Third, the collateral itself must be sufficiently liquid such that the non-defaulting counterparty can rapidly sell it at or near full market value.[131] This, in turn, points us in the direction of the most desirable forms of collateral: highly liquid and informationally insensitive debt such as cash, U.S. treasury securities, other highly-rated sovereign debt.[132] This is reflected in the results of ISDA's 2015 margin survey, in which respondents reported that 76.6% of collateral received and 77.7% of collateral delivered in connection with bilaterally cleared derivatives trades was in the form of cash.[133]

---

[131] Or sufficiently over-collateralized that the proceeds of sale, even at a discount, are sufficient to satisfy the first condition.

[132] *See* Gary Gorton and Guillermo Ordonez, "Collateral Crises" (2014), 104:2 American Economic Review 343; Tri Vi Dang, Gary Gorton, Bengt Holmstrom, "Understanding the Role of Debt in the Financial System", Bank for International Settlements Working Paper No. 479 (January 2015), available at http://www.bis.org, and Bengt Holmstrom, "Ignorance, Debt and the Financial Crisis", Working Paper (March 2013).

[133] *See* ISDA, Margin Survey (11 August 2015), available at https://www2.isda.org/functional-areas/research/surveys/margin-surveys/.

Where these conditions are satisfied, closeout netting and collateral effectively put non-defaulting traders in the same position they would have been had their counterparty not defaulted, thus rendering them indifferent to the creditworthiness of their counterparties.[134] This, in turn, can be understood as reducing the need for costly counterparty screening and monitoring. Insofar as these mechanisms ensure that counterparties possess symmetric information regarding the consequences of default, closeout netting and collateral also ameliorate potential adverse selection problems.[135] In theory, these mechanisms can thus serve to eliminate the price distortions generated by idiosyncratic counterparty credit risk, thereby ensuring that derivatives prices send a cleaner signal, and providing a more conducive environment for efficiency enhancing trade and price decoding.

Yet an important caveat is in order. Where any of these conditions is *not* satisfied, the economic and legal heterogeneity stemming from idiosyncratic counterparty credit risk may continue to generate price distortions which undermine efficiency enhancing trade and price decoding. At present, there is insufficient publicly available information about collateral practices within global derivatives markets – let alone granular transaction-level data – to determine whether or to what extent these conditions are satisfied. Ultimately, these practices can vary across any number of dimensions: from the *amount* of pledged collateral, its *quality*, and whether it can be *reused or rehypothecated*, to the *timing* of variation margin calculations, and the circumstances – or *triggers* – which will require counterparties to post additional collateral. It seems highly likely, therefore, that there exists some non-trivial level of heterogeneity in these practices within derivatives markets.

(d) ISDA and Contractual Standardization

This leaves legal heterogeneity as a potential obstacle to derivatives market efficiency. It is at this point that it becomes necessary to examine the important contribution of ISDA to the development of derivatives markets. Established in 1985, ISDA is the *de facto* trade association of the global derivatives industry, representing some 850 member dealers, institutional investors, governments, and other major counterparties.[136] ISDA's core mandate is to encourage the prudent and efficient development of derivatives

[134] Putting aside replacement risk.

[135] Holmstrom (2015) (n 132) at 5.

[136] *See* "About ISDA", available at: www2.isda.org/about-ISDA/.

markets through the promotion of, *inter alia*: practices conducive to the efficient conduct of business; sound risk management practices, and high standards of commercial conduct.[137] While ISDA's contribution toward the development of global derivatives markets can be observed across several dimensions[138], two in particular stand out as promoting greater informational efficiency.

First, ISDA has spearheaded the development of specialized legal documentation for use in connection with derivatives trades. Prior to the intervention of ISDA, the majority of derivatives were documented in *ad hoc* agreements negotiated on a trade-by-trade basis.[139] The absence of standardized legal documentation represented a significant barrier to the growth of derivatives markets.[140] Stepping into this breach, ISDA commenced publication of its Code of Standard Wording, Assumptions, and Provisions for Swaps in 1985.[141] The ISDA Swaps Code was essentially a glossary of standard terms reflecting then existing practice within the U.S. interest rate swap market.[142] Then, in 1987, ISDA published its first standardized 'master' agreements for U.S. dollar and multi-currency interest rate swaps and currency swaps. ISDA master agreements incorporate multiple future transactions between two counterparties under the umbrella of a single legal relationship, contemplating only the preparation of a brief confirmation for individual trades. Over time, the scope of these master agreements has been expanded to include equity, commodity, credit, and other derivatives.[143] ISDA has also developed a series of protocols which facilitate the *ex post* amendment of existing master agreements with a view to, *inter alia*, responding to jurisprudential developments, implementing new advancements, rectifying perceived technical deficiencies and, ultimately, standardizing market practice.[144] Together, master agreements and protocols serve to reduce the drafting, negotiation, amendment, and other transaction costs which would otherwise be

---

137 Id.

138 *See* Awrey (n 91) for a more comprehensive discussion of these contributions.

139 Norman Feder, "Deconstructing Over-the-Counter Derivatives" (2002), 17:3 Columbia Business Law Review 677 at 736.

140 Id.

141 *See* www.isda.org/publications/isdamasteragrmnt.aspx [the "Swaps Code"].

142 Feder (n 139) at 737.

143 ISDA has also developed standardized ancillary documentation – e.g. definitions, schedules, credit support agreements, and trade confirmations – for use in connection with these agreements.

144 *See* www2.isda.org/functional-areas/legal-and-documentation/protocols/.

incurred by counterparties in connection with the preparation of legal documentation for individual trades.

Second, ISDA has taken the lead in promoting international law reform in areas critical to the development of derivatives markets. Perhaps most significantly, ISDA has produced a Model Netting Act and supplemental guidance for legislators in order to assist them in enacting legislation designed to ensure the enforceability of closeout netting and collateral arrangements.[145] As of July 26, 2011, netting legislation based on this guidance has been adopted in at least 40 jurisdictions including the U.S., E.U., Japan, and Canada. More broadly, ISDA has played an active role in influencing public policy and financial law reform – including the design and implementation of post-crisis reforms targeting derivatives markets such as Title VII of the Dodd-Frank *Wall Street Reform and Consumer Protection Act*[146] and the European Market Infrastructure Regulation (EMIR).[147] Whether or not one views the Model Netting Act and other reforms as desirable from a broader social perspective, there is little doubt that they have contributed to the spectacular growth derivatives markets in recent decades.[148]

Importantly, the benefits of ISDA's activities can be understood as flowing largely from *contractual standardization*: both in terms of the contracts themselves and the statutory frameworks which underpin them. Master agreements standardize legal terms and terminology; protocols ensure consistency between past and future contracts, and netting legislation ensures equivalent treatment of closeout netting and financial collateral arrangements across jurisdictions. This standardization makes derivatives easier to write and understand. The standardization of legal terms also makes it easier for counterparties – and dealers in particular – to effectively hedge their derivatives exposures.

---

[145] *See* "2006 ISDA Model Netting Act – Version 2" and "Memorandum on the Implementation of the Model Netting Act", both available at www2.isda.org/functional-areas/legal-and-documentation/opinions/.

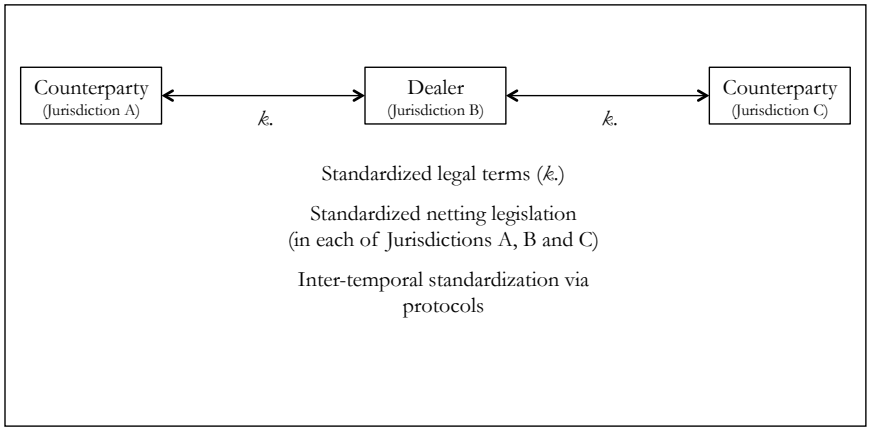
[146] Pub. L. 111–203, H.R. 4173 [hereinafter, the "*Dodd-Frank Act*"].

[147] *See* for example, ISDA, "ISDA Focus: Implementing Dodd-Frank" and ISDA, "ISDA Focus: European Market Infrastructure Regulation", both available at www2.isda.org. *See* more broadly, www2.isda.org/functional-areas/public-policy/.

[148] For a discussion of the potential moral hazard and other problems stemming from the carve outs for derivatives under U.S. bankruptcy law, *see* Roe (n 130); Partnoy and Skeel (n 130), and Edwards and Morrison (n 130).

In order to understand why contractual standardization is so important, imagine a dealer standing between two clients on opposite sides of a trade (*see* Figure 4). Imagine also that the dealer and each client are domiciled in and subject to the laws of different jurisdictions. The dealer, as we have already seen, would theoretically prefer to maintain a matched book and simply charge a fee for intermediating the trade and assuming the resulting counterparty credit and other risks (which, of course, it may also seek to shift by entering into offsetting trades). What would happen, however, if the courts in one jurisdiction (Jurisdiction A) issued an interpretation of a material term of ISDA's master agreement which was inconsistent with its interpretation in another jurisdiction (Jurisdiction C)? Alternatively, what if applicable insolvency legislation in Jurisdiction A contained carve outs from the automatic stay and fraudulent preference provisions for derivatives – thereby enabling counterparties to closeout their positions and seize collateral upon another counterparty's default – but Jurisdiction C's insolvency legislation did not?

Figure 4



Dealers can largely resolve the first problem by ensuring that the contracts are both governed by the laws of a single jurisdiction: in practice, typically either the U.S. or U.K.[149] The second problem, however, is potentially more difficult to resolve. At the very least, this legal heterogeneity would make it more complex – and thus more costly – for dealers to manage the resulting economic differences between the two sides of the

[149] As of April 2010, it is estimated that these two jurisdictions accounted for approximately 70% of global turnover in interest rate derivatives, and 55% of the global turnover in foreign exchange derivatives; Bank for International Settlements, *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity* (April 2010), available at www.bis.org at 5-6. Unfortunately, the triennial survey in 2013 did not provide an update of these estimates.

trade (commonly known as 'basis' risk). *In extremis*, this basis risk might even undercut the incentives of dealers to enter into derivatives with counterparties subject to the insolvency laws of Jurisdiction C, thereby fragmenting market liquidity and undermining the economies of scope associated with dealer intermediation.

Viewed from this perspective, contractual standardization promoted by organizations such as ISDA can be understood as making two important contributions to market efficiency. First, contractual standardization eliminates legal and economic heterogeneity, thereby removing a potentially significant source of efficiency-inhibiting price distortions. Second, standardization reduces the information, negotiation, hedging, and other costs of financial intermediation. Insofar as the reduction of these costs makes it more attractive for dealers to make markets in derivatives, this standardization can thus be seen as contributing to higher levels of market liquidity – thereby improving the process of price formation, and promoting greater informational efficiency within derivatives markets.[150]

The objective of this section has not been to suggest that derivatives markets are relatively informationally efficient. This is ultimately an empirical question which resides beyond the scope of this paper. Moreover, as described above, it seems intuitively likely that different derivatives markets will incorporate new information into prices at different speeds and in different ways. Rather, the objective has simply been to identify the mechanisms which can potentially serve to reduce the impediments to greater informational efficiency stemming from the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity. The next section examines some of the important policy implications which flow from this examination of the mechanisms of derivatives market efficiency.

5. POLICY IMPLICATIONS

In theory, each of the mechanisms examined in the previous section holds the potential to make a significant contribution towards the efficiency of derivatives markets. At the same time, important questions remain regarding the effectiveness of these mechanisms

[150] These non-dealer counterparties may also benefit from a reduction in legal and other forms basis risk insofar as they, too, are entering into multiple (potentially offsetting) swaps with multiple counterparties.

and whether their benefits outweigh the associated costs. Moreover, this examination of the mechanisms of derivatives markets efficiency raises a host of important and timely policy questions.[151] The most important of these questions revolve around the potential impact of recent regulatory reforms introducing new derivatives trade reporting and disclosure requirements, incentivizing the shift toward mandatory central clearing for many standardized derivatives, and imposing new and more onerous prudential requirements on derivatives dealers.[152] This examination also raises important questions about the optimal balance between pubic and private ordering within derivatives markets. This section examines each of these policy questions in greater detail.

(a) Derivatives Trade Reporting and Disclosure

Promoting greater market efficiency is frequently identified as one of the fundamental objectives of securities regulation.[153] In pursuit of this objective, securities laws typically impose *pre*-trade transparency requirements on stock exchanges and other trading platforms to publicly disseminate prevailing bid, ask, volume, and other market information.[154] They also require *post*-trade dissemination of price, volume, and other information in relation to executed trades. Historically, derivatives have been largely exempt from the application of these pre- and post-trade transparency requirements.[155] In response to the recent financial crisis, however, policymakers in the U.S. and elsewhere have introduced a number of regulatory reforms designed to enhance the transparency of derivatives markets.

Section 727 of the *Dodd-Frank Act*, for example, mandates post-trade reporting of price, volume, and other information for all swaps to a registered swaps data repository

---

151 Yesha Yadav has already examined one of these policy questions: namely, whether we need to rethink our approach toward the regulation of insider trading within derivatives – and in particular CDS – markets; *see* Yesha Yadav, "Insider Trading in Derivatives Markets" (2015), 103 Georgetown Law Journal 381.

152 *See infra* Part 5 for a more detailed exploration of these policy questions.

153 *See* Zohar Goshen and Gideon Parchomovsky, "The Essential Role of Securities Regulation" (2006), 55 Duke Law Journal 711 and John Coffee, "Market Failure and the Economic Case for a Mandatory Disclosure System" (1984), 70 Virginia Law Review 717.

154 Alternative trading platforms being a notable exception, where regulatory rules contemplate the non-application or waiver of pre-trade transparency requirements in certain circumstances; *see* for example, SEC, Regulation of Exchanges and Alternative Trading Systems, 17 C.F.R. 202, 240, 242 and 249 (21 April 1999).

155 *See* William Meehan and Gabriel Rosenberg, *OTC Derivatives Regulation Under Dodd Frank: A Guide to Registration Reporting, Business Conduct and Clearing* (Thomson Reuters, New York, 2015) at 72-73.

(SDR).[156] The information which must be reported to an SDR under Section 727 includes: the notional value of the swap; the price or exchange rate; whether any counterparty to the swap is a dealer, major swap participant (MSP), or financial entity; whether the swap is collateralized; the date and time it was executed, and its maturity, termination, or end date.[157] This information must be reported by a designated counterparty at the time the swap is executed.[158] The designated counterparty must also report any changes to the primary economic terms of the swap over the life of the contract.[159]

Section 727 of the *Dodd-Frank Act* also imposes an affirmative obligation on SDRs to ensure the real-time *public* dissemination of certain anonymized information in relation to executed trades.[160] This obligation applies to all swaps subject to SDR reporting requirements (other than certain foreign exchange derivatives[161]) which are executed as part of an "arm's-length transaction between two parties that results in a corresponding change in the market risk position between the two parties".[162] This obligation is coupled with a negative obligation not to disseminate information "in a manner that discloses or otherwise facilitates the identification of a party to a swap."[163] There is also an exception for information relating to block trades and other large transactions, the dissemination of which may be subject to a brief delay.[164] The information which must be publicly disseminated by SDRs includes: the notional value of the swap; the price or exchange rate; the underlying assets; whether the swap in bilaterally or centrally cleared,

---

156 The basic requirement articulated in Section 727 is then supplemented by regulatory rules prescribing in greater detail what information is to be reported; *see* Commodities Futures Trading Commission (CFTC) Final Rule, Swap Data Recordkeeping and Reporting Requirements, 77 Fed. Reg. 2,136 (13 January 2012) (codified at 17 C.F.R. Part 45) [hereinafter, the "SDR Reporting Rule"].

157 *See* SDR Reporting Rule, Appendix 1.

158 SDR Reporting Rule, § 45.8 provides a hierarchy for the purposes of determining which counterparty is required to report the relevant information; *see* Meehan and Rosenberg (n 155) at 74-78.

159 *See* id. at 78.

160 Once again, this basic requirement is then supplemented by more detailed rules prescribing what information SDRs are required to disseminate; *see* CFTC Final Rule, Real-Time Public Reporting of Swap Transaction Data, 77 Fed. Reg. 1,182 (9 January 2012) (codified at 17 C.F.R. Part 43) [hereinafter, the "Real-Time Reporting Rule"].

161 And specifically those subject to the Treasury Amendment; *see* CFTC, Final Determination of Foreign Exchange Swaps and Foreign Exchange Forwards Under the Commodity Exchange Act, 77 Fed. Reg. 69,694 (20 November 2012).

162 Real-Time Reporting Rule, § 43.2.

163 Real-Time Reporting Rule, § 43.4(d)(1).

164 *See* Meehan and Rosenberg (n 153) at 102-106 for a description of both the types of trades which are subject to delays and the prescribed length of the delay.

and whether it is collateralized, along with its settlement currency, payment and reset frequency, and effective start and end dates.[165] In order to ensure the uniform distribution of this information within the marketplace, dealers and MSPs are prohibited from disclosing swap transaction and pricing data prior to its dissemination by the relevant SDR.[166] Simultaneously, however, dealers and MSPs are permitted to disclose this information to their clients at the same time as they report it to the SDR, provided that the counterparties to these trades are notified in advance and that the disclosure is non-discriminatory.[167] Where this disclosure takes place, these clients will thus receive potentially valuable information before it is available to the wider marketplace.

In addition to this extensive post-trade reporting and disclosure, the *Dodd-Frank Act* also introduces a limited degree of pre-trade transparency. Specifically, Section 723 requires that derivatives subject to mandatory central clearing – *see* Part 5(b) – be executed on either a 'designated contract market' (DCM) or 'swap execution facility' (SEF).[168] DCMs are essentially options and futures exchanges which, technically at least, also facilitate the execution of swaps.[169] DCMs thus typically route submitted bids and asks into a transparent central order book and then, much like conventional stock exchanges, use order matching and trade pricing rules to match buyers and sellers. SEFs, in contrast, are trading platforms designed solely to facilitate trading in swaps. In addition to routing trades through a central order book, SEFs may also operate on the basis of a 'request-for-quote' (RFQ) system. The Commodity Futures Trading Commission describes a RFQ system as:

> "a trading system or platform in which a market participant transmits a request for a quote to buy or sell a specific instrument to no less than three market participants in the trading system or platform, to which all such market participants may respond."[170]

---

[165] *See* Real-Time Reporting Rule, Appendix A.

[166] Real-Time Reporting Rule, § 43.3(b)(3(ii).

[167] Id., § 43.3(b)(3)(ii)(A)-(D).

[168] Unless the swap is not available to trade. In order to be available to trade, a swap must either be listed for trading on a DCM or SEF or have been submitted to the CFTC for review as potentially subject to the mandatory clearing requirement; *see* CFTC, Final Process for a Designated Contract Market or Swap Execution Facility To Make a Swap Available to Trade, Swap Transaction Compliance Implementation Schedule, and Trade Execution Requirement Under the Commodity Exchange Act, 78 Fed. Reg. 33,606 (4 June 2013).

[169] In practice, DCMs have rarely been used to facilitate trading in swaps.

[170] CFTC Rule 37.9(a)(3), 17 C.F.R. § 37.9(a)(3).

A SEF that offers a RFQ system for any swap subject to mandatory central clearing is required to inform a market participant requesting a quote of any firm bids or asks currently in its order book for the same contract.[171] SEFs are also prohibited from using any mechanism that prevents a market participant from viewing the bids or asks communicated by other market participants, or that impedes the ability of a market participant to interact or trade with any other market participant.[172]

The stated objective of the *Dodd-Frank Act* derivatives reporting and disclosure requirements is to make swap transaction and pricing data available to the public on a timely basis in order to enhance the process of price formation.[173] The trade execution requirements for swaps subject to mandatory central clearing are similarly designed to enhance price formation and improve pre- and post-trade price transparency.[174] On first inspection, it seems likely that these requirements will provide many derivatives traders with more information about prevailing market conditions, along with price and other transaction data in connection with executed trades.[175] Amongst other benefits, these requirements may thus serve to reduce search costs for traders seeking multiple competitive quotes, thereby reducing the potentially acute agency costs embedded within the dealer-intermediated structure of derivatives markets.

However, whether simply providing *more* information will serve to promote greater market efficiency is ultimately something of a different question. As a preliminary matter, the *Dodd-Frank Act* reporting and disclosure requirements do little to unearth the economic and legal heterogeneity which may reside just beneath the surface of the information which market participants are required to report, and which SDRs are required to publicly disseminate. Take collateral for example. When disseminating trading information, SDRs are required to provide an "indication of whether a swap is

---

[171] Id., § 37.9(a)(3)(i).

[172] *See* CFTC, Guidance on Application of Certain Commission Regulations to Swap Execution Facilities (14 November 2013) at 1-3.

[173] Commodity Exchange Act (CEA), § 2(a)(13)(B), 7 U.S.C. § (2(a)(13)(B) (as amended by Section 727 of the *Dodd-Frank Act*).

[174] *See* Senate Committee on Banking, Housing and Urban Affairs, The Restoring American Financial Stability Act of 2010, S. Rep. No. 111-176 at 33-34 (2010).

[175] The reason that this is only 'likely' and not certain is that we do not know precisely what information dealers, interdealer brokers, and ECNs provided to other market participants prior to the introduction of these reforms.

collateralized".[176] The almost binary nature of this requirement, however, disregards the fact that – as we have already seen – derivatives collateral arrangements can vary across a number of important dimensions: e.g. the amount of pledged collateral, its quality, restrictions on reuse and rehypothecation, and the timing and triggers of any variation margin requirements. These requirements will thus not provide traders with sufficient information to isolate the impact of economic and legal heterogeneity on the stated price of a derivatives contract, thereby failing to remove a potentially significant barrier to effective price formation and market efficiency.

Another potential barrier to greater market efficiency stems from the fact that both the pre- and post-trade transparency requirements introduced under the *Dodd-Frank Act* envision that disseminated transaction data will be almost completely anonymized. This anonymity can be understood as constraining market efficiency in at least two ways. First, not knowing the identity of the counterparties to a derivatives trade – e.g. whether a swap involves Apple Inc. or Diana's Homemade Apple Pie Stand – makes it impossible for other traders to isolate and measure the potential price distortions generated by idiosyncratic counterparty credit risk. Second, and along the same vein, anonymity undermines the ability of traders to engage in efficiency enhancing trade decoding. While some degree of trade decoding may still be possible as a result of the preferential treatment afforded to the clients of dealers and MSPs[177], it thus seems somewhat unlikely that the anonymization of trading information under these new transparency requirements will create a conducive environment for derivatively-informed trading.

Finally, one might question whether the *Dodd-Frank Act* trade reporting and disclosure requirements could potentially serve to undercut the economic incentives of dealers to make markets in derivatives. In examining this question, it may be useful to compare derivatives markets with the dealer-intermediated markets for corporate, government, and other bonds. Here, available empirical evidence generally suggests that the introduction of *post-trade* transparency requirements is unlikely to have a significant impact on market liquidity. A 2007 empirical study conducted by Michael Goldstein, Edith Hotchkiss, and Eric Sirri, for example, found that the introduction of post-trade transparency requirements in connection with certain U.S. corporate bond markets was

[176] Real-Time Reporting Rule, Appendix A.

[177] Which will not only have advance access to trading information but, crucially, will also know the identity of at least one of the counterparties.

correlated with narrower bid-ask spreads and, crucially, did not result in lower trade volumes.[178] Simultaneously, however, Hendrick Bessembinder and William Maxwell have found that dealers held lower inventories of bonds and engaged in less proprietary trading after the introduction of these requirements.[179]

Intuitively, we would expect the introduction of *pre-trade* transparency requirements to have a more significant impact on derivatives market liquidity. This intuition stems from the fact that pre-trade transparency requires dealers to disclose their quotes to the marketplace, thereby enabling other market participants to more easily compare prices and potentially signaling private information to the market before dealers have the opportunity to profit from it. These requirements can thus be understood as reducing the expected payoffs for dealers, and potentially incentivizing them to cut back on their market making activities. Indeed, it is precisely to protect the economic incentives of dealers that the anonymity requirements and block trade delays under the *Dodd-Frank Act* trade reporting and disclosure rules have been introduced. Paradoxically, then, greater transparency may result in reduced liquidity, impede the process of price formation, and contribute to greater informational *inefficiency* within derivatives markets.

(b) Mandatory Central Clearing of Standardized Derivatives

The cornerstone of the post-crisis regulatory reforms targeting derivatives markets has been the introduction of mandatory central clearing for many standardized swaps. Section 723 of the *Dodd-Frank Act* makes it unlawful for a trader to enter into any swap which meets certain standardization, liquidity, and other requirements unless that swap has been accepted for clearing by an authorized clearinghouse.[180] The perceived benefits of central clearing flow principally from the mechanisms which clearinghouses employ to

---

178 Michael Goldstein, Edith Hotchkiss and Eric Sirri, "Transparency and Liquidity: A Controlled Experiment in Corporate Bonds" (2007), 20 Review of Financial Studies 235.

179 Hendrik Bessembinder and William Maxwell, "Markets: Transparency and the Corporate Bond Market" (2008), 22 Journal of Economic Perspectives 217.

180 The mandatory clearing requirement under Section 723 does not apply to commercial end-users entering into swaps for the purpose of hedging or mitigating commercial risk. When determining whether a swap should be subject to mandatory clearing, the CFTC must take into account the aggregate outstanding notional value of the relevant species of swap, the level of market liquidity, the availability of pricing data, the robustness of the infrastructure needed to clear the swap, the effect of central clearing on systemic risk and competition, and the existence of reasonable legal certainty with regards to the treatment of counterparty positions, funds, and property; *see* (CEA), § 2(h)(2)(D), 7 U.S.C. § (2(h)(2)(D). The SEC has adopted similar rules for swaps falling under its jurisdiction; *see* SEC, Process for Review of Security-Based Swaps for Mandatory Clearing and Notice Filing Requirements for Clearing Agencies, 77 Fed. Reg. 135 (13 July 2012).

manage counterparty credit risk.[181] First, clearinghouses utilize multilateral netting as a means of eliminating offsetting exposures, thereby reducing the overall size and number of payment obligations and thus each counterparty's exposure in the event of default. Second, clearinghouses seek to minimize their residual net exposures after multilateral netting by requiring counterparties to post both initial and variation margin. Unlike many bilaterally cleared swaps, however, the variation margin demanded by clearinghouses is calculated on a daily basis in order to reflect market movements in the price of the underlying. Third, clearinghouses employ a number of other loss sharing mechanisms designed to minimize the risk of market disruption in the event of the failure of one or more of its dealer (or 'clearing') members. These mechanisms include pre-funded default funds, clearing member capital calls, recourse to the clearinghouse's own capital, and so-called 'position portability' procedures.[182] Collectively, these mechanisms – often referred to as a clearinghouse's 'default waterfall' – can be understood as mutualizing the risks stemming from the default of one or more clearing members.

A great deal of scholarship has already been written examining the economics of central clearing[183], the governance and risk management of clearinghouses[184], the potential for regulatory arbitrage[185], the impact of central clearing on the resolvability of derivatives counterparties[186], and the potential knock-on effects of mandatory central clearing on financial stability.[187] This scholarship reflects a broad range of views regarding the desirability of mandatory central clearing of standardized derivatives. From the

---

181 *See* Armour et al. (n 100), ch. 20.

182 Position portability procedures obligate surviving clearing members to assume the rights and obligations of trades entered into by defaulting clearing members.

183 *See* for example, Darrell Duffie, Ada Li and Theo Ludke, "Policy Perspectives on OTC Derivatives Markets Infrastructure" (2010), Federal Reserve Bank of New York Staff Report No. 424 and Craig Pirrong, "The Clearinghouse Cure" (Winter 2008-2009), 31 Regulation 44.

184 *See* for example, Yesha Yadav, "The Problematic Case of Clearinghouses in Complex Markets" (2013), 101 Georgetown Law Journal 387 and Sean Griffith, "Governing Systemic Risk: Towards a Governance Structure for Derivatives Clearinghouses" (2012), 61 Emory Law Journal 1153.

185 *See* for example, Gabriel Rosenberg and Jai Massari, "Regulation Through Substitution as a Policy Tool: Swap Futurization Under Dodd-Frank" (2013), Columbia Business Law Review 667 and Dan Awrey, "Toward a Supply-side Theory of Financial Innovation" (2013), 41:2 Journal of Comparative Economics 401.

186 Richard Squire, "Clearinghouses and the Rapid Resolution of Financial Firms" (2014), 99 Cornell Law Review 857.

187 *See* for example, Mark Roe, "Clearinghouse Overconfidence" (2013), 101:6 California Law Review 1641 and Craig Pirrong, "A Bill of Goods: CCPs and Systemic Risk" (2014), Journal of Financial Market Infrastructures [forthcoming].

perspective of market efficiency, however, central clearing can be understood as holding out an important – and yet generally underappreciated – benefit. As we have already seen, economic and legal heterogeneity together represent potentially significant obstacles to derivatives market efficiency. Central clearing reduces this heterogeneity in three ways. First, in order to ensure that clearinghouses are able to net out the risks arising from offsetting contracts, the legal architecture supporting centrally cleared swaps must be highly standardized.[188] Second, clearinghouses impose the same margin and collateral requirements on all trades in a given species of swap, thereby effectively eliminating the prospect of economic heterogeneity in collateral practices.[189] Finally, central clearing involves the novation of contracts from the original counterparties to the clearinghouse itself. In effect, the clearing house thus becomes the buyer to every seller, and the seller to every buyer. Insofar as counterparties possess any residual incentives to screen for and monitor the creditworthiness of their counterparties after the operation of closeout netting and collateral mechanisms, novation thus eliminates the need to make investments in the screening and monitoring of any counterparty other than the clearinghouse. In theory at least, this should serve to dramatically reduce the costs of counterparty due diligence, especially where clearinghouses are required to disclose information about their capital structure, governance, and risk management policies. Accordingly, while the overall desirability of mandatory central clearing is still very much open to debate, increasing the proportion of derivatives trades routed through clearinghouses may have a positive impact on market efficiency.

The prospective benefits of central clearing associated with greater legal and economic homogeneity also point to a potentially significant limit. Specifically, insofar as the regulation of clearinghouses diverges *across jurisdictions*, legal and economic heterogeneity will continue to exist even within centrally cleared derivatives markets. In theory, the leaders of the G20 group of countries have publicly committed to mandatory central clearing of standardized derivatives.[190] In practice, however, significant areas of divergence can be observed in the design and implementation of the relevant regulatory reforms. Yesha Yadav and Dermot Turing, for example, have identified divergence

---

[188] *See* Meehan and Rosenberg (n 155) at 342.

[189] Although one possible area of divergence is in the quality of the collateral posted by individual counterparties. While clearinghouses will often prescribe the classes of eligible collateral, counterparties may retain some discretion in terms of which types of eligible collateral to post in satisfaction of their initial and variation margin obligations.

[190] *See* G-20 Leaders Statement: The Pittsburgh Summit (24-25 September 2009) at 9.

between the *Dodd-Frank Act* and EMIR regimes governing clearinghouses across a number of important dimensions: from margin and collateral requirements, default fund and waterfall mechanisms, and clearinghouse governance and risk management, to supervisory oversight, stress testing, and access to central bank emergency liquidity assistance.[191] Ultimately, the heterogeneity generated by this regulatory divergence may serve to undercut the potential benefits of central clearing from the perspective of market efficiency.

(c) Prudential Regulation of Derivatives Dealers

In addition to enhancing the transparency of derivatives markets and introducing mandatory central clearing for many standardized derivatives, post-crisis regulatory reforms have also targeted the prudential regulation of derivatives dealers. The majority of these reforms have been spearheaded by the Basel Committee on Banking Supervision (BCBS) as part of its comprehensive amendments to its international framework for the regulation, supervision, and risk management of banks, more commonly known as 'Basel III'. Basel III refines the definition of capital for regulatory purposes, increases the percentage of common equity tier-1 (CET1) capital which banks are required to hold against risk-weighted assets, modifies the framework for calculating the risk weightings applied to various asset classes, and introduces a series of new capital buffers designed to reduce the pro-cyclicality of capital requirements, constrain excessive lending during periods of economic growth, and eliminate the 'too-big-to-fail' subsidy.[192] Basel III also introduces a new maximum leverage ratio based on non-risk weighted assets, along with two new liquidity requirements: the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).[193] Whereas the LCR is designed to ensure that banks have a sufficient stock of high quality liquid assets to survive a hypothetical 30-day stress

---

[191] *See* Yesha Yadav and Dermot Turing, "The Extra-territorial Regulation of Clearinghouses" (July 2015) [working paper on file with author].

[192] For more detailed information about the Basel III capital framework, *see* BCBS, "Basel III: Capital" (June 2011), available at http://www.bis.org/bcbs/basel3.htm. For further information about the progress of Basel III implementation in the U.S., *see* http://www.federalreserve.gov/bankinforeg /basel/USImplementation.htm. *See* also, Federal Reserve System, Regulatory Capital Rules: Regulatory Capital, Implementation of Basel III, Capital Adequacy, Transition Provisions, Prompt Corrective Action, Standardized Approach for Risk-Weighted Assets, Market Discipline and Disclosure Requirements, Advanced Approaches Risk-Based Capital Rule, and Mark Risk Capital Rule, 78 Fed Reg. 62,018 (11 October 2013) (codified 12 C.F.R. Parts 208, 217 and 225) [hereinafter, the "U.S. Final Capital Rule"].

[193] *See* BCBS, "Basel III Leverage Ratio Framework and Disclosure Requirements" (January 2014), "Liquidity Coverage Ratio (LCR)" (January 2013), and "Net Stable Funding Ratio (NSFR)" (October 2014), available at http://www.bis.org/bcbs/basel3.htm.

scenario, the NSFR is designed to constrain the reliance of banks on unstable, short-term sources of wholesale funding.[194]

Basel III introduces a number of significant changes to the framework for calculating risk-weighted capital charges for both bilaterally and centrally cleared derivatives trades. For bilaterally cleared derivatives, Basel III augments the existing framework governing the amount of capital which banks must hold against counterparty credit risk with a new credit valuation adjustment (CVA).[195] Whereas the previous framework essentially only required banks to hold sufficient capital to cover losses stemming from *counterparty default*, the CVA is designed to ensure that banks hold sufficient capital to protect against any mark-to-market losses stemming from the *deterioration of a counterparty's creditworthiness* over the life of a derivatives contract.[196] The introduction of the CVA is a reflection of the fact that, during the recent crisis, approximately two-thirds of realized losses experienced by banks on their derivatives portfolios were attributable to the deterioration of counterparty credit quality as opposed to actual counterparty default.[197] Importantly, the introduction of the CVA has coincided in the U.S. with the removal of what was previously a 50% ceiling on the risk weights applied to derivatives exposures.[198]

Basel III also introduces a new risk-weighting framework for centrally cleared derivatives. First, where a bank enters into a derivatives trade for its own purposes, Basel III imposes a relatively modest capital charge equal to 2% of the resulting trade exposure to any qualifying clearinghouse.[199] A qualifying clearinghouse for these purposes is effectively one which complies with the CPMI-IOSCO *Principles for Financial Market Infrastructures*.[200] The equivalent risk weightings for trades cleared through non-qualifying clearinghouses,

---

194 Id.

195 *See* BCBS, "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems" (June 2011), available at www.bis.org/publ/bcbs189.pdf. *See* also U.S. Final Capital Rule.

196 BCBS (n 192) at 3. *See* also BCBS, "Regulatory Reform of Over-the-Counter Derivatives: An Assessment of Incentives to Clear Centrally" (October 2014) at 4, available at http://www.bis.org/publ/othp21.htm.

197 U.S. Final Capital Rule at 62,134.

198 Id. at 62,096. *See* also http://www.usbasel3.com/tool/.

199 *See* BCBS, "Capital Requirements for Bank Exposures to Central Counterparties" (April 2014) at 4-5, available at http://www.bis.org/publ/bcbs227.pdf. The 2% risk weighting against trade exposures to clearinghouses also applies where a bank clears trades on behalf of its clients, but only where the bank also guarantees the client against any losses stemming from the failure of the relevant clearinghouse; id. at 6.

200 Id. at 2. For further details, *see* Committee on Payment and Market Infrastructures (CPSS) and International Organization of Securities Commissions (IOSCO), *Principles for Financial Market Infrastructures* (April 2012), available at http://www.bis.org/cpmi/publ/d101a.pdf.

in contrast, range from 20-100% depending on the identity of the clearinghouse.[201] Second, Basel III imposes a capital charge on clearing members on the basis of their exposure to a clearinghouse's default fund.[202] As described above, in order to mutualize any residual losses stemming from the default of a clearing member, clearinghouses typically require members to contribute to a default fund which can be drawn down in the event that any other member defaults on its obligations and the resulting losses to the clearinghouse exceed both the posted margin and default fund contribution of the defaulting member.[203] While the new trade exposure charge is designed to ensure that a bank has sufficient capital to cover losses arising from its *direct* exposure to a clearinghouse, the new default fund exposure charge can thus be understood as designed to ensure that banks hold sufficient capital against their *indirect* exposure to the default of other clearing members.

Amongst the many ways that banks can soften the impact of the Basel III capital requirements is the utilization of credit risk mitigation techniques such as collateralization. For example, by ensuring that their derivatives trade exposures are sufficiently collateralized by high quality liquid assets, counterparties can reduce the amount of capital they are required to hold against counterparty credit risk.[204] Against this backdrop, policymakers have recently introduced a number of regulatory reforms which can be expected to have an impact on both the supply and demand for eligible collateral. First, the BCBS and IOSCO have introduced a new framework imposing more onerous margin requirements on bilaterally cleared derivatives.[205] This framework articulates baseline minimum amounts and methodologies for calculating initial and variation margin, requires the bilateral exchange of both initial and daily variation margin on a gross basis, provides guidance regarding the definition of eligible collateral and collateral haircuts, and prescribes the use of collateral holding models which ensure that the collateral is immediately available to the collateral taker in the event of default. Second, the push toward mandatory central clearing – and with it daily mark-to-market margining by clearinghouses – will mean that clearing members must be prepared to post

---

[201] *See* id., revising Section XI of Annex 4 of BCBS, "International Convergence of Capital Measurement and Capital Standards: A Revised Framework Comprehensive Version" (June 2006) [hereinafter, 'Basel II'].

[202] Id. at 7-10.

[203] *See supra* Part 5(c).

[204] For further information, *see* Basel II (n 199) at 26-47.

[205] *See* BCBS and IOSCO, "Margin Requirements for Non-Centrally Cleared Derivatives" (March 2015), available at http://www.bis.org/publ/bcbs261.pdf.

high quality liquid assets on short notice in satisfaction of variation margin requirements. In order to satisfy these requirements, along with the new LCR, it is likely that clearing members will be compelled to hold a higher proportion of eligible collateral assets on their balance sheets. Finally, the Financial Stability Board (FSB) has proposed restrictions on the ability of dealers and other market participants to reuse or rehypothecate collateral posted in connection with repurchase agreements, securities lending transactions, or the provision of prime brokerage services.[206] If adopted, these restrictions will limit the ability of dealers to use posted collateral for the purpose of financing their proprietary trading activities.[207] In the aggregate, these reforms are likely to increase the cost of collateralizing derivatives trades at precisely the same time that new capital requirements are incentivizing greater collateralization.[208]

Together with other recent regulatory reforms targeting derivatives markets, these new capital, liquidity, and collateral requirements will almost inevitably increase the costs of derivatives market making for dealer banks. Global consulting firm McKinsey & Company has estimated that the new capital requirements introduced under Basel III will increase costs by an average of 85 basis points for unnetted, uncollateralized derivatives trades.[209] Compounding these costs, Manmohan Singh has estimated that the shift toward mandatory central clearing may require up to $US200 billion in additional initial margin.[210] The BCBS and IOSCO, meanwhile, have estimated that between €700 billion and €1.7 trillion in initial margin will be required to collateralize bilaterally cleared

---

206 *See* FSB, "Strengthening Oversight and Regulation of Shadow Banking: Policy Framework for Strengthening Oversight and Regulation of Shadow Banking Entities" (29 August 2013) at 19 and FSB, "Strengthening Oversight and Regulation of Shadow Banking: Policy Framework for Addressing Shadow Banking Risks in Securities Lending and Repos" (29 August 2013) at 15-16, both available at www.financialstabilityboard.org/wp-content/uploads/r_130829b.pdf?page_moved=1.

207 *See* FSB "Securities Lending and Repos" (n 206) at 16.

208 The cost of collateral can be understood as the difference between the cost of funding the acquisition and holding of the collateral and the return generated on the collateral.

209 *See* Philipp Hale, Erik Luders, Theo Pepanides, Sonja Pfetsch, Thomas Poppensieker, and Uwe Stegemann, "Basel III and European Banking: Its Impact, How Banks Might Respond, and the Challenges of Implementation", McKinsey Working Papers on Risk No. 26 (November 2010) at 9-11 [on file with author].

210 *See* Manmohan Singh, "Collateral, Netting and Systemic Risk in OTC Derivatives Markets", International Monetary Fund Working Paper No WP/10/99 (2010) at 10, available at http://www.imf.org/external/pubs/ft/wp/2010/wp1099.pdf.

derivatives trades.[211] The BCBS has also estimated that the new LCR will increase demand for high quality liquid assets by approximately €1.8 trillion.[212]

Ultimately, of course, it is difficult to quantify the marginal costs of these reforms with any real precision. It is equally difficult to predict how dealers will respond to them. Nevertheless, a number of industry observers have predicted that dealers may respond by withdrawing from market making in connection with many lower margin derivatives instruments.[213] The probability of such a withdrawal has been no doubt increased following the implementation of the so-called 'Volcker Rule'[214], which severely limits the ability of dealer banks to engage in proprietary trading alongside their market making activities: thus eliminating one of the means by which dealers might seek to monetize the informational advantages they enjoy by virtue of their role as structurally informed traders.[215] Importantly for the present purposes, should these reforms precipitate such a correlated withdrawal, this would seem very likely to have an adverse impact on market liquidity and, thus, informational efficiency. This highlights a potential tradeoff between the prudential regulation of derivatives dealers and the incentives of these structurally informed traders to perform their vital market making role.

(d) The Optimal Balance Between Private Ordering and Public Regulation

A good deal of scholarship has already been written examining the optimal balance between private ordering and public regulation within derivatives markets.[216] As we have

---

211 *See* BCBS and IOSCO, "Margin Requirements for Non-Centrally Cleared Derivatives", Consultative Document (July 2012) and BCBS and IOSCO, "Margin Requirements for Non-Centrally Cleared Derivatives", Consultative Document (February 2013), both available at http://www.bis.org.

212 *See* BCBS, "Results of the Basel III Monitoring Exercise as of 30 June 2011" (April 2012) and BCBS, "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring", Consultative Document (December 2010), both available at http://www.bis.org.

213 *See* for example, Deloitte UK, "OTC Derivatives: The New Cost of Trading" (April 2014) at 2, available at http://www2.deloitte.com/content/dam/Deloitte/uk/Documents/financial-services/deloitte-uk-fs-otc-derivatives-april-14.pdf.

214 *Dodd-Frank Act*, Section 619.

215 For an overview of how the Volcker Rule could serve to reduce liquidity within derivatives and other markets, *see* Darrell Duffie, "Making Markets Under the Proposed Volcker Rule", Rock Centre for Corporate Governance Working Paper No. 106, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1990472.

216 *See* for example, Dan Awrey, "The Dynamics of OTC Derivatives Association: Bridging the Public-Private Divide" (2010), 11:2 European Business Organization Law Review 155; Brian Quinn, "The Failure of Private Ordering and the Financial Crisis of 2008" (2009), 5 New York University Journal of Law and Business 549; John Lynch, "Credit Derivatives: Industry Initiative Supplants Need for Direct Regulatory Intervention – A Model for the Future of U.S. Regulation" (2008), 55 Buffalo Law Review 1371; Sean Flanagan, "Rise of a Trade Association: Group Interactions within the International Swaps and Derivatives

seen, private actors such as dealers, interdealer brokers, ECNs, and ISDA have played a pivotal role in the emergence, development, and ongoing evolution of modern derivatives markets. Simultaneously, however, and as we might expect, these private actors do not always possess the strongest incentives to respond to the myriad of information, agency, externality, and public goods problems encountered within these markets.[217] Dealers, for example, have sometimes abused their market power and position as structurally informed traders to exploit financially unsophisticated clients.[218] And while hard data is scarce, it is likely that a significant fraction of derivatives trading activity has historically been significantly under-collateralized, thereby generating risks to both institutional and broader financial stability.[219] In theory, the failure of private actors to effectively respond to these problems opens a window for public regulatory intervention – a window that policymakers have been quick to jump through in the wake of the recent financial crisis. Ideally, however, this impulse should be suppressed in favor of a rigorous examination of the feasibility, potential costs and benefits, and likely behavioral impact of public regulatory intervention.[220]

Our examination of the mechanisms of derivatives market efficiency holds out a number of potentially useful insights into important policy issues at the intersection of private ordering and public regulation. This section briefly examines two of these issues. The first stems from recent proposals to supplement or replace conventional capital requirements for banks with more market-based metrics of institutional stability. Oliver Hart and Luigi Zingales, for example, have advanced a proposal which would replace capital requirements for systemically important banks with prudential requirements based on these banks' CDS prices.[221] Under Hart and Zingales' proposal, where CDS spreads on a bank's junior term debt exceeded specified thresholds, this would trigger a

---

Association" (2001), 6 Harvard Negotiation Law Review 211, and Lynn Stout, "Why the Law Hates Speculators: Regulation and Private Ordering in the Market for OTC Derivatives" (1999), 48 Duke Law Journal 701.

[217] *See* Awrey (n 216) at 174-180 for a more detailed description of these problems.

[218] *See* for example the recent swaps mis-selling scandal in the U.K. (n 95).

[219] *See* Manmohan Singh, "Under-Collateralization and Rehypothecation in the OTC Derivatives Markets", Banque de France Financial Stability Review No. 14 (July 2010), available at https://www.banque-france.fr.

[220] This approach is reflected in Ronald Coase's statement that "satisfactory views on policy can only come from a patient study of how, in practice, the market, firms, and government handle the problem of harmful effects."; Ronald Coase, "The Problem of Social Cost" (1960), 3 Journal of Law and Economics 1 at 10.

[221] *See* Oliver Hart and Luigi Zingales, "A New Capital Regulation for Large Financial Institutions" (2011), 13:2 American Law and Economics Review 453.

requirement for the bank to raise additional equity or enable prudential supervisors to take other remedial measures. In effect, this proposal seeks to harness the sensitivity of CDS markets to negative credit information in order to create an "early warning system"[222] alerting regulators to potential institutional instability.

The desirably of Hart and Zingales' proposal is clearly contingent on the quality of the signal sent by CDS prices.[223] However, as we have already observed, this signal may be vulnerable to distortions stemming from idiosyncratic counterparty credit risk, along with other potential sources of legal and economic heterogeneity. CDS prices may also be distorted by the simultaneous withdrawal of liquidity by dealers and other market participants during periods of broader market disruption. More specifically, during such periods, an observed increase in CDS spreads may reflect a system-wide adverse selection problem of the variety observed in connection with the recent crisis as opposed to the market's assessment of the creditworthiness of individual banks.[224] This puts prudential supervisors in the unenviable position of having to distinguish between those banks which actually require recapitalization in order to avoid potential solvency problems and those which are (merely) suffering short-term liquidity problems symptomatic of the change in broader market conditions. Out of an abundance of caution, supervisors might reasonably elect under these circumstances to require *all* systemically important banks to raise fresh capital[225]: thus essentially negating the primary benefit of this more market-based approach toward capital requirements.

As we have seen, part of the solution to this problem is to subject the CDS contracts upon which Hart and Zingales' proposal relies to mandatory central clearing. This would eliminate the distortions generated by idiosyncratic counterparty credit risk, if not those stemming from any deterioration in the creditworthiness of the relevant clearinghouse.

---

[222] Id. at 455.

[223] Although Hart and Zingales do contemplate that prudential supervisors will conduct a stress test on the relevant bank for the purposes of determining whether CDS prices are accurate; id. at 457.

[224] For a discussion of the withdrawal of market liquidity during the recent financial crisis, *see* Markus Brunnermeier, "Deciphering the Liquidity and Credit Crunch 2007–2008" (2009) 23 Journal of Economic Perspectives 77–100 and BIS, "OTC Derivatives Market Activity in the second half of 2008 (May 2009), available at http://www.bis.org..

[225] As the U.S. federal government arguably did in the fall of 2008 when it required many of its largest and most interconnected banks to issue new preferred shares and warrants pursuant to the Capital Purchase Programme under the Troubled Asset Relief Program.

These CDS should also be subject to mandatory exchange trading[226], thereby ensuring the existence of at least one source of market liquidity which is at least theoretically independent of the willingness of dealers to make markets in these contracts.[227] Ultimately, however, even these relatively interventionist measures cannot completely eliminate the possibility that bank CDS prices may be the least informative at the exact moment that this information is most urgently required.

The prospect that dealers might withdraw from derivatives market making has a second potential implication in terms of the optimal balance between public and private ordering. Given the structure of derivatives markets, we would expect the correlated withdrawal of liquidity by dealers – whether in response to adverse market conditions or the imposition of more onerous capital, collateral, or other regulatory requirements – to have a significant impact on market efficiency. Insofar as well functioning derivatives markets are essential to effective risk management by banks and other financial institutions, the withdrawal of liquidity might also be expected to have an adverse impact on financial stability. Against this backdrop, the threat of withdrawal can be understood as giving dealers powerful leverage over elected officials, regulatory authorities, and financial supervisors who understandably do not want to be perceived as the cause of market inefficiency or instability. It is not inconceivable that dealers would then wield this leverage in order to lobby for the adoption of regulatory rules viewed as less costly or which entrench their position as structurally informed traders. Viewed from this perspective, the dealer-intermediated structure of derivatives markets thus exacerbates the already acute political economy problems which undermine the pursuit of effective financial regulation.

Amongst the ways that policymakers can potentially dilute the potency of this threat is by taking a more proactive approach toward the development of alternative sources of market liquidity. One possible option would be to compel derivatives exchanges to make derivatives instruments deemed to have some degree of systemic importance available for trading as a condition of their registration. Instruments falling into this category might include, for example, certain highly traded interest rate and currency derivatives, or the CDS written on the debt of systemically important banks at the heart of Hart and

[226] While Hart and Zingales do suggest that the relevant CDS contracts should be traded on exchanges, they do not provide an explicit rationale for this suggestion.

[227] In practice, of course, dealers might also represent significant sources of liquidity as both buyers and sellers within exchange-traded derivatives markets.

Zingales' proposal. In exchange, regulators could provide derivatives exchanges with subsidized liquidity support or loss mutualization mechanisms in connection with trading in these instruments.

A second and more radical option would be for central banks such as the U.S. Federal Reserve to play a more active role in derivatives market making. Indeed, in many respects, central banks – with their vast networks, large balance sheets, and the effective absence of counterparty credit risk – are almost the ideal market makers. Thus, for example, and putting aside the fact that this would require a substantial overhaul of the *Federal Reserve Act*, the Fed could publish firm quotes on systemically important derivatives instruments. Under normal market conditions, these quotes could be set just outside the prevailing bid and asking prices quoted by private dealers, thereby minimizing any market distortions stemming from the Fed's presence in the market.[228] At the same time, this presence would offer a credible alternative for those not wanting to transact with private dealers, or in the event of the widespread withdrawal of private liquidity. In effect, this option would institutionalize, normalize, and expand upon what Perry Mehrling has described as the Fed's 'dealer of last resort' function in the context of the recent financial crisis.[229]

Ultimately, the objective in identifying these options is not to put them forward as socially desirable strategies for reducing the political economy and other problems stemming from the dealer-intermediated structure of derivatives markets. Indeed, both of these options raise important theoretical and practical questions in terms of their design, implementation, and potential costs. A comprehensive exploration of these questions resides beyond the scope of this paper. What identifying these options does serve to do, however, is illustrate how understanding the structure of derivatives markets – along with the mechanisms of derivatives market efficiency – can help us better frame these important policy problems, along with potential strategies for tackling them.

6. CONCLUSION

Derivatives are different. These differences stem from the executory nature of derivatives contracts, the dealer-intermediated structure of the markets in which they

[228] Being able to draw a relatively clear distinction between 'normal' and 'abnormal' market conditions for these purposes would of course represent a significant challenge.

[229] *See* Mehrling (n 110).

trade, and the role of derivatives dealers as the primary sources of market liquidity. These differences generate information, coordination, agency, and other problems not generally encountered within public equity markets. These problems have lead to the emergence of a unique constellation of mechanisms which – in theory at least – serve to enhance derivatives market efficiency. To date, however, the contributions of these mechanisms toward derivatives market efficiency have received relatively little attention from scholars or policymakers. Reflecting this gap in our understanding, the potential role and importance of these mechanisms has not featured prominently in recent policy debates examining the impact of post-crisis regulatory reforms targeting derivatives markets. The objective of this paper has been to start us down the path toward closing this gap.

Perhaps the most important contribution of this paper is to identify possible avenues for further research. As a preliminary, there is still a relative scarcity of empirical research examining how rapidly derivatives markets – other than those for CDS – actually incorporate new information into prices. Given the potentially important differences between CDS, equity, and other derivatives in terms of the nature of price sensitive information, we must be careful not to extrapolate too far on the basis of existing evidence. At the same time, there is a great deal we do not yet know about the precise patterns of information dissemination within the complex and evolving network of dealers, interdealer brokers and ECNs, and other derivatives market participants. We also know surprisingly little about the level of legal and economic heterogeneity within derivatives markets: e.g. the utilization of initial and variation margin in bilaterally cleared trades, the patterns of reuse and rehypothecation of financial collateral, and the prevalence and specific terms of collateral triggers. Finally, of course, there are important questions surrounding the impact of recent regulatory reforms on the flow and quality of information within derivatives markets, the willingness of dealers to continue to provide liquidity to these markets and, ultimately, market efficiency.