

The Mechanisms of Derivatives Market Efficiency

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Dan Awrey

These are not your parents' financial markets. A generation ago, the image of Wall Street was one of floor traders and stock brokers, of opening bells and ticker symbols, of titans of industry and barbarians at the gate. These images reflected the prevailing view in which stock markets stood at the center of the financial universe. The high point of this equity-centric view coincided with the development of a significant body of empirical literature examining the efficient market hypothesis (EMH): the prediction that prices within an efficient stock market will fully incorporate all available information. Over time, this equity-centric view became conflated with these empirical findings, transforming the EMH in the eyes of many observers from a testable prediction about how rapidly new information is incorporated into stock prices into a more general – and generally unexamined – statement about the efficiency of financial markets.

In their seminal 1984 article *The Mechanisms of Market Efficiency*, Ron Gilson and Reinier Kraakman advanced a causal framework for understanding how new information becomes incorporated into stock prices. Gilson and Kraakman's framework provided an institutional explanation for the empirical findings supporting the EMH. It has also played an influential role in public policy debates surrounding securities fraud litigation, mandatory disclosure requirements, and insider trading restrictions. 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 article examines the mechanisms of *derivatives* market efficiency. These mechanisms respond to information and other problems not generally encountered within conventional stock 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 led to the emergence of very different mechanisms of market efficiency. This article describes these problems and evaluates the likely effectiveness of the mechanisms of derivatives market efficiency. It then explores the implications of this evaluation in terms of the current policy debates around derivatives trade reporting and disclosure, the macroprudential surveillance of derivatives markets, the push toward mandatory central clearing of derivatives, the prudential regulation of derivatives dealers, and the optimal balance between public and private ordering.

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1. INTRODUCTION

These are not your parents' financial markets. A generation ago, the image of Wall Street was one of floor traders and stock brokers, of opening bells and ticker symbols, of titans of industry and barbarians at the gate.¹ These images reflected the prevailing view in which public equity markets – *stock markets* – stood at the center of the financial universe. The high point of this equity-centric view coincided with the development of a significant body of empirical literature examining the efficient market hypothesis (EMH): the prediction that prices within an efficient stock market will fully incorporate all available information.² Over time, this equity-centric view became conflated with these empirical findings, transforming the EMH in the eyes of many observers from a testable prediction about how rapidly new information is incorporated into stock prices into a more general – and generally unexamined – statement about the efficiency of financial markets.³

In their influential 1984 article *The Mechanisms of Market Efficiency*⁴, Ron Gilson and Reinier Kraakman advanced a causal framework for understanding how new information becomes incorporated into stock prices. Gilson and Kraakman's framework was grounded in the observation that the efficiency of financial 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 offered an account of how the trading activities of one or more

¹ These images were reinforced within popular culture by movies such as Oliver Stone's *Wall Street* and books such as Bryan Burrough and John Helyar's *Barbarians at the Gate: The Fall of RJR Nabisco* (Harper & Row, New York, 1990).

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

³ In the process, the benchmark of 'efficiency' itself became prone to misunderstanding and abuse. Arguably nowhere was this more evident than in the context of the 1990s policy debates surrounding derivatives regulation and, specifically, the statements of former Federal Reserve Board Chairman Alan Greenspan. See for example, Alan Greenspan, "Technological Change and the Design of Bank Supervisory Policies", remarks at the Federal Reserve Bank of Chicago Conference on Bank Structure and Competition (1 May 1997), available at <http://www.federalreserve.gov> ("The unbundling of financial products is now extensive throughout the financial system. Perhaps the most obvious example is the ever expanding array of financial derivatives... *these and other developments facilitating the unbundling of financial products have surely improved the efficiency of financial markets.*") [emphasis added], and Alan Greenspan, "Government Regulation and Derivatives Contracts", remarks at the Federal Reserve Bank of Atlanta Conference on Financial Markets (21 February 1997), available at <http://www.federalreserve.gov> ("[T]he need for U.S. government regulation of derivatives instruments and markets should be carefully examined... *private market regulation appears to be achieving public policy objectives quite effectively and efficiently.*") [emphasis added.] See also, Alan Greenspan, "The Regulation of OTC Derivatives: Testimony before the House Committee on Banking and Financial Services, 105th Congress, 2nd Session (24 July 1998).

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

types of traders served to ensure that this information ultimately found its way into prices.⁵ Amongst its many contributions, this framework provided a detailed institutional explanation for the empirical findings underpinning the EMH.

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 been used as a conceptual 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.

This paper examines the mechanisms of *derivatives* market efficiency. More specifically, it examines the mechanisms of market efficiency within bilateral or 'over-the-counter' (OTC) derivatives markets.⁶ These markets include the \$US550 trillion dollar global markets for equity, credit, foreign exchange, interest rate, and other swaps.⁷ They also include the myriad of smaller and more exotic markets for swaps, options, and structured products based on physical commodities, emissions rights, bandwidth, macroeconomic variables, the volatility of financial instruments or indices, and even Acts of God. These

⁵ See *infra* Part 2 for a more detailed description of Gilson and Kraakman's framework.

⁶ Accordingly, this article does not directly examine the mechanisms of market efficiency within exchange-traded options or futures markets. However, as we shall see, a number of the mechanisms of OTC derivatives market efficiency – and specifically contractual standardization, netting and collateral regimes, and clearinghouses – perform a functionally equivalent role within exchange-traded derivatives markets.

⁷ 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.

derivatives share three core features.⁸ 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 the prospect of counterparty default, making the identity of each trader highly relevant from a contracting perspective. This idiosyncratic counterparty credit risk also contributes to the economic and legal heterogeneity of many derivatives contracts. Second, derivatives markets have not historically benefited from institutional arrangements equivalent to conventional stock exchanges which serve 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 derivatives markets instead revolves around a relatively small network of large financial intermediaries known as ‘dealers’. These dealers quote prices to other traders on the basis that they are willing to take either side of a trade. Dealers thus represent the primary sources of liquidity within derivatives markets.

Together, these three core features of derivatives markets introduce information and other problems not generally encountered within conventional stock 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 institutional arrangements designed to aggregate and disseminate prices and other trading information. Compounding matters, even if traders were able to observe market prices, 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, this heterogeneity introduces potentially significant price distortions: undermining the ability of traders to distill the informational *signal* embedded within any price changes 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.

⁸ See *infra* Part 4 for a more detailed discussion of these features and how they serve to distinguish derivatives from public equity securities.

Predictably, these problems have led to the emergence of very different mechanisms of market efficiency than those identified by Gilson and Kraakman.⁹ The first mechanism consists of the small network of dealers 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 trade. They also typically possess considerable expertise in screening and monitoring counterparty credit and other risks. Perhaps most importantly, however, by contractually interposing themselves between traders, dealers act as reputational intermediaries: using their status as repeat players to enhance the credibility of the commitments underpinning derivatives trades. This market making role places 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 and matching dealers looking to take the opposite sides of a trade. They can also act as informal channels for the dissemination of private trading information. In the process, interdealer brokers and ECNs can be viewed as lowering search costs within derivatives markets.

While the first two mechanisms of derivatives market efficiency can be viewed as extensions of Gilson and Kraakman's original framework, the final two mechanisms take us in an altogether different direction. The third mechanism consists of the highly specialized and intertwined contractual and legislative regimes 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 regimes can combine to render derivatives traders economically indifferent to the creditworthiness of their counterparties, thereby reducing the costs of counterparty

⁹ See *infra* Part 5 for a more detailed examination of these mechanisms.

screening and monitoring and 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 regimes, the legal homogeneity generated by this standardization can be viewed as helping to eliminate potential price distortions.

Viewed together, these four mechanisms serve to highlight the two sides of every derivatives contract. The first – ‘bright’ – side consists of an exposure to an underlying claim: whether it be an equity or debt security, loan, currency, commodity, or other asset or payoff. In the vast majority of cases, these claims will be sensitive to the revelation of new information, thus giving Gilson and Kraakman’s original framework – updated to reflect a different institutional environment – analytical traction in understanding how new information becomes incorporated into derivatives prices. The second – ‘dark’ – side consists of each trader’s exposure to the default of its counterparty. Importantly, and in direct contrast with Gilson and Kraakman’s mechanisms, the institutional arrangements used by counterparties to manage these exposures are designed to reduce the incentives of traders to acquire, process, and verify new price relevant information.¹⁰ Indeed, at least in theory, these arrangements act as *substitutes* for investments in new information. Ultimately, it is the tension between the mechanisms operating on bright and dark sides of derivatives markets which gives rise to many of the important analytical and policy problems examined in this article.

As we shall see, each of the four mechanisms described in this article holds the potential to make a significant contribution towards the efficiency of derivatives markets. By the same token, important questions remain regarding the effectiveness of these mechanisms and whether their prospective benefits outweigh the associated costs. The dealer-intermediated structure of derivatives markets makes it difficult for traders to observe the trading behavior of other market participants, thereby undermining efficiency enhancing trade and price decoding.¹¹ While we might expect dealers to share some of the trading

¹⁰ In this respect, the article shares a number of analytical parallels with the recent work of Kate Judge examining the importance of information, and “information gaps”, in equity and money markets; *see* Kate Judge, “Information Gaps and Shadow Banking” [working paper on file with author].

¹¹ *See infra* Part 2 for a more detailed description of the mechanics and efficiency implications of trade and price decoding.

information they acquire by virtue of their privileged market position, we would also expect them to fiercely protect the economic value of this information – ultimately at the expense of market efficiency. At the same time, specialized netting and collateral regimes and contractual standardization will only serve to eliminate counterparty credit risk and potential price distortions under a very narrow – and, in many cases, unrealistic – range of circumstances. Far from demonstrating their effectiveness, an examination of these mechanisms thus reveals the unique obstacles to market efficiency stemming from the nature of derivatives contracts and the structure of the markets in which they trade.

This examination of the mechanisms of derivatives market efficiency also raises a host of important and timely policy questions. The most important of these questions revolve around the post-crisis regulatory reforms introducing new derivatives trade reporting and disclosure requirements, enhancing macroprudential surveillance of derivatives markets, imposing mandatory central clearing on many standardized derivatives, and strengthening the prudential regulation of derivatives dealers.¹² More broadly, this examination raises important questions about the optimal balance between public regulation and private ordering within derivatives markets.

This paper proceeds as follows. Part 2 begins with an overview of Gilson and Kraakman’s original framework and briefly describes its influence, major criticisms, and enduring insights. Part 3 frames the motivation for this article: identifying the principal reasons why we might care about derivatives market efficiency. Part 4 then describes why Gilson and Kraakman’s 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 5 identifies and examines four mechanisms of derivatives market efficiency: dealers, interdealer brokers and ECNs, specialized netting and collateral regimes, and the ongoing efforts of ISDA to promote contractual standardization within derivatives markets. Part 6 then 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 7 concludes.

¹² See *infra* Part 6 for a more detailed exploration of these policy questions.

This article provides a detailed description of the institutional structure underpinning modern derivatives markets. It also yields a number of important policy insights. First, recent regulatory reforms designed to enhance the transparency of derivatives markets by introducing mandatory trade reporting and disclosure requirements may not have the desired impact on market efficiency. Simultaneously, however, the regulatory push toward mandatory central clearing of many standardized derivatives may have a previously underappreciated and salubrious impact on market efficiency by reducing idiosyncratic counterparty credit risk and economic and legal heterogeneity. Second, recent regulatory reforms designed to enhance the macroprudential surveillance of derivatives markets may not compel market participants to produce the type or granularity of information needed to successfully identify potential threats to financial stability. Third, 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 conventional wisdom about what works in securities laws may at best offer an incomplete framework for understanding the regulation of 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’.¹³ 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.¹⁴ 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

¹³ 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.

¹⁴ See Eugene Fama, “Efficient Capital Markets: A Review of Theory and Empirical Work” (1970), 25:2 *Journal of Finance* 383 at 384-5.

into the statement that security prices in an efficient market will fully reflect all available information.¹⁵ 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.¹⁶ The ‘weak’ form hypothesis predicts that all *historical* 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 this example 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.¹⁷ 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.”¹⁸ Subsequent theoretical and empirical scholarship has put a significant dent in the validity of this claim.¹⁹ For the present purposes, however, the more

¹⁵ Indeed, this is how Fama himself framed the EMH in the introduction to his seminal article; *id.* at 383.

¹⁶ *Id.* at 388.

¹⁷ Gilson and Kraakman (n 4) at 558.

¹⁸ Michael Jensen, “Some Anomalous Evidence Regarding Market Efficiency” (1978), 6 *Journal of Financial Economics* 95 at 95.

¹⁹ 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,

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.²⁰ 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”.²¹

Gilson and Kraakman’s framework rests on three fundamental building blocks.²² 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.²³ The higher these costs, 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.²⁴ Hence, the efficiency of the market for *information* will have a direct impact on the efficiency of the market for *capital*.²⁵ Second, and as a consequence, a market which efficiently incorporates one piece of information into prices may not do so with respect to other pieces of information.²⁶ 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

2011); 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).

²⁰ See William Beaver, “Market Efficiency” (1981), 56 *Accounting Review* 23.

²¹ Gilson and Kraakman (n 4) at 549.

²² As Gilson and Kraakman observe, these building blocks are in many respects clarifications or refinements of Fama’s original framework; *id.* at 558.

²³ *Id.* at 594.

²⁴ *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.

²⁵ Gilson and Kraakman (n 4) at 597.

²⁶ *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.

based on an inherently relative benchmark: the *speed* with which new information is reflected in security prices.²⁷ 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.²⁸

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 prices? Gilson and Kraakman’s answer to this question revolves around four distinct types of trading activity which, together, act as the mechanisms of market efficiency.

The first mechanism is “universally informed trading”.²⁹ Universally informed trading includes trading which takes place on the basis of new information which is simultaneously disseminated to the entire marketplace.³⁰ Writing over 30 years ago, Gilson and Kraakman gave as examples trading activity in response to news about the results of US presidential elections or Federal Reserve policy announcements.³¹ 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.³²

²⁷ Id. at 560. As Gilson and Kraakman observe, this maps squarely onto 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.

²⁸ 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).

²⁹ Id. at 568.

³⁰ Id. Universally informed trading also includes trading on the basis of historical information.

³¹ Id. at 569.

³² 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

The second and in many respects most important mechanism of market efficiency identified by Gilson and Kraakman is “professionally informed trading”.³³ 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 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.³⁴ These traders can 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”³⁵ information: forecasts, estimates, and other forward looking information and analysis.³⁶ 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 activities can eventually result in the broader dissemination of this information within the marketplace and, thus, its incorporation into security prices.³⁷ 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.³⁸

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

Regulation of Modern Financial Markets” (2012), 2:2 Harvard Business Law Review 235, and Bartlett (n 24).

³³ Gilson and Kraakman (n 4) at 569.

³⁴ Id. at 569 and 594.

³⁵ Id. at 561.

³⁶ 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).

³⁷ 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.

³⁸ *See* Paul Mahoney, “Market Microstructure and Market Efficiency” (2002-2003), 28 Journal of Corporation Law 541 at 544.

of market efficiency: “derivatively informed trading”.³⁹ Derivatively informed trading takes two forms.⁴⁰ The first form – “trade decoding”⁴¹ – takes place when traders observe and mimic the trading activities of other traders perceived as enjoying superior information or expertise.⁴² 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.⁴³ 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 – “price decoding”⁴⁴ – takes place when traders observe and respond to anonymous price and other trading information.⁴⁵ 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.⁴⁶

Gilson and Kraakman’s final mechanism of market efficiency is “uninformed trading”.⁴⁷ The idea that uninformed traders can contribute to market efficiency may seem somewhat counterintuitive. Nevertheless, Gilson and Kraakman argue that in certain circumstances uninformed trading can generate aggregate forecasts which over the long term may be better than those of any single trader.⁴⁸ As Gilson and Kraakman explain:

³⁹ Gilson and Kraakman (n 4) at 572.

⁴⁰ Excluding direct, inadvertent revelation of information by professionally informed traders; *id.* More recently, a new form of decoding has emerged based on order flow information (i.e. order decoding). The prevailing structure of derivatives markets makes order decoding more or less irrelevant for the purposes of the present examination.

⁴¹ *Id.* at 573.

⁴² *Id.*

⁴³ 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.

⁴⁴ *Id.* at 574.

⁴⁵ *Id.* at 575.

⁴⁶ *Id.* See also Sanford Grossman and Joseph Stiglitz, “On the Impossibility of Informationally Efficient Markets” (1980), 70 *American Economic Review* 393.

⁴⁷ Gilson and Kraakman (n 4) at 580.

⁴⁸ *Id.*

“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.”⁴⁹

In effect, Gilson and Kraakman view these aggregate forecasts as a new and potentially valuable piece of information.⁵⁰ 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.⁵¹ 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 prices.⁵²

Together, Gilson and Kraakman regard these four mechanisms as performing distinct but ultimately complementary roles in promoting market efficiency.⁵³ 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, 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”.⁵⁴

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-5⁵⁵, the SEC’s integrated disclosure and shelf

⁴⁹ Id.

⁵⁰ Id.

⁵¹ Gilson and Kraakman acknowledge that this is a demanding assumption; id. at 584.

⁵² Uninformed trading is the least developed and convincing of Gilson and Kraakman’s four 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.

⁵³ Gilson and Kraakman (n 4) at 589.

⁵⁴ Id. at 589-90.

⁵⁵ 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.

prospectus regimes⁵⁶, insider trading restrictions⁵⁷, and the regulation of the market for corporate control.^{58, 59} Gilson, Kraakman, and others have also used this framework as a basis for examining the role of underwriters as ‘reputational intermediaries’⁶⁰ in the context of both initial public offerings and the marketing of new financial products.⁶¹ Subsequent scholarship has expanded on this concept to examine the economic functions of venture capital firms⁶², auditors⁶³, and credit rating agencies.⁶⁴ Indeed, Gilson and Kraakman’s framework has even been used as a basis for exploring the mechanisms of market *inefficiency*.⁶⁵

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

⁵⁶ See for example, Gordon and Kornhauser (n 28) and Merritt Fox, “Shelf Registration, Integrated Disclosure, and Underwriter Due Diligence: An Economic Analysis” (1984), 70:5 Virginia Law Review 1005.

⁵⁷ 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 55).

⁵⁸ See for example, Guhan Subramanian, “The Drivers of Market Efficiency in *Revlon* Transactions” (2002-2003), 28 Journal of Corporation Law 691.

⁵⁹ 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.

⁶⁰ Gilson and Kraakman (n 4) at 620.

⁶¹ 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.

⁶² 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.

⁶³ 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.

⁶⁴ See Jack Coffee, *Gatekeepers: The Professions and Corporate Governance* (Oxford University Press, Oxford, 2006), chapter 8.

⁶⁵ Lynn Stout, “The Mechanisms of Market Inefficiency: An Introduction to the New Finance” (2002-2003), 28 Journal of Corporation Law 635.

discount the potential impact of heterogeneous expectations, decision-making biases, and other behavioral ‘anomalies’.⁶⁶ 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.⁶⁷ 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.⁶⁸ 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 – *not* professionally informed traders – were the first to detect possible fraud at energy trading firm Enron.⁶⁹ 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”⁷⁰: trading strategies based on beliefs, sentiments, and other irrational considerations not driven by new information.⁷¹

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.⁷² It is in pursuit of this same objective that this paper employs and expands upon Gilson and Kraakman’s framework to examine the mechanisms of derivatives market efficiency. However, before embarking on this examination, it is worth briefly identifying the principal reasons why we should care about the efficiency of derivatives markets.

⁶⁶ See for example, Alon Brav and J.B. Heaton, “Market Indeterminacy” (2002-2003), 28 *Journal of Corporation Law* 517 and Stout (n 65).

⁶⁷ Mahoney (n 38). 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 similarities with the structurally informed traders described in Part 5.

⁶⁸ 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.

⁶⁹ 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 57).

⁷⁰ Bradford De Long, Andrei Shleifer, Lawrence Summers and Robert Waldmann, “Noise Trader Risk in Financial Markets” (1990), 98 *Journal of Political Economy* 703.

⁷¹ 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.

⁷² See Allen (n 59) at 556.

3. WHY WE SHOULD CARE ABOUT DERIVATIVES MARKET EFFICIENCY

There are a number of reasons why we might care about the efficiency of derivatives markets. Derivatives are bets on the direction of *future* price movements.⁷³ Insofar as derivatives prices contain valuable information about traders' aggregate expectations regarding these future price movements, efficient derivatives markets can thus improve the efficiency of the underlying markets. Along a similar vein, derivatives are often utilized in order to create synthetic exposures to relatively illiquid assets such as corporate bonds and emerging market sovereign debt. They can also be used to create exposures to entirely artificial 'assets' such as baskets of securities (e.g. the Markit ABX index⁷⁴) or financial indicators (e.g. the VIX index⁷⁵). In many cases, these derivatives markets may be deeper and more liquid than the relevant underlying markets – thus making derivatives markets an important part of the process by which new information becomes incorporated into asset prices.

The efficiency of derivatives markets can also play an important role in promoting – or undermining – effective investor protection. The faster new information is incorporated into prices, the smaller the window of opportunity will be for well-informed traders to exploit less knowledgeable counterparties. Conversely, where markets are slow to absorb new information, this is likely to generate opportunities for well-informed traders to exploit their informational advantage. Insofar as the dispersion of information within the marketplace is random and unbiased, we might not view this as a particularly pressing problem: sometimes traders will win, sometimes they will lose. Where the prevailing market structure serves to entrench the informational advantage of a small subset of traders, however, this state of affairs may raise legitimate concerns regarding the more *systematic* exploitation of less informed market participants.

The efficiency of derivatives markets has taken on even greater importance in light of recent regulatory proposals to supplement or altogether replace conventional capital requirements for banks with more market-based measures of credit risk based on

⁷³ Or, similarly, the probability that a specified future event will take place.

⁷⁴ The Markit ABX index is a synthetic index the value of which reflects a basket of 20 subprime mortgage-backed securities; see <https://www.markit.com/product/abx>.

⁷⁵ Created and administered by the Chicago Board Options Exchange, the VIX index is a measure of the market's expectations of short-term volatility as reflected in the prices of S&P 500 stock index options; see <https://www.cboe.com/micro/vix/vixintro.aspx>.

derivatives prices. Oliver Hart and Luigi Zingales, for example, have proposed replacing capital requirements for systemically important banks with prudential requirements based on these banks' credit default swap (CDS) prices.⁷⁶ Pursuant to this proposal, where CDS prices on a bank's junior debt increase beyond a specified threshold, the bank would be required to raise additional equity capital or be subject to other prudential constraints. Clearly, the desirability of Hart and Zingales' proposal depends at least in part on how rapidly CDS markets incorporate new information regarding the creditworthiness of banks. The desirability of this and other similar proposals is examined in greater detail in Part 5(e).

Finally, we might care about the efficiency of derivatives markets because financial policymakers do. Here, it is worth noting that the US Congress has explicitly identified improving the process of "price discovery"⁷⁷ within derivatives markets as the primary rationale underpinning the introduction of the new trade reporting and disclosure requirements under Title VII of the *Dodd-Frank Wall Street Reform and Consumer Protection Act*.⁷⁸ Accordingly, even if we disagree with the proposition that the efficiency of derivatives markets is important, examining the institutional arrangements which support the process by which new information is incorporated into derivatives prices can still provide us with useful insights into whether and to what extent policymakers are likely to achieve their stated objectives. The *Dodd-Frank Act* trade reporting and disclosure requirements, along with the important question of whether they are likely to improve price discovery within derivatives markets, are thus examined in greater detail in Part 5(a).

All this is not to suggest that informational efficiency is the only yardstick against which the efficiency of derivatives markets can or should be evaluated. Far from it. Indeed, as will soon become apparent, an examination of the mechanisms of derivatives market efficiency also raises important questions about the *accuracy* of derivatives prices and, thus, the quality of the signal these prices send to both market participants and regulatory

⁷⁶ See Oliver Hart and Luigi Zingales, "A New Capital Regulation for Large Financial Institutions" (2011), 13:2 American Law and Economics Review 453.

⁷⁷ Distilled to its essence, price discovery is the process by which buyers and sellers determine the price of an asset in the marketplace. The process of price discovery includes the process by and speed with which information is absorbed by a market and incorporated into prices.

⁷⁸ Pub. L. 111–203, H.R. 4173 [hereinafter, the "*Dodd-Frank Act*"]. Section 727 of the *Dodd-Frank Act* amends section 2(a) of the *Commodity Exchange Act* (7 U.S.C. 2(a)) to acknowledge that the purpose of the new trade reporting and disclosure rules is to "enhance price discovery".

authorities. Moreover, as explored in greater detail in the next section, the ‘dark side’ of derivatives markets fits uncomfortably within an analytical framework dedicated to understanding how new information becomes incorporated into prices. Nevertheless, approaching this examination from the perspective of informational efficiency offers some unique insights into the fundamental institutional differences between derivatives and equity markets and, accordingly, why conventional frameworks for thinking about the role of ‘securities’ regulation – based on the dominant equity-centric view – are of limited utility when attempting to understand the challenges of regulating derivatives markets.

4. 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.⁷⁹ This same equity-centric view is reflected in both Gilson and Kraakman’s original framework and the scope of its subsequent influence.⁸⁰ Importantly, however, stock markets represent a relatively small fraction of the global stock of financial assets. As of June 2015, global public equity market capitalization stood at approximately \$US68.6 trillion dollars.⁸¹ While significant, this figure nevertheless renders public equity markets smaller than both the global markets for bonds, notes, and other fixed income securities (\$US76.1 trillion⁸²) and exchange-traded options and futures (\$US68.9 trillion⁸³). While apples-to-apples comparisons are difficult, this figure also pales in comparison to the \$US550 trillion dollar global swaps market.⁸⁴

⁷⁹ 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 13). See Section 4 for a survey of the relatively small body of scholarship focusing more specifically on the informational efficiency of derivatives markets.

⁸⁰ 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.

⁸¹ See World Federation of Exchanges, *Monthly Reports* (June 2015), available at <http://www.world-exchanges.org/statistics>.

⁸² See Bank for International Settlements, *Debt Securities Statistics* (8 June 2015), available at <http://www.bis.org/statistics/secstats.htm>.

⁸³ See Bank for International Settlements, *Derivatives Statistics* (6 December 2015), available at <http://www.bis.org/statistics/derstats.htm?m=6> | 32.

⁸⁴ 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 of size is ‘gross market value’, which

More importantly, a detailed examination of the institutional arrangements supporting public equity and derivatives markets reveals significant differences 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 these differences, along with their important implications in terms of the information, agency, coordination, and other costs which traders in these markets are likely to encounter. Predictably, these costs have led to the emergence of very different mechanisms of derivatives market efficiency.

(a) The Nature of the Contracts

The first important difference between equity and derivatives markets stems from the nature of the contracts which create these instruments and which define the relationship between two traders on opposite sides of a trade.⁸⁵ While these contracts vary in many important respects⁸⁶, there are two principal 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 on the basis of something resembling a classical ‘spot’ contract.⁸⁷ The buyer promises to pay a price today in exchange for the delivery of a specific number of shares, and the seller promises to deliver the shares in exchange for payment. Viewed from this perspective, the transaction is thus not fundamentally dissimilar from the purchase of any number of other goods – an apple, say – which we make on a daily basis. Importantly, these contracts envision no contractual future beyond a very brief settlement period – typically no more than 48-72 hours after the trade is executed.⁸⁸ The relationship between the buyer and seller is thus entirely extinguished within a matter of

reflects the current exposures of counterparties under open contracts assuming that these contracts were all settled immediately. As of 30 June 2015, the Bank for International Settlements estimated the gross market value of all outstanding OTC derivatives at \$US15.5 trillion; id.

⁸⁵ 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.

⁸⁶ Kate Judge, for example, has observed that the *perpetual* nature of equity securities means that their economic value can only be realized by selling them on a secondary market; *see* Judge (n 10) at 9. As we shall see, derivatives markets are not characterized by the existence of the same type of secondary markets.

⁸⁷ *See* Ian Macneil, “The Many Futures of Contract” (1974), 47 Southern California Law Review 691 for a typology of contracts on the basis of temporal and other dimensions.

⁸⁸ *See* for example, Euronext, “Introduction of T+2 Settlement Lifecycle” (14 January 2014), available at <http://www.nyxdata.com>. At the same time, any residual credit risk is effectively eliminated by virtue of the operation of the delivery-versus-payment settlement systems employed by stock exchanges.

days, leaving the traders to go about their business completely unaffected by any subsequent changes in the creditworthiness of their erstwhile counterparty. As a result, the *identity* of the traders within public equity markets is essentially irrelevant from a contracting perspective.⁸⁹

In sharp contrast, one of the core features of derivatives is their status as ‘neoclassical’ executory contracts which contemplate the performance of obligations by one or both traders over time.⁹⁰ Under a typical swap contract, for example, both traders will owe contingent obligations toward one another over a period which may span several years. Rather than contemplating the simple purchase of an apple at your local supermarket, these contracts are thus analogous to an enforceable obligation to continue to buy and sell apples at today’s prices on a periodic basis for several years into the future. Importantly, the duration of these contracts introduces the risk that a trader may become insolvent or 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 have historically provided a form of standardized private law governing, for example, issuer disclosure obligations, capital structure, governance, and the transfer of securities.⁹¹ While much of this private law has now been supplanted by public regulation, the effect has nevertheless been to inject a

⁸⁹ 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 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 3, the identity of a trader is very relevant indeed for the purposes of effective trade decoding.

⁹⁰ See Williamson (n 89) at 237-238 for a description of the characteristics of such neoclassical contracts.

⁹¹ 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.

fairly high degree of standardization or homogeneity into both publicly-traded shares and the legal and institutional environment in which they trade.⁹²

Derivatives, in contrast, can 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 coordination mechanisms equivalent to a stock exchange might be expected to lead to considerable divergence in terms of the underlying contractual architecture.

Crucially, this heterogeneity can even be observed in connection the ‘purchase’ and subsequent ‘sale’ of a single derivative exposure by a single trader. Specifically, where the exposure – a long position in the shares of Apple, for example – is acquired under a derivatives contract with one counterparty subject to the laws of one jurisdiction, and later shifted under a contract with another counterparty subject to the laws of another jurisdiction, the trader will actually find itself a counterparty to *two* separate contracts, subject to the laws of *two* jurisdictions, and exposed to the default of *two* counterparties with potentially different credit risk profiles. The result is a complex and constantly changing web of market and counterparty exposures.

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 exposure to counterparty default or insolvency – 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.⁹³ 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

⁹² 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].

⁹³ See Williamson (n 89) at 239-245.

research of Donald Morgan, who finds an unusual pattern of disagreement – or ‘splits’ – between credit rating agencies over the ratings of banks and insurance firms.⁹⁴ Morgan attributes this disagreement to the high costs of observing the quality of these firms’ assets and the nature of their trading activities.⁹⁵

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 economic price can be understood as incorporating any non-price 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 future obligations.⁹⁶ 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 in response to changes in interest rates or her own creditworthiness.

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.⁹⁷ 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

⁹⁴ See Donald Morgan, “Rating Banks: Risk and Uncertainty in an Opaque Industry” (2002), 92:4 American Economic Review 874.

⁹⁵ Id. at 874.

⁹⁶ These differences in contractual terms may also reflect relative differences in bargaining power between Diana and Apple Inc.

⁹⁷ Especially where this results in the dealer being able to secure more collateral against Diana’s obligations under the swap; see *infra* Part 5.

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 broader relationship, creditworthiness, 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.

Figure 1

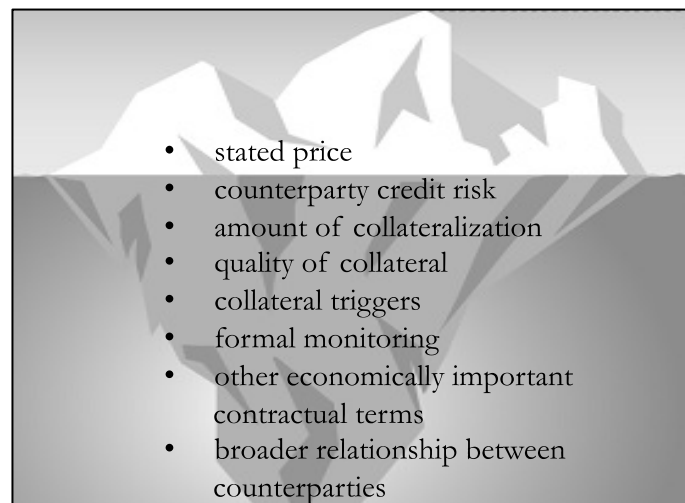


Figure 1 also helps demarcate the boundary between the 'bright' and 'dark' sides of a derivatives contract. The bright side consists of an exposure to changes in the value of an underlying asset, or the probability of an expected future payoff. This exposure is commonly referred to as 'market risk'. In many cases, the price of this underlying – shares in Apple, for example⁹⁸ – will be sensitive to the revelation of new information. As a corollary, we would expect any new information to also eventually find its way into the price of derivatives contracts which create an exposure to this underlying. Indeed, as we shall see, this information may even be incorporated into derivatives prices *before* it is

⁹⁸ While equity securities offer a relatively straightforward example for the present purposes, there remains an important question concerning how far we can extend this to other asset classes. This question is examined in greater detail in Part 5.

reflected in the price of the underlying. Where this is the case, we would expect the stated price of executed trades to signal potentially valuable information to the marketplace about traders' expectations regarding future price movements, thereby theoretically opening the door for efficiency enhancing trade and price decoding. Importantly, the fact that information regarding recently executed trades is likely to be relevant to the price of both subsequent derivatives contracts *and* the underlying means that conventional regulatory strategies such as post-trade transparency may serve to enhance informational efficiency.⁹⁹

The dark side of a derivatives contract consists of the exposure of each trader to the default or insolvency of its counterparty. As described in greater detail in Part 5(c), traders employ a number of mechanisms to manage this idiosyncratic counterparty credit risk. The most important of these mechanisms include closeout netting and the posting of financial collateral. As we shall see, these mechanisms are theoretically designed to act as *substitutes* for investments by traders in new information about the creditworthiness of their counterparties, thus leaving them in what Bengt Holmstrom has characterized as a “blissful state of ‘symmetric ignorance’”.¹⁰⁰ Importantly, the role of these mechanisms in creating an equilibrium in which mutual ignorance can be used to overcome potential adverse selection problems does not fit squarely within Gilson and Kraakman’s framework. The centrality of these mechanisms to the operation of derivatives markets also calls into question the likely effectiveness of conventional regulatory strategies as a means of enhancing informational efficiency.¹⁰¹

The bundling of market and idiosyncratic counterparty credit risk within a derivatives contract has potentially significant implications in terms of the informational content of derivatives prices. Perhaps most importantly, despite its clear economic importance, the dark side of a derivatives contract may or may not be reflected in the stated price. As a result, stated prices may send a potentially ambiguous – or ‘noisy’ – signal to other traders. Amongst other implications, this noise adds to the already significant obstacles

⁹⁹ See Judge (n 10) at 15-17. The potential impact of these strategies is examined in greater detail in Part 6(a).

¹⁰⁰ Bengt Holmstrom, “Understanding the Role of Debt in the Financial System”, Bank for International Settlements Working Paper No. 479 (January 2015) at 6, available at <http://www.bis.org>. See also Judge (n 10) at 12. While Holmstrom was writing in relation to money markets, the dynamics of the operation of closeout netting and financial collateral very much mirror those of money, and specifically, repo markets.

¹⁰¹ For an excellent discussion of the limits of conventional securities law strategies in the context of banking and money markets, see Judge (n 10).

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 5, the information costs generated by time and economic and legal heterogeneity can ultimately 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. At the same time, the observation that derivatives contracts consist of both a bright and dark side clearly serves to distinguish them from publicly traded stocks. This difference exposes the limits of Gilson and Kraakman's framework and raises a host of important and largely unanswered questions about the optimal role of regulation within derivatives markets.

(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.¹⁰² 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 securities¹⁰³, 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.¹⁰⁴

¹⁰² As of 2013, the US Securities and Exchange Commission estimated that 11.31% (by dollar volume) and 12.12% (by share volume) of trading in US 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>.

¹⁰³ 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.

¹⁰⁴ See <http://www.nasdaq.com/symbol/aapl/time-sales>.

Exchanges and alternative trading platforms also play an important role in establishing the rules pursuant to which these trades take 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, has historically been the absence of a 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 to take the opposite side of the trade. Depending on how 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.

Public equity markets provide a useful benchmark against which to compare the information and other costs which traders are likely to encounter within derivatives markets. At the same time, this comparison risks giving the misleading impression that derivatives markets are somehow completely unstructured. In practice, 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. More recently, large asset managers such as BlackRock have also started acting as derivatives dealers.¹⁰⁵ 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.¹⁰⁶ 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 US 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.¹⁰⁷ 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. Where permitted, of course, dealers may also enter into proprietary trades on the basis of their expectations regarding future price movements.

The important role played by dealers in reducing search and other information costs within derivatives markets is examined in greater detail in Part 5. At the same time, the dealer-intermediated structure of derivatives markets is also the source of potentially significant costs. 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 other market participants, theoretically enabling them to exploit their less informed clients.¹⁰⁸ The prospect of exploitation is magnified insofar as dealers are compelled to make relationship specific investments in

¹⁰⁵ See David McCrum and Michael Mackenzie, “BlackRock Looks to Take On Wall Street”, *The Financial Times* (12 April 2012), available at <http://www.ft.com>.

¹⁰⁶ 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.

¹⁰⁷ In this example, the floating leg would typically be fixed at a benchmark rate (e.g. Libor) plus a specified number of percentage (or ‘basis’) points (e.g. +2.0%).

¹⁰⁸ For a theoretical framework for understanding how the opaque, dealer-intermediated markets can generate opportunities for exploitation, see Albert Kyle, “Continuous Auctions and Insider Trading” (1985), 53:6 *Econometrica* 1315. For a sense of some of the ways in which this exploitation might manifest itself in practice, see for example the UK 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>.

understanding their clients' business and evaluating counterparty credit risk: thus giving incumbent dealers a comparative informational advantage over other dealers (which would theoretically need to factor these investments into their quoted prices) and, thereby, 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.¹⁰⁹ At a very basic level, however, liquidity can be understood as measuring a trader's ability to execute a trade rapidly and with minimal price impact.¹¹⁰ 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 prevailing spreads between bid and asking prices.

Stock exchanges promote market liquidity in two primary ways.¹¹¹ 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 for traders 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 discovery, 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,

¹⁰⁹ See Sanford Grossman and Merton Miller, "Liquidity and Market Structure" (1988), 43:3 *Journal of Finance* 617.

¹¹⁰ 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.

¹¹¹ 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.

in turn, attracts more market participants – increasing the depth and volume of trade, enhancing price discovery, reducing spreads, and generating still greater liquidity.¹¹²

Stock exchanges also utilize more bespoke mechanisms to promote market liquidity.¹¹³ 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.¹¹⁴ Along a similar vein, many exchanges impose an affirmative obligation on designated exchange members – historically referred to a ‘specialists’¹¹⁵ – to maintain fair and orderly markets 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 significant 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.¹¹⁶ Given this concentration of trading

¹¹² 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), chapter 6.

¹¹³ Harris (n 111).

¹¹⁴ Id.

¹¹⁵ Notably, the lexicon of equity market making is changing in this regard. 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 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>.

¹¹⁶ 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

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 making role. This leaves derivatives markets acutely vulnerable to the withdrawal of liquidity by dealers. 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 market, counterparty credit, or other risks.¹¹⁷ 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 step into this dealer's shoes and absorb their market share. Second, during periods of broader market disruption, dealers may take the view that it is not prudent or profitable 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. As examined in Part 6, 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 public equity securities and derivatives as fundamentally different species of financial instruments. 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 – thereby reducing the prospect of both universally and uninformed trading. These other differences may have important implications in terms of the relative information and other costs encountered by traders within these markets. Nevertheless, in the next section we confine our examination to four potential 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.

Bank of Scotland, Société Générale, UBS, and Wells Fargo. Commerzbank, Credit Agricole and/or Nomura are sometimes added to create the 'G16' or 'G17'.

¹¹⁷ 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.

5. THE MECHANISMS OF DERIVATIVES MARKET EFFICIENCY

As described in the previous section, traders within derivatives markets face potentially significant information, agency, coordination, and other costs. Many of these costs are 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. Against this backdrop, it may at first glance seem remarkable that available empirical evidence suggests that derivatives markets are often relatively informationally efficient. Indeed, at least with respect to some types of information, some 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 CDS prices react to negative credit information in a manner consistent with the use of non-public information by relationship or ‘insider’ banks.¹¹⁸ Lars Norden and Martin Weber similarly find that CDS markets react more rapidly to potential credit rating downgrades than equity markets.¹¹⁹ Other studies have found that CDS markets lead both bond markets¹²⁰ and credit rating agencies¹²¹ in reacting to negative news about the creditworthiness of corporate debt issuers. The salient question thus becomes: how exactly does this new information become incorporated into derivatives prices?

This section identifies and examines four potential 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. 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 will particularly be the case where

¹¹⁸ Viral Acharya and Timothy Johnson, “Insider Trading in Credit Derivatives” (2007), 84 *Journal of Financial Economics* 110.

¹¹⁹ 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.

¹²⁰ 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.

¹²¹ 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.

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. By the same token, 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 4, 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.¹²² Established in 1944, the Bretton Woods 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.¹²³ In effect, these capital controls restricted the amount of money which could be moved across international borders.

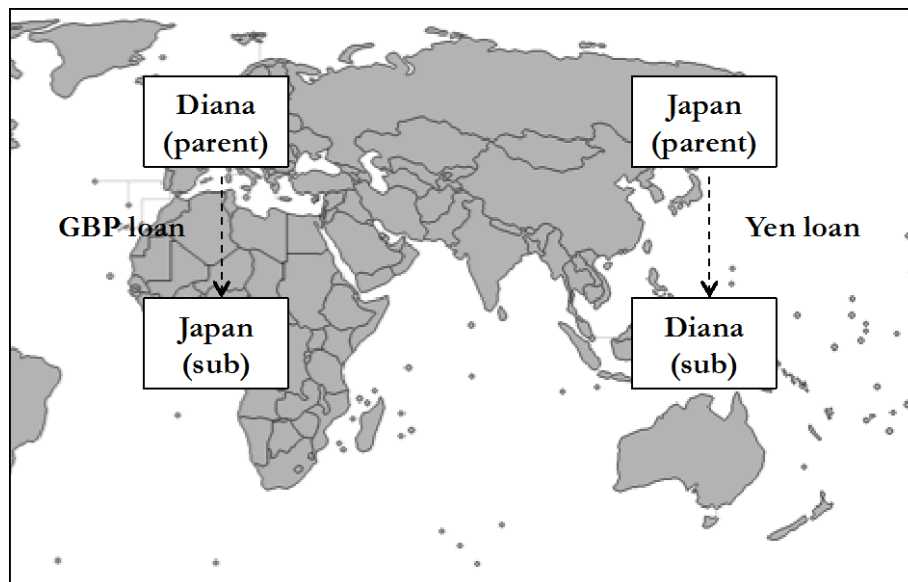
So-called ‘parallel loans’ – the predecessor of modern swaps – emerged as a means of circumventing these controls. Parallel loans worked as follows. Imagine that Diana’s Homemade Apple Pie Stand, domiciled in the UK, required Yen in order to finance the expansion of its burgeoning Japanese subsidiary. 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 UK subsidiary

¹²² 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.

¹²³ 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.

denominated in Sterling (*see* Figure 2).¹²⁴ 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



Dealers performed two important functions 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 G14¹²⁵,

¹²⁴ In reality, the funds for these loans would typically be borrowed by the parent firm from a financial institution located in the relevant jurisdiction.

¹²⁵ *See* n 116.

the resulting economy of scope gave large cross-border banks a comparative advantage in making markets in parallel loans.

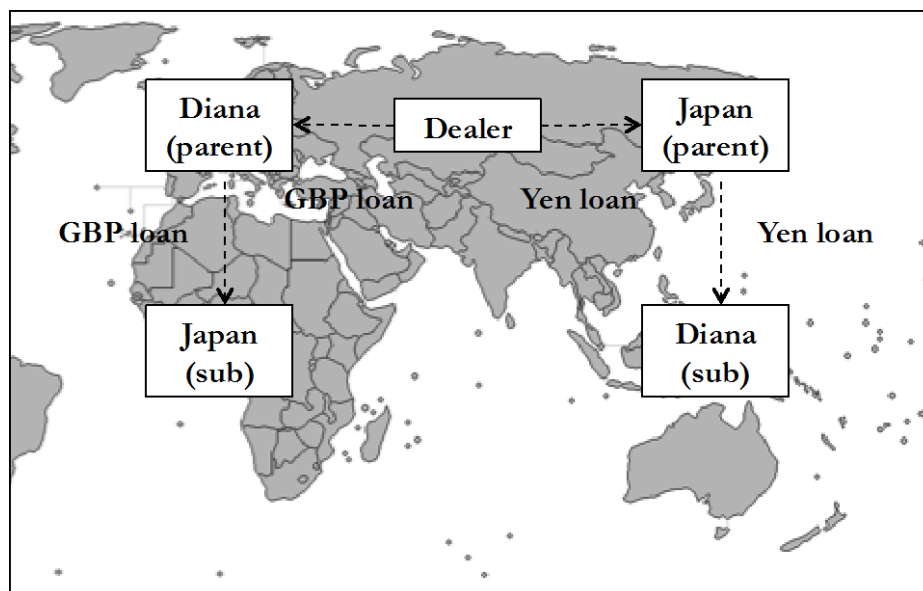
Second, dealers played a crucial role in the intermediation of parallel loans. In our example, both Diana's Homemade Apple Pie Stand and the Japanese firm may initially possess very little information about one another. They may also not have the expertise or other resources necessary to effectively 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 UK and Japanese parents the Pound Sterling and Yen necessary for the purpose of extending the loans to each subsidiary (*see* Figure 3).¹²⁶ While the dealer is still 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. This enables dealers to better absorb counterparty credit, foreign exchange, and other risks, and to bridge any temporal gaps between the financing needs of Diana and the Japanese firm. 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 make them less likely to engage in opportunistic behaviour. In Gilson and Kraakman's terms, this enables dealers to function as reputational intermediaries: renting their reputations to their clients as a means of lowering information, agency, and other costs and strengthening the credibility of the commitments underpinning parallel loans. In effect, the reputation of dealers acts as a

¹²⁶ 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.

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.¹²⁷ And like their forebears, modern derivatives markets continue to rely on dealers as the primary source of market information, access, and liquidity.¹²⁸ 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 market conditions, and other trading information. In effect, dealers acquire and aggregate this information as a natural byproduct of their interactions with clients

¹²⁷ 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 exchange rate between two currencies, parallel loans thus evolved into the first currency swaps; *see* Mehrling (n 122).

¹²⁸ Awrey (n 106).

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*.¹²⁹

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. 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.¹³⁰ Importantly, 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 clear and enforceable 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 – all of whom 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-lead underwriter on Apple's \$USD17 billion sale of floating rate notes in April 2013¹³¹ 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

¹²⁹ Whereas Gilson and Kraakman's professionally informed traders are incentivized to *actively* ferret out and trade on new information, structurally informed traders *passively* acquire this information as a natural byproduct of their market making activities.

¹³⁰ See Part 6 *infra* for a very brief discussion of recent restrictions which impact on the ability of some dealers to engage in proprietary trading.

¹³¹ See Prospectus filed 29 April 2013, available at <http://www.sec.gov/Archives/edgar/data/320193/000119312515028777/d861669d424b2.htm#toc>.

information to JP Morgan.¹³² 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.¹³³

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, or '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.¹³⁴

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.¹³⁵ 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 insider's trades as signalling private information.¹³⁶ *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 these markets.¹³⁷ Accordingly, insofar as existing

¹³² The value of this signal is of course reduced insofar as Goldman Sachs may simply be engaged in market making for one of its clients.

¹³³ Acharya and Johnson (n 118).

¹³⁴ See Norden and Weber (n 119); Blanco, Brennan and Marsh (n 120); Hull, Predescu, and White (n 121), and Acharya and Johnson (n 118).

¹³⁵ 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).

¹³⁶ 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.

¹³⁷ 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.

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 may signal private information through their trading activities raises a host of other important questions. In the absence of an exchange, 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 from 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. Where permitted, 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 derivatives and other financial instruments. The largest interdealer brokers are ICAP, Tullett Prebon, Tradition, BCG Partners, and GFI Group.¹³⁸ As their name suggests, the services of interdealer brokers are generally available only to dealers. Institutional investors and other ‘buy-side’ traders thus do not typically enjoy access to their full range of services.¹³⁹ 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.¹⁴⁰ This composite data is accessible through market data providers such as

On the other hand, in the absence of an unambiguous signal analogous to that of the relationship banks examined by Johnson and Acharya, it may be difficult for traders to successfully identify whether another trader is acting on the basis of private information.

¹³⁸ See “Interdealer Brokers: At the Sharp End”, *The Economist* (17 November 2012), available at <http://www.economist.com>.

¹³⁹ Although the move of asset managers such as BlackRock into derivatives market making is beginning to disrupt this status quo.

¹⁴⁰ 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).

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 their clients. 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 the 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 superior information. Returning to our previous example, if Goldman Sachs is quoting a price which deviates significantly from the reported average for total return swaps on shares of Apple Inc., this may signal to JP Morgan that its counterparty is trading on the basis of private information.¹⁴¹ Finally, while interdealer brokers typically offer dealers full pre-trade anonymity, they may nevertheless

¹⁴¹ Of course, the strength of this signal will be a function of how closely the reported average tracks the actual price of executed trades.

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.¹⁴²

(c) Netting and Collateral Regimes

As we have seen, idiosyncratic counterparty credit risk is a potentially significant 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 mitigate counterparty credit risk.¹⁴³ The first is closeout netting. Closeout netting involves the termination, valuation, and netting out of contractual obligations in the event of counterparty default or insolvency. Where the netted closeout amount puts the *non-defaulting* counterparty in the money, closeout netting entitles this party to immediately seize (as necessary¹⁴⁴) and liquidate any collateral posted by the defaulting counterparty in satisfaction of this amount.¹⁴⁵ 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 relies on a series of carve outs – or ‘safe harbors’ – from the automatic stay and fraudulent preference rules under applicable insolvency laws.¹⁴⁶

¹⁴² To prevent this, dealers may of course break up their trades amongst multiple interdealer brokers and counterparties.

¹⁴³ See Armour et al. (n 112).

¹⁴⁴ In what is ultimately an excellent example of the legal heterogeneity associated with derivatives contracts, the precise operation of closeout netting will depend on whether the relevant collateral was posted pursuant to a title transfer or security interest system. Under a title transfer system, there is technically no need for the non-defaulting counterparty to ‘seize’ the relevant collateral upon default.

¹⁴⁵ With any residual amounts owed generally being treated as an unsecured claim in the defaulting counterparty’s estate.

¹⁴⁶ For further information about these safe harbors under US insolvency 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 UK and EU, 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 safe harbors from applicable insolvency laws.

Together, closeout netting and collateral can theoretically transform a trader’s exposure to idiosyncratic counterparty credit risk into an exposure to the market risk of the underlying collateral. In order for this transformation to take place, a derivatives trade must meet four conditions. These conditions can be thought of as constituting a first-best state contingent contract. First, the value of posted collateral must in all potential future states of the world 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 this 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.¹⁴⁷ This points us in the direction of the optimal forms of collateral: highly liquid and informationally insensitive debt such as cash, US treasury securities, other highly-rated sovereign debt.¹⁴⁸ The desirability of these forms of financial collateral 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

¹⁴⁷ Or sufficiently over-collateralized that the proceeds of sale, even at a discount, are sufficient to satisfy the first condition.

¹⁴⁸ See Gary Gorton and Guillermo Ordonez, “Collateral Crises” (2014), 104:2 American Economic Review 343; Bengt Holmstrom (n 100), Tri Vi Dang, Gary Gorton, Bengt Holmstrom, “Ignorance, Debt and the Financial Crisis”, Working Paper (March 2013).

in connection with bilaterally cleared derivatives trades was in the form of cash.¹⁴⁹ Finally, although technically not related to closeout netting and collateral arrangements, the non-defaulting counterparty must secure a credible commitment from a third party to fully insure it against any replacement risk in the event of counterparty default.

Importantly, where these conditions are satisfied, this first-best state contingent contract will put non-defaulting traders in the exact same position they would have been had their counterparty not defaulted. Put differently, this contract renders traders economically indifferent to the creditworthiness of their counterparties, thus eliminating the need for costly counterparty screening and monitoring. Viewed from this perspective, mechanisms such as closeout netting and collateral serve as *substitutes* for investments in information. Insofar as these mechanisms ensure that counterparties possess symmetric information regarding the consequences of default, they also ameliorate potential adverse selection problems.¹⁵⁰ Most importantly for the present purposes, by eliminating the noise generated by the dark side of derivative contracts, these mechanisms can be understood as enhancing the clarity of the signal sent by stated derivatives prices. This, in turn, can be seen as creating a more conducive environment for efficiency enhancing trade and price decoding.

Ultimately, of course, first-best state contingent contracts of the variety described above may be extremely costly. High quality, liquid collateral is expensive. In some instances, counterparties may also incur non-trivial costs in seizing and liquidating it. Perhaps more importantly, the cost of obtaining credible *ex ante* insurance against replacement risk from private market participants is likely to be prohibitive given the prospect of highly correlated payouts in the context of widespread market disruption.¹⁵¹ As a result, derivatives counterparties may understandably resort to second-best contracts which expose them to some level of risk in the event of counterparty default.

Importantly, where any of these conditions is *not* satisfied, the economic heterogeneity stemming from idiosyncratic counterparty credit risk and other factors may continue to generate price distortions which undermine efficiency enhancing trade and price

¹⁴⁹ See ISDA, Margin Survey (11 August 2015), available at <https://www2.isda.org/functional-areas/research/surveys/margin-surveys/>.

¹⁵⁰ Holmstrom (n 100) at 5.

¹⁵¹ The role of central banks in this context as ‘dealers of last resort’ is explored in Part 6(e).

decoding. At present, there is insufficient publicly available information about closeout netting and collateral practices within global derivatives markets to determine whether or to what extent these conditions are satisfied.¹⁵² 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 margin. As a result, there exists considerable scope for significant levels of economic heterogeneity within derivatives markets. Where this heterogeneity exists, the dark side of derivatives markets will cast a shadow over the informational efficiency of derivatives prices.

(d) ISDA and Contractual Standardization

This leaves legal heterogeneity as a potential obstacle to derivatives market efficiency. It is at this point that we encounter the important role of ISDA in the development of modern 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.¹⁵³ ISDA's core mandate is to encourage the prudent and efficient development of derivatives 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.¹⁵⁴ While ISDA's contribution toward the development of global derivatives markets can be observed across several dimensions¹⁵⁵, two in particular stand out as promoting greater informational efficiency.

First, ISDA has spearheaded the development of specialized legal documentation for use in 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.¹⁵⁶ The costs of designing, drafting, and negotiating these agreements understandably represented a

¹⁵² The type of information which would be required in this regard is discussed in Part 6(b) and Appendix A.

¹⁵³ See "About ISDA", available at: www2.isda.org/about-ISDA/.

¹⁵⁴ Id.

¹⁵⁵ See Awrey (n 106) for a more comprehensive discussion of these contributions.

¹⁵⁶ Norman Feder, "Deconstructing Over-the-Counter Derivatives" (2002), 17:3 Columbia Business Law Review 677 at 736.

significant barrier to the growth of derivatives markets.¹⁵⁷ Stepping into this breach, ISDA commenced publication of its Code of Standard Wording, Assumptions, and Provisions for Swaps in 1985.¹⁵⁸ The ISDA Swaps Code was essentially a glossary of standard terms reflecting then existing practice within the US interest rate swap market.¹⁵⁹ In 1987, ISDA published its first standardized ‘master’ agreements for US dollar and multi-currency interest rate swaps and currency swaps. These master agreements incorporated 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.¹⁶⁰ 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, more generally, standardizing market practice.¹⁶¹ Together, master agreements and protocols serve to reduce the design, drafting, negotiation, and other transaction costs which would otherwise be 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.¹⁶² As of July 26, 2011, netting legislation based on this guidance has been adopted in at least 40 jurisdictions including the US, EU, 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 Act and the

¹⁵⁷ Id.

¹⁵⁸ See www.isda.org/publications/isdamasteragrmnt.aspx [the “Swaps Code”].

¹⁵⁹ Feder (n 156) at 737.

¹⁶⁰ ISDA has also developed standardized ancillary documentation – e.g. definitions, schedules, credit support agreements, and trade confirmations – for use in connection with these agreements.

¹⁶¹ See www2.isda.org/functional-areas/legal-and-documentation/protocols/.

¹⁶² 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/.

European Market Infrastructure Regulation (EMIR).¹⁶³ 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.¹⁶⁴

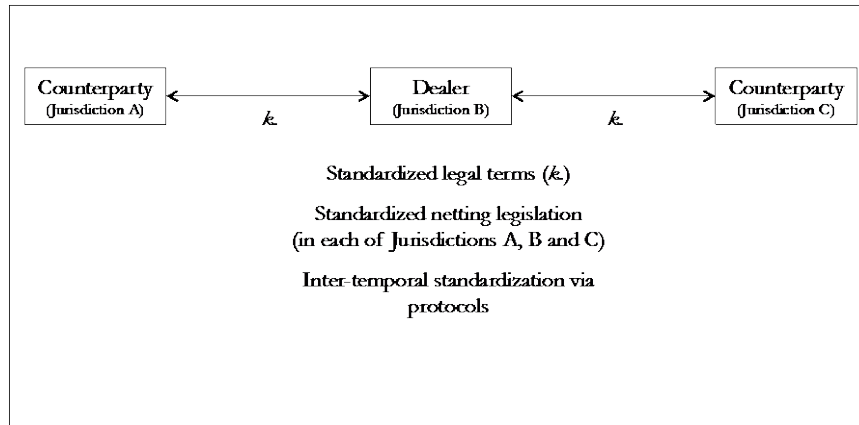
Importantly, the benefits of ISDA's activities can be understood as flowing largely from *contractual standardization*: both in terms of the contracts themselves and the statutory frameworks which ensure their effective enforcement. Master agreements standardize legal terms and terminology; protocols 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.

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 were 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 then 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 laws in Jurisdiction A contained safe harbors from the automatic stay and fraudulent preference provisions – thereby enabling counterparties to closeout their positions and seize collateral upon another counterparty's default – but Jurisdiction C's insolvency legislation did not?

¹⁶³ 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/.

¹⁶⁴ For a discussion of the potential moral hazard and other problems stemming from the safe harbors for derivatives under US bankruptcy law, see Roe (n 146); Partnoy and Skeel (n 146), and Edwards and Morrison (n 146).

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 US or UK.¹⁶⁵ 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 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 undercutting 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 reduces legal and economic heterogeneity, thereby ameliorating 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

¹⁶⁵ 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 <http://www.bis.org> at 5-6. Unfortunately, the triennial survey in 2013 did not provide an update of these estimates.

more attractive for dealers to make markets in derivatives, this standardization can thus be seen as contributing to market liquidity – thereby improving the process of price discovery, and promoting greater informational efficiency within derivatives markets.¹⁶⁶

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, it seems intuitively likely that different derivatives markets will incorporate new information into prices at different speeds and in different ways. What this section has instead attempted to do is examine some of the existing institutional arrangements which might serve to promote greater informational efficiency within derivatives markets and, importantly, how they theoretically respond to the information and other problems stemming from the nature of derivatives contracts, the structure of the markets in which they trade, and the sources of market liquidity. In the process, it has also examined some of the costs associated with these arrangements, and thus their practical limits as mechanisms of derivatives market efficiency. The next section examines some of the important policy implications which flow from this analysis.

6. POLICY IMPLICATIONS

This examination of the mechanisms of derivatives markets efficiency raises a host of important and timely policy questions.¹⁶⁷ The most important of these questions revolve around the potential impact of recent regulatory reforms introduced in the wake of the financial crisis. These reforms includes the introduction new derivatives trade reporting and disclosure requirements, a greater emphasis on macroprudential surveillance of derivatives markets, the shift toward mandatory central clearing for many standardized derivatives, and the imposition new and more onerous prudential requirements on derivatives dealers.¹⁶⁸ This examination also raises important questions about the

¹⁶⁶ 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.

¹⁶⁷ 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.

¹⁶⁸ *See infra* Part 6 for a more detailed exploration of these policy questions.

optimal balance between public 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.¹⁶⁹ 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.¹⁷⁰ They also require *post*-trade dissemination of price, volume, and other information in connection with executed trades. Historically, derivatives have been largely exempt from the application of these pre- and post-trade transparency requirements.¹⁷¹ In response to the recent financial crisis, however, policymakers in the US 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 (SDR).¹⁷² The information which must be reported to an SDR under Section 727 includes: the notional value of the swap; the stated 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.¹⁷³ This information must be reported by a designated counterparty at the time the swap is executed.¹⁷⁴ The designated counterparty must also

¹⁶⁹ 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.

¹⁷⁰ 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).

¹⁷¹ 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.

¹⁷² 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”].

¹⁷³ See SDR Reporting Rule, Appendix 1.

¹⁷⁴ 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 171) at 74-78.

report any changes to the primary economic terms of the swap over the life of the contract.¹⁷⁵

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.¹⁷⁶ This obligation applies to all swaps subject to SDR reporting requirements (other than certain foreign exchange derivatives¹⁷⁷) 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”.¹⁷⁸ 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.”¹⁷⁹ 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.¹⁸⁰ The information which must be publicly disseminated by SDRs includes: the notional value of the swap; the stated price or exchange rate; the underlying assets; whether the swap is bilaterally or centrally cleared, and whether it is collateralized, along with its settlement currency, payment and reset frequency, and effective start and end dates.¹⁸¹ 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.¹⁸² 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.¹⁸³ Where this disclosure takes place, these clients will thus receive potentially valuable information before it is available to the wider marketplace.

¹⁷⁵ *See id.* at 78.

¹⁷⁶ 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”].

¹⁷⁷ 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).

¹⁷⁸ Real-Time Reporting Rule, § 43.2.

¹⁷⁹ Real-Time Reporting Rule, § 43.4(d)(1).

¹⁸⁰ *See* Meehan and Rosenberg (n 171) at 102-106 for a description of both the types of trades which are subject to delays and the prescribed length of the delay.

¹⁸¹ *See* Real-Time Reporting Rule, Appendix A.

¹⁸² Real-Time Reporting Rule, § 43.3(b)(3)(ii).

¹⁸³ *Id.*, § 43.3(b)(3)(ii)(A)-(D).

In addition to this extensive post-trade reporting and disclosure, the *Dodd-Frank Act* also introduces a limited degree of pre-trade transparency. Section 723 requires that derivatives subject to mandatory central clearing – *see* Part 6(c) – be executed on either a ‘designated contract market’ (DCM) or ‘swap execution facility’ (SEF).¹⁸⁴ DCMs are essentially options and futures exchanges which, technically at least, also facilitate trading in swaps.¹⁸⁵ 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.”¹⁸⁶

A SEF that offers a RFQ system for any swap subject to mandatory central clearing is required to inform a trader requesting a quote of any firm bids or asks currently in its order book for the same contract.¹⁸⁷ SEFs are also prohibited from using any mechanism that prevents a trader from viewing the bids or asks communicated by other traders, or that impedes the ability of a trader to interact or trade with any other trader.¹⁸⁸

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 discovery.¹⁸⁹ The trade execution requirements for swaps subject to mandatory central clearing are similarly designed to

¹⁸⁴ 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).

¹⁸⁵ In practice, DCMs have rarely been used to facilitate trading in swaps.

¹⁸⁶ CFTC Rule 37.9(a)(3), 17 C.F.R. § 37.9(a)(3).

¹⁸⁷ *Id.*, § 37.9(a)(3)(i).

¹⁸⁸ *See* CFTC, Guidance on Application of Certain Commission Regulations to Swap Execution Facilities (14 November 2013) at 1-3.

¹⁸⁹ 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*).

enhance price discovery and improve pre- and post-trade price transparency.¹⁹⁰ 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.¹⁹¹ Amongst other benefits, these requirements may serve to reduce search costs for traders seeking multiple competitive quotes, thereby reducing the potentially acute adverse selection and agency problems embedded within the dealer-intermediated structure of derivatives markets.

While the new derivatives trade reporting and disclosure requirements will undoubtedly provide the marketplace and regulators with *more* information, whether they will serve to promote greater market efficiency is ultimately something of a different question. As a preliminary matter, the these requirements do little to shine a light on 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 merely required to provide an “indication of whether a swap is collateralized”.¹⁹² The binary nature of this requirement 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. Each of these dimensions is relevant to the question of how large each trader’s exposure is to the idiosyncratic credit risk of its counterparty. These requirements will thus not provide traders with sufficiently granular 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 discovery and informational 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

¹⁹⁰ 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).

¹⁹¹ 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.

¹⁹² Real-Time Reporting Rule, Appendix A.

anonymity can be understood as inhibiting 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 MSPs¹⁹³, 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.

Perhaps counter-intuitively, the optimal policy response to the lack of publicly available information about the identity of counterparties and the precise terms of their contractual arrangements – in short, the dark side of derivatives markets – may not be to shine additional light on it. Indeed, as Kate Judge has observed, mandating further transparency in this context would actually serve to *increase* information costs for traders¹⁹⁴, thereby undermining the prospective benefits of mechanisms such as closeout netting and collateral designed to serve as substitutes for investments in information about the creditworthiness of derivatives counterparties. Once this veil of mutual ignorance has been lifted, we might expect some counterparties – namely dealers – to be in a better position to evaluate this new information. Recognizing this advantage, other traders may be reluctant to enter into trades with these counterparties. Viewed from this perspective, greater transparency may actually give rise to an adverse selection problem, thereby undercutting market liquidity and reducing the informational efficiency of derivatives markets.

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

¹⁹³ Which will not only have advance access to trading information but, crucially, will also know the identity of at least one of the counterparties.

¹⁹⁴ Judge (n 10) at 31-35.

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 US corporate bond markets was correlated with narrower bid-ask spreads and, crucially, did not result in lower trade volumes.¹⁹⁵ 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 requirements¹⁹⁶, suggesting that greater pre-trade transparency had diluted some of the ancillary economic benefits of market making.

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 in their capacity as structurally informed traders, and potentially incentivizing them to cut back on their market making activities. They can similarly be understood as undercutting the incentives of professionally informed traders to acquire, analyze, verify, and trade on new information. Indeed, it is precisely to protect the economic incentives of dealers and professionally informed traders 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 discovery, and contribute to greater informational *inefficiency* within derivatives markets.

(b) Macroprudential Surveillance of Derivatives Markets

A second objective of the *Dodd-Frank Act* reporting and disclosure requirements is to enhance the macroprudential surveillance of derivatives markets by the newly created Financial Stability Oversight Council and other members of the US supervisory and regulatory community.¹⁹⁷ One of the most important lessons of the financial crisis was

¹⁹⁵ Michael Goldstein, Edith Hotchkiss and Eric Sirri, “Transparency and Liquidity: A Controlled Experiment in Corporate Bonds” (2007), 20 *Review of Financial Studies* 235.

¹⁹⁶ Hendrik Bessembinder and William Maxwell, “Markets: Transparency and the Corporate Bond Market” (2008), 22 *Journal of Economic Perspectives* 217.

¹⁹⁷ Meehan and Rosenberg (n 171) at 72.

that the effective *microprudential* regulation and supervision of banks and other financial institutions must be combined with a rigorous and comprehensive assessment of potential *macroprudential* risks.¹⁹⁸ While the precise definition of macroprudential risk is still somewhat contested, it can be understood as encompassing at least two different types of risks.¹⁹⁹ The first are *cross-sectional* risks generated by various direct and indirect transmission mechanisms which create complex and often hard to detect interconnections among and between different financial markets and institutions. The second are *times series* risks generated by the procyclicality of the financial cycle, or arising by virtue of the interactions between financial and business cycles.²⁰⁰

Derivatives pose a number of potentially significant macroprudential risks. Perhaps most obviously, derivatives can generate cross-sectional risks as a result of direct counterparty exposures: with the financial distress or insolvency of one firm, operating within a particular jurisdiction or segment of the financial services industry, potentially undermining the stability of its derivatives counterparties in other jurisdictions or market segments. The risks stemming from this type of ‘domino’ effect are arguably magnified by the dealer-intermediated hub-and-spoken counterparty network at the heart of derivatives markets. The collective actions of derivatives traders can also generate indirect cross-sectional risks, such as those arising from the correlated withdrawal of liquidity by dealers during periods of market turmoil. Once again, given the highly concentrated dealer-intermediated structure of derivatives markets and the widespread use of derivatives across a broad range of (non-financial) sectors, such correlated withdrawals can have reverberations far outside the financial system.

Derivatives can also contribute to the procyclicality of the financial cycle. In order to understand how, we need to first understand how derivatives can generate high levels of

¹⁹⁸ See for example, Andrew Crockett, “Marrying the Micro- and Marco-prudential Dimensions of Financial Stability, speech given at the 11th International Conference of Banking Supervisors (18 September 2000); Claudio Borio, “Towards a Macroprudential Framework for Financial Supervision and Regulation?” (2003), 49 *CESinfo Economic Studies* 181; Samuel Hanson, Anil Kashyap, and Jeremy Stein, “A Macroprudential Approach to Financial Regulation” (2011), 25 *Journal of Economic Perspectives* 3, and Robert Hockett, “The Macroprudential Turn: From Institutional ‘Safety and Soundness’ to ‘Systemic Financial Stability’ in Financial Supervision” (2014), 15 *University of Virginia Law and Business Review* 201.

¹⁹⁹ See Armour et al. (n 112), chapter 23.

²⁰⁰ See Claudio Borio, “The Financial Cycle and Macroeconomics: What Have We Learnt” (2014), 45 *Journal of Banking and Finance* 182.

(implicit) leverage.²⁰¹ Imagine that Diana, our market savvy baker, enters into a total return equity swap on shares of Apple with a notional value of US\$10 million and semi-annual payments of 5%. In effect, Diana has contracted to pay her dealer US\$500,000 every six months, in exchange for which she will receive payments from the dealer equal to any capital appreciation and dividends on US\$10 million worth of Apple shares. If the price of Apple declines, meanwhile, Diana will be required to pay the dealer an amount equal to the value of this decline. From a basic economic perspective, this swap is identical to Diana simply borrowing US\$10 million from the dealer on margin at a 5% rate of interest and then investing the proceeds in Apple shares. And like all debt financing, the implicit leverage associated with derivatives means that relatively small changes in the market price of the underlying can have a significant impact on the liquidity and solvency of debtor counterparties.

That derivatives are essentially a form of debt should come as no surprise: what is idiosyncratic counterparty credit risk, after all, if not the exposure of a lender to the default of a borrower? Viewed in this light, the detailed contractual terms of a derivatives trade become clearly important determinants of the nature and extent of the implicit leverage. Thus, for example, the quality and amount of collateral that Diana (or the dealer) is required to post will, in effect, determine the extent to which Diana's obligations to the dealer (and vice versa) should be viewed as constituting *secured* debt. Similarly, the precise conditions under which Diana will be required to post additional collateral during the life of the contract will have important implications in terms of the allocation of risk between debtor and creditor counterparties. Where these collateral requirements, variation margin triggers, and other contractual terms are relatively debtor-friendly, this can ultimately be viewed as contributing to the build-up of potentially socially suboptimal levels of indebtedness within the financial system.

Against this backdrop, it is highly doubtful that the *Dodd-Frank Act* derivatives reporting and disclosure requirements compel dealers and other counterparties to report the type or granularity of information needed to support effective macroprudential surveillance. As described above, the trade-level data required to be reported to an SDR pursuant to Section 727 includes: the notional value of a swap; its price; whether one or both of the counterparties is a dealer, MSP, or financial entity, and whether the swap is collateralized.

²⁰¹ See generally, Frank Partnoy, "Financial Derivatives and the Costs of Regulatory Arbitrage" (1996-1997), 22 *Journal of Corporation Law* 211 at 225-226 and Jonathan Macey, "Derivatives Instruments: Lessons for the Regulatory State" (1995), 21 *Journal of Corporation Law* 69 at 82.

Notably, however, these requirements do not require ongoing reporting of gross market values or other measures of a counterparty's net exposure over the life of a swap. Nor – beyond the mere fact of whether a swap is or is not collateralized – do these requirements mandate reporting of economically important terms such as the amount of posted collateral, its composition and quality, or whether it can be reused or rehypothecated in connection with other transactions. Perhaps most importantly, these requirements do not compel detailed reporting of the triggers pursuant to which counterparties may be required to post additional variation margin. As a result, supervisors may find themselves with insufficient data for the purposes of measuring the level of leverage within derivatives markets, or identifying circumstances where contractual terms may facilitate correlated run-like behavior by derivatives and other counterparties as occurred in advance of the failure of Bear Stearns, Lehman Bros. and AIG.²⁰² To return to our earlier analogy, macroprudential supervisors may thus struggle to see anything beyond the tip of the derivatives iceberg. Appendix A identifies several contractual data points that regulators could theoretically collect through SDRs for the purpose of enhancing their macroprudential surveillance of derivatives markets.

(c) Mandatory Central Clearing of Standardized Derivatives

The *Dodd-Frank Act* trade reporting and disclosure requirements represent an important step in the evolution of derivatives regulation. Arguably more important, however, 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.²⁰³ The perceived benefits of central clearing flow principally from the mechanisms which clearinghouses employ to

²⁰² See Darrell Duffie, “The Failure Mechanics of Dealer Banks” (2010), 24:1 *Journal of Economic Perspectives* 51; Congressional Oversight Panel, “The AIG Rescue, Its Impact on Markets, and the Government’s Exit Strategy”, Oversight Report (10 June 2010) at 29, and Roe (n 146).

²⁰³ 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.²⁰⁴ 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 counterparty default.²⁰⁵ Second, clearinghouses seek to minimize 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 market 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.²⁰⁶ 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 clearing²⁰⁷, the governance and risk management of clearinghouses²⁰⁸, the potential for regulatory arbitrage²⁰⁹, the impact of central clearing on the resolvability of derivatives counterparties²¹⁰, and the potential knock-on effects of mandatory central clearing on

²⁰⁴ See Armour et al. (n 112), chapter 20.

²⁰⁵ Clearinghouses also use 'trade compression'. Trade compression is a process whereby economically redundant contracts are eliminated, thereby reducing the number of contracts outstanding between two counterparties without impacting their net positions.

²⁰⁶ Position portability procedures obligate surviving clearing members to assume the rights and obligations of trades entered into by defaulting clearing members.

²⁰⁷ 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.

²⁰⁸ 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.

²⁰⁹ 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.

²¹⁰ Richard Squire, "Clearinghouses and the Rapid Resolution of Financial Firms" (2014), 99 Cornell Law Review 857.

financial stability.²¹¹ This scholarship reflects a broad range of views regarding the desirability of mandatory central clearing of standardized derivatives. From the 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 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.²¹² Second, clearinghouses impose the same margin and collateral requirements on all trades in a given species of swap, thereby significantly reducing economic heterogeneity in collateral practices.²¹³ Third, central clearing involves the novation of contracts from the original counterparties to the clearinghouse itself. In what has become one of the most repeated phrases in finance, the clearinghouse 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 itself. 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. In effect, by reducing the noise generated by the dark side of derivatives contracts, central clearing can thus enhance the quality of the signal sent by derivatives prices. 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

²¹¹ 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].

²¹² See Meehan and Rosenberg (n 171) at 342.

²¹³ 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.

regulation of clearinghouses diverges *across jurisdictions*, legal and economic heterogeneity will continue to exist 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.²¹⁴ 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 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.²¹⁵ Ultimately, the heterogeneity generated by this regulatory divergence may serve to undercut the potential benefits of central clearing from the perspective of market efficiency.

(d) 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.²¹⁶ Basel III also

²¹⁴ See G-20 Leaders Statement: The Pittsburgh Summit (24-25 September 2009) at 9.

²¹⁵ See Yesha Yadav and Dermot Turing, “The Extra-territorial Regulation of Clearinghouses” (2015), *Journal of Financial Regulation* [forthcoming; working paper on file with author].

²¹⁶ 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 US, 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 “US Final Capital Rule”].

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).²¹⁷ 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 scenario, the NSFR is designed to constrain the reliance of banks on unstable, short-term sources of wholesale funding.²¹⁸

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).²¹⁹ 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.²²⁰ 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.²²¹ Importantly, the introduction of the CVA has coincided in the US with the removal of what was previously a 50% ceiling on the risk weights applied to derivatives exposures.²²²

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

²¹⁷ 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>.

²¹⁸ Id.

²¹⁹ 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 US Final Capital Rule.

²²⁰ BCBS (n 216) 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>.

²²¹ US Final Capital Rule at 62,134.

²²² Id. at 62,096. See also <http://www.usbasel3.com/tool/>.

qualifying clearinghouse.²²³ A qualifying clearinghouse for these purposes is effectively one which complies with the CPMI-IOSCO *Principles for Financial Market Infrastructures*.²²⁴ The equivalent risk weightings for trades cleared through non-qualifying clearinghouses, in contrast, range from 20-100% depending on the identity of the clearinghouse.²²⁵ Second, Basel III imposes a capital charge on clearing members on the basis of their exposure to a clearinghouse's default fund.²²⁶ 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.²²⁷ 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: i.e. the posting of initial and variation margin. 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.²²⁸ 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

²²³ 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.

²²⁴ *Id.* at 2. For further details, see Committee on Payment and Market Infrastructures (CPMI) and International Organization of Securities Commissions (IOSCO), *Principles for Financial Market Infrastructures* (April 2012), available at <http://www.bis.org/cpmi/publ/d101a.pdf>. Ultimately, one could ask whether the CPMI/IOSCO Principles are sufficiently detailed to make any assessment of 'compliance' truly meaningful.

²²⁵ 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'].

²²⁶ *Id.* at 7-10.

²²⁷ See *supra* Part 5(c).

²²⁸ For further information, see Basel II (n 225) at 26-47.

new framework imposing more onerous margin requirements on bilaterally cleared derivatives.²²⁹ 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 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.²³⁰ If adopted, these restrictions will limit the ability of dealers to use posted collateral for the purpose of financing their proprietary trading activities.²³¹ In the aggregate, these reforms seem likely to increase the demand for high quality liquid collateral assets, and thus the cost of collateralizing derivatives trades. What is more, they will be doing so at precisely the same time that new capital requirements are incentivizing greater collateralization of derivatives trades.²³²

²²⁹ See BCBS and IOSCO, “Margin Requirements for Non-Centrally Cleared Derivatives” (March 2015), available at <http://www.bis.org/publ/bcbs261.pdf>. These rules have recently been incorporated into US law; see Department of the Treasury, Federal Reserve System, Federal Deposit Insurance Corporation, Farm Credit Administration, and Federal Housing Finance Agency, Margin and Capital Requirements for Covered Swap Entities, Final Rule, 80 Fed. Reg. 74840 (30 November 2015) and CFTC, Margin Requirements for Covered Uncleared Swaps for Swap Dealers and Major Swap Participants, Final Rule, 81 Fed. Reg. 636 (6 January 2016). The SEC is expected to adopt equivalent rules in the near future.

²³⁰ 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.

²³¹ See FSB “Securities Lending and Repos” (n 230) at 16.

²³² 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. Viewed from this perspective, it is effectively the *opportunity* cost of holding collateral versus other assets.

Together with other recent regulatory reforms targeting derivatives markets, these new capital, liquidity, and collateral requirements will almost inevitably increase the costs of market making for derivatives dealers. 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.²³³ Compounding these costs, Manmohan Singh has estimated that the shift toward mandatory central clearing may require up to \$US200 billion in additional initial margin.²³⁴ 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 derivatives trades.²³⁵ The BCBS has also estimated that the new LCR will increase demand for high quality liquid assets by approximately €1.8 trillion.²³⁶

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 contracts.²³⁷ The probability of such a withdrawal has no doubt increased following the implementation of the so-called ‘Volcker Rule’²³⁸, 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

²³³ See Philipp Hale, Erik Luders, Theo Papanides, 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].

²³⁴ 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>.

²³⁵ 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>.

²³⁶ 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>.

²³⁷ 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>.

²³⁸ *Dodd-Frank Act*, Section 619.

traders.²³⁹ Importantly for the present purposes, should these reforms precipitate such a correlated withdrawal, this would seem highly likely to have an adverse impact on market liquidity and, with it, informational efficiency. This serves to highlight 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.

(e) 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.²⁴⁰ As we have seen, private actors such as dealers, interdealer brokers, ECNs, and ISDA have each played a pivotal role in the emergence, development, and ongoing evolution of derivatives markets. At the same time, however, and as we might expect, these private actors do not always possess the strongest incentives to respond to the myriad of information, agency, and other problems encountered within these markets.²⁴¹ Dealers, for example, have sometimes abused their market power and position as structurally informed traders to exploit financially unsophisticated clients.²⁴² And while hard data is scarce, it is likely that a significant fraction of historical derivatives trading activity has been significantly under-collateralized, thereby generating risks to both institutional and broader financial stability.²⁴³ In theory, the failure of private actors to effectively respond to these problems opens a window for public regulatory intervention – a window that

²³⁹ 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.

²⁴⁰ 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 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.

²⁴¹ See Awrey (n 240) at 174-180 for a more detailed description of these problems.

²⁴² See for example the recent swaps mis-selling scandal in the UK (n 108).

²⁴³ 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>.

policymakers have been quick to jump through in the wake of the financial crisis. Ideally, however, this impulse should be constrained in favor of a more rigorous examination of the feasibility, potential costs and benefits, and likely behavioral impact of public regulatory intervention.²⁴⁴

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 indicators 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.²⁴⁵ Under Hart and Zingales' proposal, where CDS spreads on a bank's junior term debt exceeded specified thresholds, this would trigger a 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"²⁴⁶ alerting regulators to potential institutional instability.

The desirability of Hart and Zingales' proposal is clearly contingent on the quality of the signal sent by CDS prices.²⁴⁷ As we have already observed, however, 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. During periods of market disruption, an observed increase in CDS spreads may therefore reflect a *systemic* 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. This puts

²⁴⁴ 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.

²⁴⁵ See Hart and Zingales (n 76).

²⁴⁶ *Id.* at 455.

²⁴⁷ 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. Even here, however, there are important questions surrounding the feasibility of conducting these tests on multiple banks, and within a relatively short timespan, in the context of an unfolding crisis.

prudential supervisors in the difficult position of having to distinguish between those banks which actually require recapitalization in order to avoid potential solvency problems, and those which – while also caught up in the system wide adverse selection problem – are otherwise fundamentally sound. Out of an abundance of caution, supervisors might reasonably elect under these circumstances to require *all* systemically important banks to raise fresh capital²⁴⁸: 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. These CDS should also be subject to mandatory exchange trading²⁴⁹, 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.²⁵⁰ Ultimately, however, even these relatively interventionist measures cannot completely eliminate the possibility that bank CDS prices may be the least informative at the precise moment at which 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 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 adopting policies – e.g. capital, liquidity, collateral, or other requirements – which threaten to undermine market efficiency or stability. It is not

²⁴⁸ As the US 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.

²⁴⁹ 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.

²⁵⁰ In practice, of course, dealers might also represent significant sources of liquidity as both buyers and sellers within exchange-traded derivatives markets.

inconceivable that dealers would then wield this leverage in order to lobby for the adoption of regulatory requirements which do not impose significant costs 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 liquid interest rate and currency derivatives, or the CDS written on the debt of systemically important banks envisioned by Hart and 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 of member banks, 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 likely require significant changes to the scope of its authority under the *Federal Reserve Act*²⁵¹, 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. 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 what Perry Mehrling has described as the Fed's 'dealer of last resort' function in the context of both the recent and previous financial crises.²⁵²

²⁵¹ ch. 6, 38 Stat. 251, 12 U.S.C. ch. 3.

²⁵² See Mehrling (n 122).

While this option might at first glance seem like a dramatic expansion of the role of the state within ostensibly private markets, it is worth making three preliminary observations. First, as illustrated by large scale interventions of the US Treasury and Federal Reserve during the recent crisis, states already perform this role during periods of systemic instability. What is more, formalizing this role along with the credible threat of *ex post* sanctions – e.g. compensation clawbacks and personal liability for officers and directors – could help constrain the moral hazard associated with the near inevitability of state intervention in these circumstances.²⁵³ Second, states arguably possess a comparative advantage over private derivatives dealers in terms of their ability to make markets in derivatives. Specifically, the size of their balance sheets, the absence of binding solvency or liquidity constraints, and the legal authority to print money puts states in an advantageous position to provide the missing markets for liquidity during periods of financial instability. The state is thus able to provide credible insurance against replacement risk. Finally, a well designed dealer of last resort mechanism presenting something of a ‘win-win’ proposition. If the threat of correlated dealer withdrawal or failure is credible, the dealer of last resort mechanism can play an important role in stabilizing derivatives markets. If the threat is not credible, meanwhile, the distortions generated by state intervention into private markets are likely to be minimal as few, if any, market participants will take advantage of this mechanism.

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

7. CONCLUSION

²⁵³ For a compelling argument in favour of the imposition of these mechanisms (and in particular personally liability for officers and directors), see John Armour and Jeff Gordon, “Systemic Harms and Shareholder Value” (2014), 6:1 *Journal of Legal Analysis* 35.

Derivatives are different. These differences stem from the executory nature of derivatives contracts, the dealer-intermediated structure of the markets in which they trade, and the role of derivatives dealers as the primary sources of market liquidity. These differences generate information, agency, coordination, and other problems not generally encountered within public equity markets. These problems have led to the emergence of a unique constellation of institutional arrangements which – in theory at least – serve to promote derivatives market efficiency. To date, however, the contribution of these mechanisms toward derivatives market efficiency has received surprisingly little attention from scholars or policymakers. Reflecting this gap in our understanding, the 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 article has been to close this gap.

Ultimately, perhaps the most important contribution of this article is to identify avenues for further theoretical and empirical research. As a preliminary matter, there is still a paucity of empirical research examining how (and how quickly) derivatives markets other than those for CDS impact new information into prices. Given the potentially significant differences in terms of the information sensitivity of the underlying assets, the ability of traders to identify traders with superior information, and other factors, we must be careful not to extrapolate too far on the basis of existing evidence. Second, there is still much to learn about the more granular operation of the mechanisms of derivatives market efficiency. How much information do traders actually glean off the trading activities of derivatives dealers? From interdealer brokers and ECNs? And how – if at all – do traders take into account the economic and legal heterogeneity of derivatives contracts in the process of determining prices? Third, we are still largely in the dark about the dark side of derivatives markets. How well are derivatives markets collateralized? How heterogeneous are the contractual terms surrounding, for example, variation margin triggers? And how do these terms differ between bilateral and centrally cleared markets, and across jurisdictions? Finally, we still have a long way to go to understand the impact of recent regulatory reforms on derivatives trade volumes, market structure and liquidity, and informational efficiency. The answers to these questions are vital if we are to better understand the role derivatives play in modern financial markets and how best to approach their regulation.

APPENDIX A

Contractual Data Point	Reported As
Applicable Law	
1. The jurisdiction of the <i>law governing the contract</i> (typically New York or the UK).	[e.g. NY]
2. The <i>jurisdiction of incorporation</i> of each of the counterparties (for the purposes of determining relevant contract, property, and insolvency rules).	[e.g. NY, UK]
Assignment	
3. Whether the <i>contract is assignable</i> by one or both parties (for the purposes of determining whether counterparties may ‘run by assignment’ as took place in the case of Bear Stearns. This information also ties in with data point 9 below as the ability of a counterparty to return any pledged collateral upon assignment will be a function of whether it has re-used or re-hypothecated this collateral).	[Y/N]
Closeout Netting	
4. Whether the contract is subject to standard ISDA provisions in relation to closeout netting (for the purpose of calculating net cash flows upon default – assuming information about other relevant exposures is available).	[Y/N]
Collateralization	
5. Whether the collateral is posted pursuant to a title transfer or security interest system.	[TT/SI]
6. Whether one or both counterparties are required to post an <i>initial amount</i> (IA) at the outset of a contract (this information would ideally be supplemented by information about the amount and quality of pledged collateral, along with the historical correlation between the collateral assets and underlying).	[Y/N]
7. Whether one or both counterparties are required to post <i>variation margin</i> (VM) over the duration of the contract (again, this information would ideally be supplemented by information about the amount, quality, and correlations of pledged collateral – if specified <i>ex ante</i>).	[Y/N]
8. The <i>timing</i> for the calculation and delivery of VM (e.g. daily, weekly, quarterly, etc.).	[D/W/Q]
9. Any <i>triggering events</i> which have the effect of obligating a party to post VM – e.g. changes in the market value of the underlying or downgrades in the credit rating of either a counterparty or, in the case of credit derivatives, underlying reference entities or obligations (for the purpose of determining whether a counterparty may be subject to pro-cyclical collateral calls as took place in the case of AIG Financial Products).	[e.g. CR downgrade]
10. Whether one or both parties have permitted the <i>re-use or re-hypothecation</i> of pledged collateral (this information ties in with points 1 and 2 above as the treatment of pledged collateral varies by jurisdiction).	[Y/N]
11. Measures of the <i>composition</i> of posted collateral.	[e.g. percentage of collateral of different asset classes]
12. Measures of the <i>quality</i> of posted collateral.	[e.g. collateral baskets used by central banks in connection with access to the discount window]