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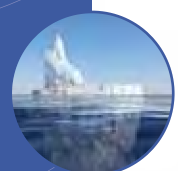

MARKET OVERSIGHT FOR CAP-AND-TRADE:

EFFICIENTLY REGULATING THE CARBON DERIVATIVES MARKET

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MARKET OVERSIGHT FOR CAP-AND-TRADE:
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This paper is the third in a five paper series on US cap-and-trade design

Craig Pirrong

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Introduction

The original concept of cap-and-trade envisioned that the total amount of carbon dioxide (CO_2) emissions would be capped and rights to emit would be traded. But it is inevitable that there will be demand to trade instruments other than emissions rights themselves. Specifically, there will be a demand to trade derivatives on emissions rights.

This has raised alarms in Congress, particularly in the aftermath of the energy price spike of 2008 and the financial crisis of 2008-2009. Numerous voices inside Congress as well as outside have laid the blame for these episodes squarely on derivatives markets. As a result, the current regulatory environment is extraordinarily hostile to derivatives generally, and to carbon derivatives particularly. Indeed, several proposals have been introduced to constrain or eliminate various types of derivatives trading, including proposals to:

- Impose limits (e.g., speculative limits) on the uses of these products, or on the amount of trading certain kinds of entities can undertake;

- Restrict where and how derivatives are traded, with a decided preference for trading on organized exchanges;

- Constrain arrangements for the allocation of performance risk, with a decided preference for "clearing" derivatives transactions through central counterparties ("CCPs");

- Ban certain derivatives altogether.

The American Clean Energy and Securities Act (ACESA), passed by the US House of Representatives in June, includes provisions mandating many of these restrictions.[1]

All of these proposals are misguided, some extremely so. They are predicated on a widespread misunderstanding of what derivatives are, how they work, and the reasons that firms trade them. These are, no doubt, provocative statements. In this chapter I will support them by going back to basics, describing what derivatives are, why they are used, how they are traded, the abuses they are subject to, and the most efficient ways to constrain those abuses.

This chapter is organized as follows: Section 2 gives an overview of what derivatives are and how they are traded. Section 3 discusses derivatives markets abuses, such as manipulation and excessive speculation, and Section 4 evaluates the potential vulnerability of carbon markets to these

[1] Text of this bill can be found at: <http://energycommerce.house.gov>.

abuses. Section 5 summarizes the ACESA provisions related to derivatives, and Section 6 evaluates the desirability of these provisions. Section 7 provides a brief summary.

Derivatives and Derivatives Markets

Derivatives are financial instruments. They are sometimes considered a modern innovation, even though they have been traded for millennia. It is indeed the case that the scale and scope of derivatives trading has mushroomed in recent years, but these products are as old as financial trading itself.

The name "derivative" gives a sense of their nature. These are financial instruments that have a cash flow that is derived from some "underlying" instrument. For example, a gold forward contract—an agreement to buy or sell gold at a future date—has a cash flow that is dependent on—derived from—the price of gold. Another name for derivative—"contingent claim"—conveys the same idea. The payoff to a derivative is contingent on the price of some underlying instrument.

The instruments that underlay derivatives contracts were once limited to a relatively narrow range of physical commodities, such as corn or gold. Beginning primarily in the early 1970s, however, derivatives have been introduced on just about everything conceivable, including energy commodities, financial instruments such as stocks and bonds, and even the weather.

There are a variety of basic types of derivatives. The most fundamental type of derivative is a forward contract. For instance, in July 2009, Mr. S might enter into a contract to sell oil to Ms. B for delivery in January 2010 at a fixed price of $70/barrel. This agreement to sell in the future at a fixed price is a forward contract. Typically, the buyer and the seller agree on a forward price such that the value of the contract is zero, so no money changes hands when the contract is signed.

Another, slightly more complicated derivatives product is an option. Whereas a forward contract creates a binding legal obligation to the buyer and seller, an option gives the buyer a choice. For instance, Ms. B might enter into a call option contract to buy oil in January from Mr. S at a fixed price of $70/barrel. If the price of oil in January is above $70, say $75, Ms. B will exercise her option to buy at $70 and pocket a $5 payment. In practice, she may realize this profit by buying at $70 and immediately selling into the market at $75.

In contrast, if the price of oil in January is less than $70, she will not exercise her option. Since options have a heads-I-win-tails-I-don't-lose character, a buyer is willing to pay a positive price for the option, and the seller (who faces a heads-I-lose-tails-I-don't-win situation) will only enter the contract if paid a positive price upfront. This upfront payment is called the option premium, and it depends on the characteristics of the option (e.g., its time to expiration, the fixed "strike" price of the option, the type of option) and on the characteristics of the underlying instrument (most notably, its current price and price volatility).

Forwards and options are the basic derivatives, but more complicated products can be created by putting together these basic pieces like Legos. A swap, for instance, is effectively a bundle of forward contracts. Contracts can be created with various option features, and more complicated options, such as options that depend on the path of the underlying price over time rather than at a single point in time are also quite common.

Derivatives are Janus-like, because they can be used for very different purposes. Indeed, these purposes sometimes seem antithetical, but they are in fact symbiotic. For instance, derivatives can be used to reduce risk exposure, that is, to hedge. A natural gas producer concerned that a fall in the price of gas to $3/MMBtu might render him unable to repay debt to his bank might sell a forward contract on natural gas for delivery at the prevailing market price of $4/MMBtu. If the price of gas indeed falls to $3, the producer receives a profit of $1/MMBtu on his forward contract (he sold at $4 and can repurchase it for $3), which, when added to the $3 he gets when he sells his gas, generates a cash flow of $4/MMBtu that is sufficient to meet his debt.

In the above example, to get adequate protection, the producer foregoes the upside; if the price of gas were to rise to $6, for instance, the producer would lose $2 on his forward sale, leaving him with a $4 net. That is, a forward contract hedger protects on the downside by giving up the upside, and effectively locks in a price of $4—the prevailing forward price in the market. Alternatively, the producer could buy a put option that gives him the right (but not the obligation) to sell gas at $4/MMBtu. This would put a floor on the price that the producer receives equal to $4 minus the price paid for the put; unlike with a forward sale, however, the put purchase allows the producer to profit from price increases.

Although derivatives can be used for hedging, they can also be used for speculation. If I believe that the price of oil is going to rise, I can buy an oil forward contract. If I am right, and the price of oil exceeds the forward price I locked in, I make money. If I am wrong, and the price of oil falls, I lose money. Therefore, whereas a hedger trades derivatives to reduce risk exposure, a speculator willingly adds to risk exposure.

There is a common tendency to treat hedging as a virtuous use of derivatives markets and speculation as a vice akin to gambling. But, in this instance, virtue and vice are codependents. The hedger needs somebody to take the opposite side of his trade: a buyer (seller) if he is a seller (buyer). Perhaps there is another hedger with a mutually coincident need, in which case hedger can trade with hedger. But at any instant of time, and even over longer time periods, the buying hedging and selling hedging interests need not exactly offset. For instance, more firms may want to sell forward as a hedge than wish to purchase at a price that reflects the expected value of the underlying at the derivative's expiration date. This would tend to depress the forward price, which provides a profit opportunity to a speculator willing to bear the associated risk. Thus, speculators facilitate hedging by taking on the risk that hedgers wish to shed.

Put differently, derivatives markets are risk transfer markets. They facilitate the transfer of risk from those exposed to it but who do not wish to bear it (hedgers) to others not naturally exposed to it but willing to bear it (speculators). Trades between speculators and hedgers are transactions between consenting adults who wish to transfer risk at a mutually beneficial price.

Derivatives are traded in a variety of ways. Some derivatives are traded on organized exchanges, such as the Chicago Mercantile Exchange or Eurex. For instance, forward contracts—typically called "futures" contracts"—are traded on both exchanges. Organized exchanges operate centralized markets where buyers and sellers submit orders. These orders are matched, and prices determined in an auction process. Historically, these were face-to-face "double" auctions conducted on exchange trading floors. Increasingly, however, the auctions are computerized.

The prices determined in exchange auctions are transparently observable. Since individuals with information can buy or sell derivatives, their trades affect prices and cause these prices to reflect their information. In this way, derivatives trading can aggregate information dispersed among myriad market participants, and prices reflect this aggregated information. In this way, derivatives markets contribute to "price discovery."

Exchanges perform a variety of other functions in addition to operating auction markets. They create derivatives contracts with standardized terms. For instance, just as Henry Ford said you can buy a Model T in any color as long as it is black, you can buy any kind of oil future on the New York Mercantile Exchange as long as it is for delivery of 1000 barrels of light sweet crude oil in Cushing, Oklahoma.

Such standardization has advantages and disadvantages. On the one hand, it tends to contribute to liquidity by concentrating trading activity on a single benchmark contract. On the other hand, it precludes market users from customizing terms to accommodate their specific preferences and information.

Modern exchanges also typically operate "clearinghouses," or enter into arrangements with third parties whereby their contracts are cleared. In a cleared market, once Mr. S and Ms. B have agreed to a price, the trade is submitted to the clearinghouse. After clearing, Mr. S and Ms. B have no contractual relationship. Instead, Mr. S has a contract to sell to the clearinghouse, and Ms. B has a contract to buy from the clearinghouse. Thus, even if Mr. S does not perform on his contractual obligation, Ms. B will receive all due her; the clearinghouse makes her whole.[2]

That is, the clearinghouse becomes the seller to every buyer and the buyer to every seller. This means that an individual is not subject to the risk that the party with whom she originally dealt will perform on his contractual obligation. This makes cleared derivatives fungible; the identities of buyer and seller are irrelevant.

Exchanges also engage in oversight of those who trade on their markets. Since they operate centralized markets, they can also collect—and provide to regulators—information about all trading activity, and the positions held by all market participants.

The other major venue for derivatives trading is the over-the-counter (OTC) market. The OTC market is not centralized; it is decentralized. Buyers and sellers can interact in a variety of ways. They can negotiate deals by phone. They can use the services of brokers. They sometimes use electronic platforms that bear some similarities to exchanges.

Moreover, OTC derivatives are not *necessarily* standardized by a central organization like an exchange, although many OTC derivatives are highly standardized. Traders in OTC markets can customize the terms of "bespoke" transactions to suit their particular hedging or speculative objectives. The type of contract that can be traded OTC is limited only by the imagination of market participants and the ability to find a willing trading partner.

[2] This is an overly simplified description of how clearing works. In practice, it is far more complicated. I will address some of these complications below. For more detail, see Telser (1981), Edwards (1983), Pirrong (2008, 2009).

Most OTC derivatives are not cleared (although OTC clearing is becoming more common, especially in energy derivatives). As a result, if Mr. S and Ms. B do an OTC deal, they are each at risk to the other's non-performance for the life of the transaction (i.e., until it matures or they agree to terminate it by mutual consent). Such deals are said to be "bilateral" because the two original trading partners remain contractually committed throughout the life of the trade, in contrast to a cleared transaction.

This means too that bespoke deals are not fungible. Whereas because of clearing I can exit an exchange traded futures position by finding *anyone* willing to take the other side of the trade, I can exit a bilateral deal only by trading with my original counterparty, or by finding a third party whom my original counterparty is willing to accept in my place.

The prices of most OTC deals are not transparently observable, although some transactions prices and some information on tradable prices are disseminated electronically and through brokerages. Moreover, there has been no centralized collection of trading and position data in the OTC markets. The paucity of price and position transparency (as compared to exchanges) has led some to apply the pejorative label "dark markets" to OTC dealings.

Derivatives Market Abuses

Like any tool, derivatives are subject to misuse and abuse. Two widespread concerns are "manipulation" and "excessive speculation." The former term is employed far too promiscuously, but derivatives markets can be manipulated. In contrast, excessive speculation is a far more dubious concept.

First consider "manipulation." The abandon with which this term is used is best illustrated by the words of a Texas cotton broker testifying before the Senate in 1928: "The word 'manipulation' . . . in its use is so broad as to include any operation of the cotton market that does not suit the gentleman who is speaking at the moment"(United States Senate, 1928). That said, there are certain kinds of conduct that are abusive and fairly called manipulative in the sense that they cause market prices to deviate from their competitive values.

The most common, and historically important kind of manipulation is a market power manipulation, also known as a corner or squeeze.[3] In a corner, a single trader or colluding group of traders accumulates a long forward position that is larger than the amount of the commodity that can be supplied at the competitive price. For instance, a trader may purchase 20 million bushels of soybean futures when there are only five million bushels of soybeans available in the delivery location at the competitive price. Additional supplies can be brought to the delivery location, but this involves diverting soybeans from other markets, and this diversion is costly.

The large "long" can present the "shorts" who have sold the 20 million bushels of futures with a choice: they can incur the cost of diverting soybeans from other markets, or buy back their obligations to deliver at a premium above the competitive price that is slightly below this cost of diversion. If the cost of diversion is sufficiently high, the large long can extract a healthy premium from the shorts. Indeed, the large long will typically take delivery of more than the five million bushels available in the delivery market, in order to require the sellers to make even more inefficient diversions at even higher costs in order to extract an even higher premium from the remaining sellers. This causes the price of the manipulated future to rise precipitously relative to the prices in other locations, and relative to the price for delivery at subsequent dates.

Once the corner is over, the large long is likely to release the excessive supplies into the market,

[3] See Pirrong (1996) for an extended treatment of the subject.

thereby causing a crash in prices. This dumping of supplies, and the associated price crash, is sometimes referred to as "burying the corpse." Thus, a corner leads to a distinctive pattern in prices. The manipulated price rises relative to the prices of related commodities (i.e., the price at non-delivery locations), and then collapses after the corner is over.

This conduct is an exercise of market power that distorts prices and leads to inefficient movements of the commodity. Since it is inefficient, it is legitimately considered a market abuse—a manipulation.

Another kind of manipulation involves the dissemination of false rumors or of improper price information. This last kind of manipulation is especially problematic when the misreported prices are used to determine the payoffs on contracts.

Yet another kind of manipulation involves concentrated trading activity near the settlement of a futures contract. Some futures prices, such as the price of NYMEX natural gas futures, are used to determine the final prices of OTC derivatives transactions. A firm with a large position in an OTC derivative may earn a larger profit if the final settlement price of the NYMEX natural gas futures contract is lower. That party would have an incentive to drive down the final settlement price of the NYMEX future, and it might be able to accomplish this by selling excessive quantities during the period of time used to establish the NYMEX settle. This "slamming the close" manipulation would tend to distort final settlement prices.[4]

All of these kinds of conduct can happen in derivatives markets, and do occur in fact, although their frequency is a matter of considerable dispute. Regardless of their frequency, they undermine both the price discovery and risk management functions of derivatives markets. Thus, they are legitimate sources of regulatory and legislative concern, although considerable care should be devoted to determining the efficient way to reduce the frequency and severity of manipulations.

Since market power manipulations typically involve the accumulation of a large position, one way to combat them is to impose limits on the sizes of positions that market participants can hold. Unfortunately, it is efficient for some market participants to hold large positions for legitimate hedging or speculative reasons, and position limits can constrain these efficient trades. Moreover, the susceptibility of a market to manipulation varies over time due to changes in market conditions (e.g., a drought that reduces available supplies), but position limits are difficult to adjust to such changes in a discriminating fashion.

Regulators—including exchanges—can also attempt to intervene to prevent manipulations when they are in progress. However, these interventions are often too little, too late, since manipulations can develop very quickly, and regulators may not become aware of them until price distortions are already manifest.

Easterbrook (1986) and Pirrong (1996, 2004) argue that the most effective way to deter market power manipulations is to impose penalties after the fact. Such *ex post* deterrence works best when the probability of detection is very high and the culprit has the financial wherewithal to compensate those he harms. Both conditions are likely to exist in market manipulations, including market power manipulations. For instance, the price distortions that result from a corner, and the associated distortions in the flow of commodities, are quite distinct and perfectly observable after the fact; the burying the corpse effect is particularly distinctive.[5]

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[4] For an example of an alleged "slamming" of the close, see US Federal Energy Regulatory Commission (2007).

[5] For an early, cogent legal application of these ideas, see the opinion of Mr. Justice Taft in Board of Trade of City of Chicago v. Olsen 262 US 1 (1923).

As a result, Easterbrook and Pirrong argue that it is possible to detect manipulations with very high probability after the fact, and additionally, that wrongful accusations of manipulation are easily shown. Moreover, since manipulators necessarily require large financial resources to accumulate large derivatives positions, they typically have the wealth required to compensate those harmed by the manipulation. Thus, the conditions for *ex post* deterrence are almost optimal for derivatives manipulation.

Indeed, this is true even in the allegedly scary "dark" OTC markets. For example, consider events in the propane market in 2004. Propane was traded almost exclusively OTC and was one of the most obscure, darkest corners of the OTC energy markets. Energy giant BP squeezed the propane market in February 2004 and market participants noticed. Since somebody is harmed by price distortions, somebody *always* notices a manipulation; as Judge Easterbrook has written, the undetected manipulation is an unsuccessful manipulation. In this case, the government also noticed and prosecuted BP criminally. BP entered into a deferred prosecution agreement under which it admitted guilt and agreed to pay tens of millions in fines and restitution.

Unfortunately, as shown by Pirrong (1996, 1997), courts and regulators in the United States have routinely made mistaken judgments in manipulation cases. As a result, they have undermined the efficacy of *ex post* deterrence, including legal action by regulators and by private plaintiffs.

Whereas market manipulation is a source of legitimate concern, excessive speculation is the subject of much thoughtless and misguided analysis. Whenever prices rise or fall dramatically, speculators are routinely blamed for causing prices to deviate from the levels justified by market fundamentals. These arguments are typically based on severe logical fallacies and usually devoid of evidence. For instance, during and subsequent to the oil price spike of 2008, it was widely asserted that purchases of derivatives by speculators introduced additional, spurious demand into the market, thereby driving prices above the level justified by fundamentals.

Such arguments are predicated on a serious misunderstanding of how derivatives markets work. Most buyers of futures contracts sell without taking delivery, and others who enter into derivatives positions that profit from higher prices utilize contracts that do not permit them to take delivery at all.[6] Thus, these speculators do not typically demand the physical commodity, and indeed are selling claims on the physical commodity as expiration nears. Thus, if their buying prior to expiration tended to cause prices to increase, their selling at expiration would tend to have the offsetting effect.[7]

If speculators were indeed to cause prices to rise above the level justified by fundamentals, they would end up owning large amounts of the actual commodity. If they are willing to pay a price that exceeds what other market participants believe is justified, those other participants would be more than willing to sell the actual commodity to them. Thus, when looking for evidence of speculative distortion in prices, it is necessary to look not at prices alone, but at speculative holdings of the physical commodity.

[6] So-called "cash settled" or "financial" derivatives contracts do not permit the buyer to take delivery. Instead, they make cash payments to buyer and seller based on a formula that utilizes prices from other contracts, usually a delivery settled futures contract. In essence, financial derivatives are "bets" on prices, although they can be used to hedge other risks.

[7] This has long been recognized. For instance, disputing the theory that "speculation in futures is an organized attempt to suppress prices to producers," the United States Industrial Commission noted: "First. Because every short seller must become a buyer before he carries out his contract. Second. Because, so far as spot prices are concerned, the short seller appears as a buyer not a seller, and therefore, against his own will is instrumental in raising prices." United States Industrial Commission (1901).

For instance, one notable example where speculators did arguably distort prices involved the Hunt brothers in the silver market in 1979-1980. These speculators bought large quantities of silver futures, but to keep prices up they also had to take ownership of vast quantities of silver (Williams, 1995). Indian brides in their thousands melted down the silver in their dowries, whence it was shipped to Switzerland, Britain, and the US for delivery to the Hunts. Buried in an avalanche of silver, even the fabulously wealthy Hunts were unable to pay for it all, and when at the end of their financial rope they sold their silver, prices plummeted.

This example shows that speculators *can* distort prices, but it also illustrates that quantity distortions are the tell-tale sign of such a distortion. Such quantity distortions have been notably absent in other episodes of speculative excess, most notably in the energy (and other commodity markets) in the summer of 2008. Although speculation was widely blamed for the rise in energy prices, as well as for the prices of other commodities in 2008, these markets did not exhibit the inflation of inventories that are an important symptom of price distortions.

The Potential for Abuses in the Carbon Derivatives Market

A major regulatory concern in carbon markets is their susceptibility to manipulation. First consider the potential for a market power manipulation. Market power manipulations in commodities such as soybeans or copper typically exploit the costs of enhancing deliverable supplies. Physical commodity futures contracts typically specify that delivery can occur at a small number of locations. It is often physically possible to enhance supplies in this market in response to a corner, but due to the costs of transportation, and the costs of distorting the flow of commodities, it is costly to do so. The manipulator exploits this cost by demanding a premium to sell his contracts that is just below the cost that those who had sold contracts to him would incur to bring additional deliverable supplies to market. Thus, physical commodity market corners exploit the costs of moving commodities.

Put differently, transportation costs and other frictions make the supply curve of deliverable commodities slope up. The manipulator can cause the price of the deliverable to rise by forcing the market up that supply curve. In theory, such costs are completely absent in carbon markets. Carbon emissions rights will be represented by electronic entries in a central registry that are transferrable at a trivial cost. Thus, it would appear at first blush that a corner or squeeze is not possible in carbon markets.

Reflection on the experience in another market gives pause, however. Specifically, squeezes occur periodically in government securities markets, including the market for US Treasury notes and bonds. Just like carbon emissions permits, ownership of Treasury securities can be transferred electronically at trivial cost, yet squeezes occur nonetheless.

These manipulations occur because there are other frictions in the market. In particular, some owners of Treasury securities do not actively participate in the secondary market. They purchase securities for investment and hold these instruments to maturity. Not participating actively in the market, these traders may not make their securities available to those needing to make delivery against Treasury derivatives even when prices become distorted due to a squeeze. That is, the supply of Treasury securities available for delivery may slope up because some owners are lured into the market only when price distortions are substantial.

In other words, the "float" in a particular Treasury security may be far less than the amount outstanding.[8] A trader who amasses a position that

[8] The "float" is the amount of the security actively traded in the market, and readily available for purchase or sale.

is larger than the float, but smaller than the total amount outstanding, can squeeze the market.[9]

It is likely that a similar phenomenon will arise in carbon derivatives markets. Many market participants will buy and hold emissions permits to meet their own emissions needs, and not trade these permits actively. For instance, a utility or cement plant that knows it needs a certain amount of permits over the next year may acquire these at auction, or via some other allocation mechanism, and then hold them and surrender them as needed, and not participate actively in the secondary market. This would tend to restrict the "float" of permits to an amount below, and perhaps well below, the total amount outstanding. Just as in Treasury markets, a derivatives market participant could exploit this limited float to squeeze the market.

This prospect may also arise because it is highly likely that emissions permits will be used as collateral in loans, just as Treasury securities are widely used as collateral in so-called "repurchase" ("repo") trades. That is, owners of permits will almost certainly use them as collateral for short-term financing transactions; these secured transactions can be a very inexpensive way of financing the acquisition of permits.[10] However, as Treasury market experience demonstrates, such repo transactions can be used to amass forward positions that exceed the available float, and thus to execute squeezes. Just as repo squeezes are quite common in most government securities markets (including the markets for non-US government securities), the prospect for repo squeezes in emissions markets is a very real one.

Moreover, it should be noted that the amount of permits outstanding will drop to very low levels even in competitive markets, making the markets vulnerable to squeezes at such times. When economic activity is robust, the demand for permits will be high and it will be efficient to draw down the supply of permits in order to meet demand. Under these circumstances, the supply of available permits may fall to very low levels, and the float will be lower than that. The market is most vulnerable to a squeeze during these low-supply periods.

The timing and frequency of these low supply periods will depend in part on market design, and most notably on the frequency of permit issuance. If, for example, permits are issued annually, it will typically be optimal to draw down holdings of permits to zero immediately before the issuance of the next vintage; this is true even if permits can be carried over from one period to the next (Pirrong, 2009). This is similar to what happens in agricultural markets, where inventories are drawn down to low levels immediately before the harvest. Thus, the carbon market may be particularly susceptible to squeezes right before the issuance of a new vintage, when that issuance occurs relatively infrequently (e.g., annually).

Squeezes may occur even when permits are issued more frequently, say monthly or even weekly. Even under these circumstances, there will be times when holdings of permits are drawn to very low levels, making the market vulnerable to the exercise of market power. The primary difference is that these occurrences will not be as frequent when permits themselves are issued more frequently.

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[9] Examples of Treasury squeezes include the infamous Solomon Brothers squeeze of the Two Year Treasury Note in 1991, and squeezes of the 30 Year Treasury Bond (allegedly by Japanese investors) in the mid-1980s. Squeezes of Treasuries became so chronic in the mid-2000s that senior Treasury officials publicly warned market participants to crack down on the practice or face aggressive regulatory action. The Federal Reserve Bank of New York also warned market participants about squeezes.

[10] For instance, a utility could buy a permit, and then engage in a repurchase transaction with a bank. Under the repo agreement, the utility would sell the permit to the bank today at an agreed price, and then contract to buy it back in a month, say, at a different (and likely higher) price. The difference between the buy and sell prices in the transaction would determine the effective interest rate in the transaction. In the transaction, the utility gets cash today and pays out cash when the repo agreement matures. This is the same cash flow pattern as in a loan. The permit serves as collateral. If the utility fails to buy the permit back as agreed, the bank can sell the permit.

The form of permit allocation may also affect vulnerability to squeezes. If permits are auctioned, the entire auctioned amount is in the float at the time of the auction. In contrast, if permits are allocated to end-users directly, the float will be smaller, perhaps dramatically so.[11] Thus, the market is most vulnerable to market power manipulation when permits are allocated rather than auctioned. The market is least vulnerable to manipulation when permits are auctioned relatively frequently.

The other types of manipulation, such as slamming the close or the spreading of false information may also occur in carbon markets. In particular, if exchanges introduce carbon futures contracts, and settlement prices of these contracts are utilized to determine the payoffs on other contracts, some parties may have the incentive and ability to distort these settlement prices by slamming the close or other means.

As noted in section 3 above, these abuses are best deterred *ex post*, rather than through the use of position limits, or by attempting to intervene in the market while a manipulation appears to be in progress. These manipulations will leave distinctive evidence in the form of characteristic price distortions. Moreover, the parties that could profit from such schemes are likely to be financially solvent and therefore not immune to punishment. Thus, conditions for *ex post* deterrence being efficient hold in carbon markets, and public policy should be directed towards strengthening it.

My skepticism about the likelihood that "excessive" speculation distorts the prices of other commodities extends to carbon derivatives markets. Thus, measures to constrain it will almost certainly impose costs on market users without producing any corresponding benefits.

[11] For a broader discussion of permit allocation, see Morris (2009).

Carbon Derivatives Regulation in ACESA

The American Clean Energy and Security Act expressly permits trading of carbon derivatives but subjects them to a strict regulatory regime. Moreover, in addition to its provisions dealing specifically with carbon derivatives, ACESA implements dramatic changes to derivatives regulation generally, and to energy derivatives in particular.

In order to put ACESA's derivatives provisions in context, some historical background is useful. The Federal government first regulated certain agricultural futures contracts in 1922, with the passage of the Grain Futures Act (GFA). This Act was amended in 1936 and renamed the Commodity Exchange Act (CEA). The CEA enlarged the set of commodities covered and imposed additional regulatory restrictions. The CEA has been amended over the years, with the most important of these changes occurring with the Commodity Futures Modernization Act (CFMA) of 2000. ACESA reverses many of the changes adopted in the CFMA.

The stated purpose of Federal commodity derivatives regulation is to prevent and diminish manipulation and excessive speculation, and to ensure fair practices and honest dealing in derivatives trading. To achieve these objectives, the original regulatory schema in the GFA, which was continued in the CEA until its amendment by the CFMA, was to require that all derivatives be traded on "designated contract markets," that is, on exchanges. To obtain and retain contract market status, exchanges were obligated to self-regulate and take measures to prevent and diminish manipulation and excessive speculation. Failure to do so could result in revocation of the contract market designation.

These provisions effectively precluded off-exchange trading of derivatives. That is, they outlawed OTC derivatives trading. However, the CEA did permit trading of cash market contracts, such as contracts between farmers and grain processors to sell the next harvest's grain.

In the 1970s and 1980s, market participants created new instruments that had futures-like features but were designed as securities. In addition, during the 1980s, financial institutions introduced new derivatives contracts, notably swaps, with futures-like characteristics. These innovations placed the CEA regulatory regime under tremendous stress. There was a clear demand by market participants to trade instruments that were substitutes for futures and to trade them over-the-counter. The Commodity Futures Trading Commission (CFTC) responded by granting one-off exemptions from the contract market requirement, but this only created another set of difficulties. In particular, it created legal uncertainty because of the ambiguous status of these exemptions; there was a very real possibility that the CFTC exemptions would not stand a legal challenge and that billions and eventually trillions of dollars in notional amount of derivatives transactions not executed on exchanges would be found unlawful.

Congress responded in 2000 by passing the CFMA. This law created a tripartite hierarchy of derivatives. Agricultural derivatives continued to be subject to the contract market requirement, and off-exchange traded agricultural derivatives could be traded only with express CFTC exemption from the exchange trading requirement. Another group of commodities, including notably energy commodities, were exempted from certain provisions of the CEA, and in particular, from the exchange-trading requirement; these commodities were still subject to the anti-manipulation and anti-fraud provisions of the Act. A third set, including things like "an interest rate, exchange rate, currency, security, security index, credit risk or measure, debt or equity instrument, index or measure of inflation, or other macroeconomic index or measure" were excluded altogether from all provisions of the CEA.

The CFMA secured legal certainty for OTC derivatives and contributed to a proliferation of these products in both financial instruments (e.g., credit default swaps or "CDS") and physical commodities (especially energy). But these OTC derivatives markets, especially CDS, received widespread (and, in my view, wholly wrongheaded) blame for the financial crisis of 2008-2009. Thus, in the aftermath of the crisis, there have been numerous initiatives in Congress to reverse the CFMA. ACESA is a perfect reflection of this *zeitgeist*.

ACESA adds carbon derivatives to the list of agricultural commodities that are subject to all provisions of the CEA, including the exchange trading requirement. Thus, ACESA requires that carbon derivatives be traded on exchange and subjects them to the most restrictive regulatory regime.

Moreover, the bill changes regulations for energy commodities and other previously exempt commodities. In particular, it eliminates the exemptions and exclusions for energy commodity transactions and therefore requires exchange trading of energy commodities. The CFTC may grant exemptions from the exchange-trading requirement, but only if the contract is cleared through a CFTC approved clearinghouse. There is a further possibility for exemption from this clearing requirement, but only for "highly customized" transactions. In addition, ACESA extends the clearing requirement to previously excluded commodities. That is, these products can be traded off-exchange, but only if they are cleared. Again, there is the possibility for an exemption from the clearing requirement for highly customized transactions, but the criteria for exemption are quite strict.

In a nutshell, under ACESA, most commodities, including carbon, must be traded on exchanges; virtually all of those that aren't must be cleared; and only a very limited set of contracts meeting very special terms can escape the clearing requirement, and then only after receiving a waiver from the CFTC. Thus, ACESA imposes a regulatory regime that is a throwback to that designed in 1922, and is in fact more restrictive in some respects.[12]

[12] For instance, the GFA did not require central clearing of contracts. The Department of Agriculture, the original regulator of US futures markets, did use its power to revoke contract market designation to compel the Chicago Board of Trade to adopt clearing in 1925.

An Evaluation of ACESA's Derivatives Regulation Provisions

It is harder to imagine a more wrongheaded regulatory framework than ACESA's derivatives provisions. It is ironic that, in the aftermath of an election waged and won on a theme of "change," legislators would cast back to the era of the Charleston and rumble seats for their regulatory model. The regulatory schema of the GFA, and then the CEA, proved unworkable and unduly restrictive in the 1980s and 1990s, and if implemented in the 2000s, would prove so again. Moreover, substantively, the provisions are not economically sensible.

Exchange Requirements

The complete restructuring of the organization of derivatives trading presumes that the world's largest financial markets—the OTC derivatives markets—are in fact the largest market failures in financial history. The advocates of these sweeping changes have identified, however, no commonly understood source of market failure, such as an externality or public good problem. Moreover, an understanding of the economics of trading makes it clear why multiple trading venues have evolved and thrived.

Potential users of derivatives are heterogeneous. Hedgers have varied risk exposures, as well as different risk preferences and financial objectives. Speculators differ, *inter alia*, in their risk tolerance, capital, information, and market views. Standardized, one-size-fits-all instruments and trading methods cannot accommodate this heterogeneity. Customization of contracts results in a more discriminating match between product characteristics and the preferences and needs of users.

Exchanges specialize in the creation of standard products and in the operation of auction markets to trade these products. Design of a product and operation of an auction market entail fixed costs. Moreover, a primary advantage of auction markets is that they can offer substantial liquidity, but only if the scale of trading is sufficiently large. Given these fixed costs, and the associated economies of scale, it is economical to create and trade a particular product if the demand to trade it is sufficiently high. It is not economical to create new products and the capacity to trade them if only a relatively small niche of market participants trades these products.

The parallel development of centralized auction markets that trade standardized products and bilateral OTC markets that trade customized products permits users to make trade-offs based on their preferences. They can trade standardized products in liquid markets, or they can trade customized products in relatively illiquid ones. For some derivatives traders, liquidity is the dominant consideration, and customization is relatively unimportant; these users can opt to trade on exchanges. For other users, liquidity is less important than the ability to enter a contract tailored to meet a specific objective. These users choose customized OTC products.

For instance, a power plant is a very long-lived asset that will face carbon price risk exposure for its entire existence, many decades in duration. Moreover, the nature of this risk exposure is likely to be quite complicated and non-linear, and may depend not just on the price of carbon, but on other prices—and other economic variables. The decision to operate a power plant in a carbon capped environment will depend on, among other things, the price of carbon, the price of fuel, and the price of power. Under some combinations of these prices, it is optimal not to operate the power plant, and in this event, the firm needs to purchase no carbon permits. Under other combinations of these prices, the plant may operate, but its output—and hence its need for emissions permits—will depend on other factors. The ability to turn a plant on and off creates a non-linearity in the exposure to price risks, extending over many years. Simple vanilla carbon derivatives with maturities in months (the kind of products that would likely trade on exchange) would be completely inadequate to manage these risks.

Nor are these challenges limited to power plants alone. Other carbon intensive businesses, notably refining and cement manufacture, would also have to confront similar problems.

Moreover, there is a symbiotic relation between exchange and OTC markets. Some firms, typically large financial institutions, specialize in offering customized products to their customers. When they enter these contracts, these intermediaries take on risk exposure. Since it is difficult to find another customer with the desire to take an exactly offsetting position in an identical customized product, the intermediaries frequently lay off the risk on an exchange. These firms specialize in (a) designing (usually dynamic) trading strategies using standardized derivatives to hedge the risk embedded in customized derivatives, and (b) bearing the risks arising from hedging errors and mismatches. Thus, the existence of exchange-traded products facilitates the creation of customized products, and specialized intermediaries bridge these two markets.

This analysis implies that parallel exchange and OTC markets offers derivatives users a larger range of choices, thereby leading to a more discriminating match between the instruments they trade and their trading objectives. Forcing all trading onto exchanges imposes costs on those who prefer the benefits of a customized contract to the liquidity offered by a standardized exchange-traded product. Revealed preference—the fact that many firms choose to trade OTC instruments rather than on exchanges—demonstrates that these costs are real.

Against this it might be argued that many of the products traded in the OTC market are in fact highly standardized. This is true, but two points should be kept in mind. First, these highly standardized OTC contracts are often highly liquid, with trading costs on a par with, and sometimes lower, than trading costs on exchanges. Second, these OTC contracts, although standardized in many respects, still offer flexibility that exchange traded instruments do not, and this flexibility can be quite beneficial to market users.

Perhaps the most important source of flexibility relates to the management of contract performance risk. Exchanges utilize central clearing. Part of the clearing process is rigorous collateralization. Traders must post collateral—margins—to initiate positions; this collateral serves as a performance bond. Moreover, their margins are adjusted on a daily basis as market prices change in the so-called "mark-to-market" process. Through this process, when prices move in favor of a particular position, the holder of that position receives a cash payment equal to the price change times the size of the position; but when prices move against the position, the holder must *make* a cash payment determined using the same formula.

This mark-to-market process can be onerous for some hedgers because it creates cash flow risks. For instance, consider a firm that has bought a cargo of oil that it anticipates selling in three weeks. The value of that cargo rises and falls with the price of oil, but the owner will not receive a cash flow until he sells it. Thus, day-to-day changes in the value of the cargo do not result in day-to-day cash flows. If he hedges that cargo by selling oil futures, changes in the price of oil will result in changes in the value of the futures position that will mirror changes in the value of the cargo, but importantly, will also result in cash flows on the day the price change occurs—but only on the futures "leg" of the hedge. Thus, there is a mismatch between the cash flows on the thing being hedged (the cargo) and the hedging instrument (the futures contract); the futures contract has (unpredictable) cash flows every day, but the cargo's cash flows occur on a single day.

This cash flow risk can be damaging to firms. For instance, if the price of oil skyrockets, the owner of the hedged cargo will have to make a large cash payment on his futures position, but he will not receive the cash inflow reflecting the gain on the cargo until it is sold some days later. Thus, firms that use futures to hedge need to have access to sufficient liquid capital to cover potential mark-to-market losses. This liquidity is costly for many firms.

In contrast, OTC collateralization arrangements are much more flexible. An OTC dealer may extend credit to the counterparty and not require daily marking to market. Thus, firms may prefer to trade OTC contracts, even if highly standardized, because they impose fewer cash flow risks and associated costs. This is a material consideration for many traders, and explains their preference for OTC products.

In sum, there are good reasons why some traders prefer to trade OTC products as opposed to exchange-traded ones. In particular, customization and more flexible collateralization mechanisms make it more efficient for some firms to trade OTC contracts. Forcing trading onto exchanges would sacrifice these efficiencies.

Clearing Requirements

The regulatory scheme mandated by ACESA, and by other proposals to restructure derivatives markets, would permit firms to trade some contracts (though not carbon derivative contracts) OTC, but only if they are cleared by a designated clearinghouse. This is also undesirable for a variety of reasons.

First, as noted above, the more rigid collateralization mechanism in clearing imposes substantial costs on some market users. Second, clearing is a risk sharing mechanism, and like any such mechanism, it can create incentive and information problems that generate costs that exceed the benefits of risk sharing.

In a clearing mechanism, if one trader defaults on his contractual commitment, the clearinghouse is obligated to assume the defaulter's obligation.[13] But the clearinghouse is essentially a sharing mechanism. The clearinghouse is capitalized by its member firms, and these firms are obligated to make additional contributions to cover losses arising from the defaults of other members if

[13] As noted before, clearing is actually more complex than this. See the references in footnote 2 for a more detailed description.

their original capital contributions are insufficient. Thus, a clearinghouse shares default or performance risk among its members.

This sharing mechanism can increase the amount each trader receives on his derivative contract (Pirrong, 2009). But like other sharing mechanisms, it can create incentive problems. In particular, like any sharing mechanism, it creates a moral hazard. Members of the clearinghouse have an incentive to take on too much risk because they realize that if this risk bankrupts them, other members of the clearinghouse will bear some of the loss.

The clearinghouse can control this moral hazard by charging margins to its members to constrain their risk taking. However, collateral is costly, so it is costly to control moral hazard. Moreover, if clearinghouse members are heterogeneous—as is typically the case—it is impossible to choose a common collateral level that gives each member the appropriate incentive to control risk; the collateral level will underprice the risk of some members, who will trade too much, and overprice the risk of other members, leading them to trade too little.

A clearinghouse also faces information asymmetries that can lead to adverse selection problems. Member firms have better information about their creditworthiness, and possibly about the risks of the products they trade, than the clearinghouse. It is well known that adverse selection also gives rise to costs in any risk sharing arrangement.

In sum, although performance risk sharing through a clearinghouse has some advantages, it also has costs. Moreover, alternative arrangements, most notably bilateral trading, will be less costly under some circumstances. In particular, bilateral trading relationships in OTC markets are not as subject to moral hazard problems because unlike in a clearinghouse, balance sheets are not public goods.

Furthermore, participants in bilateral markets have private information about the performance risk of their counterparties and the risk characteristics of the products they trade. In addition, participants in bilateral transactions can vary the terms of trade, including collateral levels and contract prices, to reflect the varying performance risk of different counterparties.

Such information and flexibility allows bilateral market participants to price performance risk more precisely than clearinghouses. The advantage of doing so is likely to be greatest for complex products[14] traded by financially complex firms (e.g., large banks).[15] And indeed, it is generally the case that more complex products traded by complex intermediaries are not cleared. Thus, again, there are very good economic reasons for clearing some products, and not clearing others. Mandating clearing will therefore impose costs on market users.

Against this it is sometimes argued that clearing reduces systemic risks because it reduces dangerous interconnections in the financial system. For instance, it is feared that the default of a large trader in the OTC market can cause the default of the traders this firm trades with, which in turn can cause the default of the traders these firms trade with, and so on. That is, contractual connections in OTC markets can spread default risks to many market participants.

It is peculiar indeed to justify clearing on these grounds, because clearing too spreads default

[14] Here complexity does not necessarily relate to the complexity of contract terms. Instead, it relates to the complexity of the risk exposure of the contract. A highly standardized contract, such as a credit default swap, can give rise to very complex performance risks.
[15] See Pirrong (2009) for the details of this analysis.

risks. That is, it creates interconnections between market participants that can lead to the same default contagion as can occur in bilateral markets. Clearing does not make performance risks disappear; it just allocates them differently than bilateral markets. Moreover, clearing creates a concentrated point of failure—the clearinghouse. This concentration can increase systemic risk.

It is also argued that clearing, and exchange trading, can improve regulatory oversight by centralizing the collection of information about the positions that market participants hold, thereby giving regulators better information about the risks in the system and allowing them to act more effectively in a crisis. Clearing and exchange trading may be sufficient to achieve this outcome, but not necessary to achieve this outcome. The same result could be obtained by requiring centralized reporting of derivatives trades and positions, without restricting market participants' ability to choose the trading and performance risk management mechanisms that are most efficient for them.

Finally, exchange trading and centralized clearing have been defended as the most effective means of combating manipulation and excessive speculation. Indeed, one of the main justifications for the exchange trading requirement in the original Grain Futures Act was that (a) exchanges have the knowledge necessary to identify manipulations, and (b) the threat of losing contract designation would give them an incentive to combat this conduct.[16] Pirrong (1995) demonstrates that this reliance of self-regulation is not supported by the historical experience of exchanges in the US or elsewhere. Moreover, as noted above, *ex post* deterrence, including private actions by parties harmed by manipulation, is a more effective means of diminishing price manipulation than real time oversight, whether by exchanges or government regulators.

There is no basis to believe that clearing will constrain "excessive" speculation more effectively than bilateral performance risk management mechanisms. Both clearinghouse and bilateral mechanisms will permit speculation by a market participant in accordance with that participant's financial capacity to bear risk, and will make no judgment as to whether that participant is trading in a way that causes prices to deviate from fundamentals.

Toward Efficient Derivatives Markets

The bottom line is that the diversity of trading and performance risk management mechanisms observed in modern financial markets makes good economic sense. The diversity of institutions in derivatives markets, that is, the co-existence of exchanges, cleared OTC, and non-cleared OTC, is a discriminating match between trading mechanisms, instruments, and market participants. It accommodates heterogeneity in trader preferences for customization, liquidity, cash flow risk and performance risk. It similarly accommodates heterogeneity in information among market participants.

Mandating one-size-fits-all trading and performance risk management mechanisms, as envisioned in ACESA and other "reform" proposals, imposes costs because it precludes market

[16] Congress evidently despaired of defining manipulation, and punted responsibility for controlling it to the exchanges. During the debate over the Futures Trading Act (a predecessor of the Grain Futures Act that was found to violate the Constitution's taxation provisions), Senate Agriculture Committee Chairman Norris said "[t]he difficulty, as I understand it, is that these things [manipulations] are various and impossible of direct definition. I do not know how we could draw a definition to bring it home to the individual. At least it is the theory of the bill, as I understand it. . . that the board of trade itself could bring about these reforms, and [the House and Senate] are trying to hold the board of trade responsible" (United States Senate, 1921).

participants from making mutually beneficial arrangements that reflect their heterogeneous preferences and information. Moreover, mandated clearing will, in my view, actually exacerbate systemic risks because it ignores the incentive and information considerations that make bilateral management of performance risk more efficient under quite common circumstances. Since ACESA subjects carbon markets to the most restrictive part of the entire regulatory scheme, it will constrain these markets most. In effect, ACESA will make it extremely costly to trade anything but the simplest, most plain vanilla derivatives that are suited for exchange trading.

This is harmful because vanilla derivatives are unsuitable for managing many of the risks that those with carbon exposure face, as the earlier example of the power plant's hedging needs illustrates. Most exchange-traded derivatives that will attract any liquidity will have relatively short maturities—in months, at most.[17] Moreover, the most liquid contracts will be "linear" instruments, like futures. That is, their payoffs will be linear functions of the price of carbon. Even those contracts with non-linear payoffs, like vanilla put and call options, will have (a) short maturities, and (b) a very limited set of possible payoffs.

But since as noted earlier many firms exposed to carbon price risk will face very long dated exposures, and optimal risk management strategies would require the use of derivatives with non-linear derivatives (Froot, Scharfstein, and Stein, 1993). Raising the cost of managing these risks by forcing market participants to go through a cumbersome waiver process would force firms either to bear the higher cost, or live with the risk, which imposes costs of its own on investors. Moreover, raising the costs of managing risks is likely to raise the cost of financing new capacity. Given the potential importance, and great uncertainty of carbon price risk over the life of a power plant or chemical refinery, those financing such facilities may prefer, and indeed require, that the borrower manage such risks. Raising the costs of managing these risks will impede investment.

In brief, by creating appreciable regulatory obstacles to the creation of the kinds of contracts that are best adapted to the needs of some users, ACESA will impede efficient management of carbon price risk. This will impose costs. Some investments will be foregone. Moreover, risks that could be borne at a lower cost if shifted via derivatives, will instead be borne by those who incur high costs, including costs of financial distress. What's more, no visible benefit offsets these costs. For instance, these contracts are not useful for carrying out a manipulation, so impeding their use will not advance the legitimate regulatory goal of diminishing manipulation.

[17] Even in those commodities in which exchanges list contracts with maturities going out years, trading activity is focused in the nearby contracts. For instance, on August 10, 2009 crude oil contracts were listed with maturities extending to December 2017, but well over 95 percent of trading volume was for contracts expiring in the next three months.

Conclusions

The creation of a market for carbon will result in the creation of a price for carbon. This, in turn, will impose carbon price risks on myriad firms and give rise to the demand to hedge these risks. Derivatives have proven amazingly powerful tools to manage numerous risks, including commodity price risks like carbon. Thus, it is inevitable that the creation of a carbon market, through ACESA or some other mechanism, will create a demand for carbon derivatives.

In the minds of many in Congress, this is something to be feared, rather than embraced. There is very deep suspicion in Congress of derivatives, and this suspicion is embodied in ACESA's derivatives regulation provisions. The bill subjects carbon derivatives to the most rigorous regulatory regime, requiring all carbon derivatives to be exchange traded. ACESA also imposes draconian restrictions on other derivatives.

These provisions reflect the widespread belief that derivatives were a major cause of the financial crisis of 2008-2009 and the energy price spike of 2008. This brings to mind Mark Twain's quip that "It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't true." Congressional animus—and hence, the derivatives provisions in ACESA—are based on a fundamental misunderstanding of derivatives in general, and their role in the ongoing financial crisis in particular.

As a result of this misunderstanding, ACESA imposes restrictions that will greatly reduce the benefits that market users will obtain from derivatives. These restrictions will impair, and likely impair substantially, the ability of market participants exposed to carbon price risk to manage that risk. Moreover, these restrictions will do little to combat real potential abuses of these products, such as market power manipulations. Furthermore, although many of the restrictions (e.g., clearing mandates) are justified as a means to reduce systemic risk, they can also contribute to systemic risk, and even ignoring that possibility, impose unnecessary costs on market participants.

Congress would play a more constructive role if it were to focus on legitimate market abuses, such as manipulation, and revitalize the *ex post* deterrence that is the most efficient way to combat it. A series of misguided court and commission decisions have undermined *ex post* deterrence; in large part, blame for these misguided decisions rests with Congress and its failure to define what constitutes an illegal manipulation with sufficient precision to permit courts and regulatory agencies to deter it efficiently. In trying to draft statutes so broad as to encompass every conceivable form of manipulative conduct, it has instead produced laws so vague and ambiguous that they arguably fail to reach any manipulative conduct with any degree of reliability, most notably the most practically important form of manipulation.

The bulk of the derivatives-related provisions of ACESA reflect an implicit assumption that derivatives markets are the world's largest market failure. Yet its authors and advocates have failed to identify just what the sources of those market failures are. What's more, a back-to-basics evaluation of the structure of derivatives markets shows that their current structure, though not perfect, strongly reflects fundamental economic considerations in a discriminating way. Consequently, the derivatives-related proposals will impede, rather than facilitate, the efficient evolution of derivatives markets.

It is especially telling that in its zeal to "reform" derivatives markets, Congress can do nothing but resurrect a regulatory scheme first devised almost 90 years ago. This regulatory framework proved woefully inadequate beginning in the 1980s, and its inadequacies are even more pronounced today. Thus, Congress has made it clear that it wants to regulate derivatives in the worst way, and has achieved its desire.

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