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Evaluating Limits on Participation and Transactions in Markets for Emissions Allowances

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Preface

In response to concerns that the accumulation of greenhouse gases in the atmosphere could have serious and costly effects, the Congress has considered creating a nationwide cap-and-trade program that would limit emissions of those gases below the levels projected under current law and would allow trading of rights (allowances) to produce those emissions. The ability to buy and sell allowances would reduce the cost to the economy of meeting the cap by letting market forces determine where, how, and when the associated cuts in emissions would be made. However, in creating markets for allowance trading, policymakers would face important questions about how best to ensure that any instability in those markets did not raise the cost of reducing emissions or spill over to the rest of the U.S. economy—as happened with instability in mortgage markets during the recent financial crisis.

Various types of participants would probably be active in allowance markets, including covered entities (emitters that must comply with the cap); other entities that would receive allowances from the government and want to sell them; and numerous banks, investors, and other parties that would buy allowances from, and sell them to, the first two types of participants. Transactions in allowance markets would most likely include allowance derivatives (financial contracts whose value would depend on the future price of allowances). Although broad participation and derivatives transactions are common in many markets—such as those for agricultural and energy commodities—some observers have proposed excluding certain market participants or transactions under a potential cap-and-trade program to protect allowance markets and the broader economy from unwanted risks.

This Congressional Budget Office (CBO) study—prepared at the request of the Chairman of the Senate Committee on Energy and Natural Resources—examines the likely impact of prohibiting allowance trading by parties other than covered entities or allowance recipients and of banning the use of allowance derivatives. The report also discusses some alternative restrictions on participation and transactions in allowance markets that could impose lower costs on covered entities while reducing the risk of instability in those markets and in the overall economy. In keeping with CBO's mandate to provide objective, impartial analysis, this study makes no recommendations.

Andrew Stocking of CBO's Microeconomic Studies Division wrote the study, under the guidance of Joseph Kile and David Moore. Terry Dinan, Mark Hadley, Deborah Lucas, David Torregrosa, and Steven Weinberg of CBO provided helpful comments on earlier drafts, as did Scott Irwin of the University of Illinois at Urbana-Champaign, Irina Leonova of the Commodity Futures Trading Commission, and Jeffrey Hopkins of Rio Tinto. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Christian Howlett edited the study, and Kate Kelly proofread it. Maureen Costantino prepared the report for publication, with assistance from Jeanine Rees, and designed the cover. Monte Ruffin oversaw the printing of the report, Linda Schimmel handled the print distribution, and Simone Thomas prepared the electronic versions for CBO's Web site (www.cbo.gov).

Douglas W. Elmendorf
Director

December 2010

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Summary

Following the recent financial crisis, concerns about how financial markets function and what can destabilize them have increased. In a cap-and-trade program to reduce greenhouse gas emissions—such as the programs that have been considered by the Congress—a central feature would be the markets in which emissions allowances would be traded. Thus, issues of key interest to policymakers designing such a program include what kinds of participants and transactions would be permitted in allowance markets.

Under a cap-and-trade program, entities covered by the cap—which could include oil refiners, natural gas distributors, and large electricity generators that use fossil fuels—would be required to hold government-issued allowances that would give them the right to emit a specific amount of greenhouse gases into the atmosphere. Those covered entities would be free to buy and sell allowances, which would give rise to markets to facilitate that trading. Active allowance trading would reduce the total cost of meeting a cap on emissions by helping covered entities manage fluctuations in their need for allowances caused by changes in the production of emissions-intensive goods and services.

At the same time, observers worry that active allowance markets could foster complex or opaque transactions, price bubbles, market manipulation, or other instabilities that could raise the cost of reducing emissions and harm the broader economy. That potential has spurred proposals to prohibit or otherwise limit certain types of market participants or transactions under a cap-and-trade program. This analysis finds that less restrictive limits would generally have a greater chance of addressing observers' concerns, with fewer negative effects, than outright prohibitions would.

Concerns About Allowance Markets

Unless regulation prevented it, allowance markets would probably attract many of the same types of traders and transactions as existing markets for agricultural, energy, and financial products. Besides covered entities (and other entities that might receive allowances from the government), traders would include banks, investors, and other parties that would not be subject to a cap on emissions but would facilitate transactions by trading allowances with covered entities. The transactions of those various parties would probably include allowance derivatives—financial contracts that, for example, would guarantee the holder a price for a specific number of allowances at a specified future time. Such traders and transactions are common in existing allowance markets, including the ones created by current cap-and-trade programs for greenhouse gas emissions in the northeastern United States and the European Union.

Some observers, however, are concerned that transactions by traders who are not covered entities (sometimes called "speculators") and derivatives transactions can pose risks to the stability of allowance markets and reduce the cost-effectiveness of a cap-and-trade program. For example, concerns exist that speculative traders and complex or opaque financial transactions can make allowance markets less transparent, cause allowance prices to spike and perhaps differ (become "decoupled") from the cost of reducing emissions, or contribute to market manipulation. Moreover, instability in allowance markets might harm the broader economy. That concern is underscored by the recent collapse of the market for private mortgage-backed securities, which illustrated how disruptions in one market or sector of the economy can spill over into other markets—a phenomenon known as systemic risk.

Limiting Participants in Allowance Markets

To reduce worries about systemic risk, price decoupling, and manipulation, some observers have proposed limiting participation in allowance markets only to covered entities. Prohibiting other parties from trading in

allowance markets, however, would most likely raise costs for covered entities by reducing market liquidity (the ease with which firms could buy or sell large quantities of allowances without affecting their current market price). In addition, a ban on certain participants would be difficult and costly to enforce.

Such a ban would also be unlikely to address concerns about allowance markets effectively. The reason is that the same financial incentives that would motivate non-covered entities to participate in the market—the ability to profit from absorbing the risk of price changes or the potential to realize gains from investing in allowances—would probably cause some covered entities to pursue those same opportunities. But to the extent that those covered entities were less effective at doing so than the excluded participants, the cost of complying with the program would be higher and market stability could decline.

Alternatively, participation limits that were less stringent and more targeted could address some of the concerns noted above at a lower cost. For example, many markets for agricultural, energy, and financial products have implemented "position limits," which restrict the number of contracts a participant can hold. Many of those markets also use "circuit breakers," which limit the total amount by which prices can rise or fall over a given period. Position limits would probably lessen the possibility of systemic risk and manipulation in allowance markets, and circuit breakers would reduce the likelihood that allowance prices would become decoupled from the cost of reducing emissions. Both types of regulations have the drawback of tending to make prices less informative, but they would impose lower costs on covered entities than a ban on certain participants would.

Limiting Derivatives Transactions in Allowance Markets

Participants in many markets for commodities or financial securities use derivatives extensively to reduce their exposure to changes in prices. However, certain types of derivatives played key roles in the recent financial crisis, and their potential complexity and opacity have prompted concerns that derivatives in allowance markets could also foster systemic risk and decrease transparency.

Some observers have responded to those concerns by proposing that a potential cap-and-trade program prohibit the trading of allowance derivatives. Not being able to use derivatives contracts, however, would increase covered entities' exposure to changing allowance prices, which would raise the costs of complying with the cap-and-trade program. Moreover, like banning certain market participants, prohibiting derivatives would probably not reduce the risk of disruptions in allowance markets—and might even increase that risk. In particular, the costs associated with absorbing price uncertainty could encourage firms to seek the benefits of derivatives from other financial transactions that would be harder to regulate or less transparent because they might, for example, occur in markets outside the United States. Consequently, enforcing a ban on derivatives would be difficult and expensive.

Other approaches could be more effective than a ban at addressing concerns about derivatives. For instance, increasing reliance on centralized clearing houses (institutions that facilitate the settlement of transactions between two parties) and on exchanges (organized markets, such as the Chicago Mercantile Exchange, where standardized financial transactions take place) would increase transparency and probably reduce systemic risk in allowance markets. In addition, raising transaction fees on trades that occurred "over the counter" rather than through a clearing house or exchange would create an incentive to move trading to those more transparent settings. And if set correctly, the fees would also cover the cost of the risks posed by transactions that were not suited to clearing houses or exchanges. Such changes would address concerns about systemic risk and lack of transparency while continuing to allow covered entities to use derivatives to reduce their costs of complying with a cap-and-trade program.

The recently enacted Dodd-Frank Wall Street Reform and Consumer Protection Act (Public Law 111-203) includes similar changes to existing financial markets. The law requires the federal agency that regulates derivatives transactions in commodity markets to set position limits for exchange-traded derivatives on all energy, metal, agricultural, and other physical commodities. It also expands the use of clearing houses and exchanges and increases regulation of over-the-counter derivatives. Although the regulations implementing the Dodd-Frank law are still being drafted, the law's provisions would probably apply to any allowance markets created as part of a nationwide cap-and-trade program for greenhouse gas emissions.

Evaluating Limits on Participation and Transactions in Markets for Emissions Allowances

Overview of Allowance Markets in a Proposed Cap-and-Trade Program

In light of concern about global climate change, the Congress has considered policies that would reduce emissions of carbon dioxide and other greenhouse gases (GHGs) by establishing a cap-and-trade program for those emissions.[1] Under such a program, the government would set a limit on total GHG emissions in a given year and would issue allowances (rights to emit) equal to that overall limit, or cap, on emissions. Entities covered by the cap—such as oil refiners, natural gas distributors, large electricity generators, and other firms that emit large quantities of greenhouse gases—would be required each year to submit a number of allowances equal to their GHG emissions from the previous year.

The cap-and-trade program would give rise to a set of interrelated allowance markets, including a primary market, in which the government would initially distribute allowances by auctioning them off or giving them away for free, and a secondary (or resale) market, in which various parties would subsequently buy and sell allowances. The price of allowances in those markets would probably change frequently as buyers and sellers assessed new information about the cost of reducing emissions and the demand for allowances.[2] Those price changes in turn would lead to shifts in production and consumption of emissions-intensive goods and services. The changing allowance price, and the constant adjustments by producers and consumers that would result, would lead covered entities to seek the least expensive combination of cuts in emissions and purchases of allowances to comply with the cap, thus guiding the economy toward the lowest-cost approach to reducing GHG emissions to meet the cap.

Currently, cap-and-trade programs for GHG emissions are operating in Europe (covering 29 countries) and in the northeastern United States (covering 10 states). Cap-and-trade programs for emissions of sulfur dioxide and nitrogen oxides are also in effect across the United States. Those programs, the oldest of which began in 1995, include active primary and secondary markets for allowances.

Participants in Allowance Markets

Under a nationwide cap-and-trade program for GHG emissions, allowance markets would most likely include several types of participants with various objectives:

- Energy producers and other covered entities that would have to comply with the cap on emissions;
- Entities that would receive allowances from the government but would not be subject to the cap;[3] and
- Businesses and individuals—mainly banks and investors, as well as companies that use emissions-intensive

1. See Congressional Budget Office, *The Economic Effects of Legislation to Reduce Greenhouse-Gas Emissions* (September 2009).

2. For more about allowance prices and the possible effects of placing upper or lower limits on them, see Congressional Budget Office, *Managing Allowance Prices in a Cap-and-Trade Program* (November 2010).

3. Past proposals have called for allocating allowances to state governments, electricity distributors, or industries that might suffer from a competitive disadvantage in world markets because of the higher prices for emissions-intensive goods and services.

goods and services—that would trade allowances and related financial products with the first two types of participants and with each other.[4]

The third group is sometimes referred to as speculators or traders. However, speculation and trading for reasons other than complying with the cap would not be limited to that group; entities in the first two categories would have incentives to engage in those activities as well.

Generally speaking, the inclusion of more traders with diverse trading objectives would cause allowance markets to become more liquid, meaning that all participants could buy or sell allowances more easily without affecting the price of an allowance. Allowances traded in a liquid market would be considered safer because market participants could buy or sell allowances more quickly if their needs changed.

The Market for Allowance Derivatives

The establishment of a secondary allowance market would be expected to spawn a market for allowance derivatives—financial contracts whose value would depend on the future price of allowances. Derivatives could be used by covered entities and other participants in allowance markets to protect themselves from changing prices, in the same way that derivatives on agricultural commodities let farmers lock in prices for their crops before those crops are harvested or even planted.

The most common types of derivatives are forward, futures, and options contracts, which are used extensively by participants in many sorts of markets. A forward contract is an agreement to exchange a fixed quantity of a good at an agreed-upon price on a specified future date. A futures contract is a type of forward contract with standardized quantities and delivery dates that is traded on an exchange (an organized market, such as the New York Mercantile Exchange or the Chicago Board Options Exchange). An options contract gives its holder the right (but not the obligation) to buy or sell a good at a specific price on the specified future date. Buying a forward or futures contract for allowances would lock in a future transaction price for those allowances, whereas buying an options contract would give the holder the choice of trading a specified number of allowances in the future at a predetermined price in return for an up-front fee. Producers and consumers of energy products—who would also be many of the covered entities in an allowance market—are accustomed to using such derivatives contracts to manage risks to their operating costs posed by changes in energy prices.

Southwest Airlines's use of derivatives offers an example of how covered entities and other participants might interact in a market for allowance derivatives. The company made a well-known decision to reduce its exposure to changing prices for jet fuel by entering into derivatives contracts with other market participants. In 2008, when the price of crude oil (from which jet fuel is made) rose to more than $140 a barrel, Southwest Airlines was paying market participants with whom it had entered into crude-oil derivatives contracts only $51 a barrel for a large portion of its fuel. When those contracts were created, the other parties to them presumably did not expect that oil prices would rise above that level. Alternatively, if the price of oil had fallen to $30 a barrel rather than increasing to $140, those participants would have made money on the contracts. However, regardless of the outcome, Southwest Airlines benefited from its derivatives contracts because they reduced the company's exposure to price uncertainty.

The Potential Scale of the Derivatives Market

Given regulation consistent with that of other derivatives markets, the market for allowance derivatives would probably be smaller than those other markets, even ones that had a smaller primary market for the underlying commodity. Analysis by the Congressional Budget Office (CBO) of two legislative proposals in the 111th Congress suggests that allowances distributed in the primary market during the first year of a cap-and-trade program would have had a total value of roughly $70 billion to $80 billion (see Table 1).[5] Transactions in the associated

4. In U.S. markets for wheat, corn, soybeans, gasoline feedstock, and natural gas, traders that do not classify themselves as commercial participants who produce, process, or use the traded commodity account for about two-thirds of the markets' total participants and capital. See Commodities Futures Trading Commission, *Commitments of Traders: Disaggregated Futures and Options Combined Report* (April 20, 2010).

5. See Congressional Budget Office, cost estimate for H.R. 2454, American Clean Energy and Security Act of 2009 (June 5, 2009), and cost estimate for S. 1733, Clean Energy Jobs and American Power Act (December 16, 2009). Neither of those bills became law, although H.R. 2454 was passed by the House and S. 1733 was ordered reported by the Senate Committee on Environment and Public Works.

Table 1.

Sizes of Derivatives Markets for Emissions Allowances, Financial Products, and Various Commodities, 2009

	Estimated Value of Primary Market (Billions of dollars)[a]	Estimated Value of Exchange-Traded Derivatives Market (Billions of dollars)[b]	Estimated Ratio of Exchange-Traded Derivatives to Primary Market	Estimated Value of OTC-Traded Derivatives Market (Billions of dollars)[c]
		Markets for Emissions Allowances		
Proposed Nationwide U.S. Market for GHG Allowances				
Under H.R. 2454[d]	69	*	*	*
Under S. 1733[e]	78	*	*	*
Existing Markets for GHG Allowances				
EU's Emission Trading System	39	71	1.8	n.a.
U.S. Regional Greenhouse Gas Initiative	0.7	2	3.5	n.a.
Other U.S. Allowance Markets[f]				
Sulfur dioxide	0.8	0.7	0.8	n.a.
		Other Markets		
Financial Products				
5-year Treasury notes	460	10,200	22	66,000
10-year Treasury notes	260	22,800	88	148,000
30-year Treasury bonds	140	7,300	52	47,000
Agricultural Commodities				
Wheat	13	700	54	1,400
Soybeans	33	2,200	66	4,400
Corn	52	1,300	25	2,600
Energy Commodities				
Crude oil	420	14,400	34	28,800
Natural gas	90	5,000	56	10,000

Source: Congressional Budget Office.

Note: OTC = over the counter; GHG = greenhouse gas; EU = European Union; n.a. = not available; * = levels could not be determined in advance.

a. For proposed allowance markets, the estimated value of the primary market is based on the total value of the allowances that would be allocated in the first year of the program; for existing allowance markets, the estimated value of the primary market is based on the total value of newly allocated allowances in 2009, assuming allowance prices of $20 for the EU program, $3.50 for the U.S. Regional Greenhouse Gas Initiative, and $90 for the U.S. sulfur dioxide program. For other markets, the value of the primary market represents the total amount of a given Treasury security issued, agricultural commodity produced, or energy commodity consumed in 2009, multiplied by an average price for that year.

b. The estimated value of the exchange-traded derivatives market is based on the total value of transactions involving exchange-traded futures contracts in 2009 from IntercontinentalExchange, CME Group, and the Kansas City Board of Trade. (Futures contracts make up the bulk of the market for exchange-traded derivatives.)

c. The estimated value of OTC derivatives transactions comes from Bank for International Settlements, *Triennial and Semiannual Surveys: Positions in Global Over-the-Counter Derivatives Markets at End-June 2010* (Basel, Switzerland: BIS, November 2010).

d. The American Clean Energy and Security Act of 2009.

e. The Clean Energy Jobs and American Power Act.

f. Information for the U.S. market for nitrogen oxide allowances is not available.

derivatives market would mostly likely have had a larger total value than that—as is the case in other markets for commodities and securities. For example, in markets for agricultural, energy, and financial products, the value of derivatives traded in 2009 on an exchange was 20 to 90 times larger than the value of the primary market for the underlying commodity.

Derivatives markets for emissions allowances also exist under current cap-and-trade programs, such as the GHG programs in Europe and the northeastern United States and the nationwide sulfur dioxide program in the United States. In those markets, the value of exchange-traded derivatives tends to be one to four times larger than the value of the allowances released in a single year under those programs. The parallels between those markets and a proposed national market for GHG allowances suggests that the ratio between the value of exchange-traded derivatives and the value of allowances could be similar—and thus much smaller than the ratio for other commodities.

Trades on exchanges account for only part of a derivatives market, however. Other derivatives trade in over-the-counter (OTC) transactions, in which contracting terms are flexible and contracts are negotiated bilaterally between two market participants. An OTC transaction could include customized delivery dates and quantities to meet the specific needs of the buyer or seller, as opposed to the standard delivery dates and quantities in exchange-traded contracts.

OTC derivatives transactions tend not to be tracked or registered centrally, making it difficult to estimate the number of such transactions.[6] A recent report suggests that OTC derivatives transactions have about seven times the total value of exchange-traded derivatives transactions for financial products but less than twice the value of exchange-traded derivatives transactions for agricultural and energy commodities.[7] (No estimates exist of the value of OTC transactions for existing cap-and-trade programs, although such transactions regularly occur.) Those comparisons suggest that the value of OTC allowance derivatives would most likely exceed the value of the primary allowance market, although whether the relationship would resemble those in agricultural and energy markets or those in financial-product markets is unclear.

Concerns About Allowance Markets

Whatever the size of allowance markets under a potential nationwide cap-and-trade program for greenhouse gases, some observers have expressed fears that those markets would be vulnerable to disruptions that could affect the U.S. economy—much as problems in mortgage markets contributed to the recession that began in 2008. Other observers worry that even if allowance markets did not become disruptive to the U.S. economy, the presence of derivatives and speculators could reduce the markets' transparency, decouple the price of allowances from the cost of reducing emissions, or lead to outright manipulation. Any of those outcomes would increase the cost of a cap-and-trade program to the U.S. economy.

To address such concerns, various observers have suggested limiting the types of traders or transactions that would be permitted in national GHG allowance markets, even if broader participation or the use of derivatives would reduce costs in those markets. (The possible effects of such limits are discussed later in this study.)

Systemic Risk

U.S. economic activity is closely linked to the production and consumption of emissions-intensive goods and services. That connection has caused some observers to worry about the possibility that shocks to allowance markets could spill over to the broader U.S. economy. For example, a rapid increase in allowance prices could raise electricity prices, which would harm U.S. businesses that rely on electricity. The risk of cascading disruptions from the market for a single asset, such as allowances, to other markets and possibly the entire U.S. economy is called systemic risk.

6. Changes recently enacted in the Dodd-Frank Wall Street Reform and Consumer Protection Act (Public Law 111-203) are expected to reduce the difficulty of tracking OTC transactions by placing the OTC derivatives market under the jurisdiction of the Commodity Futures Trading Commission and by shifting more such transactions to organized exchanges or clearing houses.

7. See Bank for International Settlements, *Triennial and Semiannual Surveys: Positions in Global Over-the-Counter Derivatives Markets at End-June 2010* (Basel, Switzerland: BIS, November 2010), www.bis.org/publ/otc_hy1011.pdf. Estimates of the total volume of U.S. exchange-traded commodities are based on unpublished information provided by the Commodity Futures Trading Commission. Part of the reason for the relatively greater value of OTC derivatives transactions in financial markets is that factors affecting the performance of financial products are less standardized and financial markets include a larger number of affected entities with diverse needs to hedge against risk.

The danger of systemic risk from a commodity market was reinforced during the California energy crisis of 2000 and 2001. Rapidly rising wholesale prices for electricity were a factor that led to repeated service cuts to various regions for a few hours at a time and that ultimately sent the state's largest electric utility into bankruptcy. Those events had negative repercussions for businesses and industries across California.[8] Systemic risk was also evident during the nationwide 2008 financial crisis: The large losses that many financial institutions experienced on their mortgage-related assets contributed to the instability of financial and credit markets and ultimately led to the most severe economic downturn in the United States since the 1930s. The similarities between the allowance market and the electricity market in terms of participants and the scale of their involvement might suggest that the California example best encapsulates concerns about systemic risk in allowance markets. Regardless of what example is most analogous, some observers believe it is not worth taking the risk that an event in allowance markets could have costly implications outside those markets.

Lack of Transparency

The recent financial crisis also focused attention on the issue of complex derivatives, especially certain mortgage-backed securities, that lack transparency about how much risk their buyers have absorbed and that involve a significant amount of leverage, or indebtedness.[9] Some observers have raised concerns that derivatives contracts in a potential national GHG allowance market might be similarly opaque.

If the value and riskiness of such contracts were difficult to determine, holders of complex allowance derivatives could find themselves exposed to losses they had not anticipated. Moreover, the existence of complex, non-transparent derivatives could create an opportunity for some market participants to exploit those characteristics to extract profits from other participants who misjudged the derivatives' risks. Such opaque derivatives could decrease the cost-effectiveness of a cap-and-trade program by lessening the extent to which allowance prices reflect market fundamentals (the collection of factors that affect the cost of cutting emissions, such as emissions-reducing technologies, consumers' demand for emissions-intensive goods and services, economic growth, and regulatory changes).

Decoupling and Price Bubbles

Opaque derivatives are not the only means by which allowance prices could become decoupled from market fundamentals. That could also happen if some market participants based their decisions about buying or selling on expectations of what other participants would do rather than on market fundamentals. For example, if the fundamentals underlying an allowance derivative became unclear or difficult to determine, some market participants might adopt a trading strategy of following the lead of other participants. In that case, even participants who understood the market fundamentals might pursue a similar strategy, believing that they could profit more from following other participants than from following the fundamentals.

When prices become decoupled from their fundamental values, they can experience wide swings or even a bubble, similar to the ones seen with Internet-related stocks in the late 1990s and the real estate market in the 2000s. In practice, such price bubbles are often not identified until after they have burst, and their causes are poorly understood.[10] Nevertheless, a price bubble in allowance markets could be expected to disrupt a cap-and-trade program.

Manipulation

Further concerns have been raised that some participants would manipulate allowance markets. For example, a trader or group of traders might try to corner markets by purchasing a large enough share of total allowances that they could determine prices and then sell their allowances back into the market for a profit. Although a covered entity could pursue such a manipulation strategy, it could only do so profitably by purchasing significantly more allowances than it would need for complying with the

8. For more information about the crisis, see Congressional Budget Office, *Causes and Lessons of the California Electricity Crisis* (September 2001).

9. Derivatives contracts are said to involve high degrees of leverage because often they are economically equivalent to borrowing money to buy and hold a commodity.

10. A recent paper by several Federal Reserve economists concludes that "economic theory provides little guidance as to what should be the 'correct' level of asset prices—including housing prices," which makes identifying bubbles difficult. See Kristopher S. Gerardi, Christopher L. Foote, and Paul S. Willen, *Reasonable People Did Disagree: Optimism and Pessimism About the U.S. Housing Market Before the Crash*, Public Policy Discussion Paper 10-5 (Federal Reserve Bank of Boston, September 10, 2010), abstract, www.bos.frb.org/economic/ppdp/2010/ppdp1005.pdf.

cap. By contrast, market participants who were not covered entities could attempt to manipulate markets without worrying about compliance. Such manipulation has not occurred in U.S. cap-and-trade programs since 2001, but it has occurred more recently in the European Union's GHG cap-and-trade program.[11]

Unlike the other areas of concern discussed in this report, market manipulation is illegal. Although the potential for manipulation is reduced when markets are active and competitive, some manipulative threats can be countered only through diligent regulatory oversight. However, as seen in Europe, such oversight could prove difficult in the early years of a nationwide U.S. cap-and-trade program for greenhouse gases, when regulatory tools would not yet be well established and regulators would lack experience managing the markets.

Limits on Market Participants

The extent to which any of the problems described above could destabilize allowance markets is unknown, but one approach to reducing concerns about systemic risk, price decoupling, and manipulation would be to impose restrictions on participation in allowance markets. Possible restrictions include an outright prohibition on certain participants, less stringent "position limits" that specify the total amount of trading in which any one participant can engage, and "circuit breakers" to limit swings in allowance prices. Existing cap-and-trade programs for greenhouse gases have not implemented prohibitions on certain participants, but some programs have stipulated position limits. In addition, recently enacted legislation expands the use of position limits in various markets, and circuit breakers are becoming increasingly common for exchange-traded securities and commodities.

Prohibition on Traders

Banning entities not covered by the cap on emissions from owning or trading allowances would represent the most aggressive limit on participation in allowance markets. Under such a restriction, participation would be limited to electric utilities, oil and gas importers and refiners, emissions-intensive manufacturers, and other entities that would be required to comply with the cap; investment banks, firms that use emissions-intensive goods and services, and other common traders in similar markets would not be allowed to buy or sell allowances.[12]

Prohibiting those participants in an effort to reduce concerns about systemic risk, decoupling, and manipulation would make it more expensive for covered entities to comply with the cap-and-trade program. Such a prohibition could also prompt the remaining market participants to respond in ways that would exacerbate the original concerns by giving them a greater incentive to engage in speculative trading or manipulation.

Benefits of Having Many Traders. Limiting allowance trading to covered entities would mean forgoing the advantages that result from broad and diverse participation in a market. The main such advantage in allowance markets—as in markets for agricultural, energy, and financial products—would be to lower trading costs for all participants by increasing liquidity. In a more liquid market, covered entities that wanted to buy or sell allowances, particularly in large numbers, could more quickly identify another party with whom to trade without affecting the market price of allowances. Prohibiting some entities from taking part in allowance markets would reduce liquidity and thereby increase the cost to covered entities of complying with the cap-and-trade program.

A second benefit of broad participation would be to improve the likelihood that allowance prices accurately reflected the incremental cost of cutting emissions. As in any market, active traders in an allowance market would have a financial incentive to study the market and the industries underlying it, because their profits from providing liquidity would depend on the quality of their information about the cost of reducing emissions and about the future supply of and demand for emissions-intensive goods and services. Furthermore, active traders would have a financial incentive to buy when prices are low and sell when prices are high, which would lead them

11. Between 2000 and 2001, an individual active in southern California's Regional Clear Air Incentives Market (a cap-and-trade program for nitrogen oxides and sulfur oxides) engaged in manipulative fraud, stealing millions of dollars from covered entities and other traders. For information about recent cases of manipulation in the European cap-and-trade program, see Government Accountability Office, *Carbon Trading: Current Situation and Oversight Considerations for Policymakers,* GAO-10-851R (August 19, 2010), www.gao.gov/products/GAO-10-851R.

12. Under such a ban, noncovered entities that received allowances from the government might be permitted to sell them (either directly or through the government) but would not be permitted to buy allowances.

to put pressure on allowance prices to reflect the most accurate, up-to-date information about market fundamentals. As a result, with more-diverse participation in the market, the quality of information reflected in market prices would be higher, which in turn would minimize the cost to the U.S. economy of meeting the cap.

A third advantage of broad participation is that traders would be expected to hold an inventory of banked allowances (those not used during the current compliance period but saved for some future time when cutting emissions might be more expensive). Covered entities too could hold banked allowances, but doing so would be more costly for them because it would tie up capital they could invest in other ventures. In contrast, some types of traders would have access to less expensive capital than many covered entities would, making the expected return from holding inventories a more attractive investment for them.[13] If traders could reasonably be expected to hold inventories, a covered entity could use the capital that would otherwise be dedicated to banking allowances for other purposes.

Unintended Consequences of Prohibiting Traders. Although banning all participants but covered entities from allowance markets would aim to lessen the risk of market disruptions, the outcome could be different: Such a prohibition could reduce liquidity and make allowance prices more unstable. Without other traders, covered entities would have to rely on each other when they wanted to buy or sell allowances. But many covered entities would probably have similar demand for allowances at similar times, so the supply of and demand for allowances by covered entities would be unlikely to balance in the secondary market at any one time without triggering a change in allowance prices. The size of that price change would increase with the amount of the imbalance and the size of covered entities' intended trades. If only a few participants accounted for a large share of the market—as would be expected in a national GHG cap-and-trade program—those price changes could be even larger.[14]

The combination of an illiquid market and a few very large participants could make it easier for one participant to profit from cornering or otherwise manipulating the market. Thus, the lack of liquidity caused by limits on participation could expose the market and its participants to the type of manipulation that those limits would be intended to reduce. Quantifying the increased risk of manipulation or its cost is difficult, however.

In addition, restricting participation to covered entities would give some entities a financial incentive to provide the services to the market that would otherwise be offered by excluded participants. Eliminating traders who were paid a risk premium to absorb price changes would not eliminate the prospect of earning that premium, because it would not remove the risk of price fluctuations. Some covered entities would probably expand their capacity to play the role of those excluded traders in allowance markets. Eventually, they might support many of the same speculative transactions offered by excluded market participants, but from the legal structure of a covered entity. Consequently, on average, covered entities would be likely to face greater risk of variability in allowance prices, either because they had absorbed the risk of such variability from other covered entities or because they could no longer enter into some price-insurance contracts. And to the extent that the covered entities taking on more risk were less effective at managing that risk than the excluded participants would be, they would charge a higher premium to bear the risk.

The increased concentration of risk for covered entities—particularly risk related to their own operating costs—could leave some firms vulnerable to large shocks in allowance prices, which could have negative consequences for the economy. For example, an electric utility could miscalculate its risk exposure in such a way that a shock to allowance prices could force it into bankruptcy, potentially causing disruptions not only to its shareholders but also to individuals and businesses dependent on its electricity. The collapse of a risk-bearing covered

13. One reason that potential traders such as investors, mutual funds, and pension funds would have access to less expensive capital is that they do not pay corporate taxes on appreciation in their investments. Covered entities, by contrast, must pay corporate taxes on any earnings before they repay capital loans. All else being equal, entities that do not pay corporate taxes can borrow money at a lower cost than entities that do pay those taxes.

14. A consulting firm specializing in oil, gas, and carbon markets estimates that 5 oil and natural gas companies are responsible for about 25 percent of GHG emissions by covered entities in the United States and that 13 power companies are responsible for another 15 percent of emissions; see Point Carbon, *Carbon Exposure: Winners and Losers in a U.S. Carbon Market* (Washington, D.C.: Point Carbon, November 2, 2009).

entity could have greater repercussions than the collapse of a risk-bearing investor or speculator.

Alternatively, limits on participation could induce excluded traders to purchase a covered entity, thus allowing them to participate in allowance markets and continue to earn profits by offering liquidity and absorbing risk. To some extent, the foundation for that possibility is already in place: Several large investment banks own electric power generation or transmission facilities in the United States.

If any of the aforementioned responses occurred, successfully enforcing a ban on certain participants would probably entail high costs and still not entirely eliminate concerns about price decoupling or manipulation.[15] However, to the extent that a prohibition was not fully enforceable, it would have less impact on liquidity or covered entities' costs of managing risk (assuming that the inability to enforce the ban did not have other unintended consequences).

Position Limits

Another type of restriction on participation—used in commodity and financial-product markets as well as in the northeastern U.S. cap-and-trade program—is position limits, which stipulate the maximum number of contracts that an individual market participant can hold. Position limits are increasingly relied on to address concerns about manipulation; however, they tend to decrease the speed with which new information is reflected in prices and to reduce market liquidity. In addition, setting them at optimum levels and enforcing them can prove difficult and costly.

Uses and Benefits. Position limits would address concerns about systemic risk and market manipulation at a lower cost to the economy than a complete prohibition on certain traders would. The reason is that setting a maximum position would still allow broad participation but would create an upper bound on the losses of any single participant, including firms that would be a conduit for those losses to spill over to other segments of the economy.

Position limits are commonly used in derivatives markets, although variations on them (sometimes called concentration limits) have also been implemented in markets for the goods that underlie those derivatives. Typically, position limits are not applied to market participants that produce or consume the underlying good but instead are used to prevent traders from amassing holdings that could be used to manipulate a market and cause prices to deviate from market fundamentals. A less restrictive alternative to position limits is position accountability limits, which, if exceeded, trigger more-extensive reporting requirements (about, for example, the nature and size of contracts that a participant holds and the trading strategy used by the holder).[16]

Position limits for agricultural and some energy commodities are currently set by the Commodity Futures Trading Commission (CFTC), which regulates derivative transactions in various commodity markets. For example, a CFTC formula that applies to exchange-traded agricultural derivatives prohibits a market participant from holding more than 10 percent of the first 25,000 currently open derivatives contracts in a market and 2.5 percent of any contracts beyond the first 25,000.[17] Within allowance markets, the Regional Greenhouse Gas Initiative in the northeastern United States limits bidding by a single entity to 25 percent of allowances sold in an auction. Other position limits are established by individual exchanges. The European GHG cap-and-trade program does not include position limits for its allowance markets, but some individual exchanges on which European allowances are traded have adopted their own limits.

The CFTC often uses position limits to alleviate concern about manipulation in agriculture and energy markets. For example, in 2006 and 2009, Senate committee reports on speculation in commodity markets noted that although traders generally benefited those markets by increasing liquidity, they were capable of distorting commodity prices by engaging in manipulative practices or

15. See Western Climate Initiative, *Market Oversight Draft Recommendations* (April 1, 2010), www.westernclimateinitiative.org/public-comments/document/27.

16. For a more detailed discussion of position and position accountability limits, see Jeffrey H. Harris, *Report on Holdings Limits to the Western Climate Initiative Markets Committee* (Western Climate Initiative, May 6, 2010), www.westernclimateinitiative.org/public-comments/document/31.

17. A contract is defined differently for each agricultural commodity. A single corn contract, for instance, represents 5,000 bushels of corn at a specified grade.

excessive speculation.[18] The CFTC found no evidence that speculative activity had caused price changes in the instances cited in the reports; nevertheless, it chose to implement position limits on four commonly traded energy commodities.[19]

The Dodd-Frank Wall Street Reform and Consumer Protection Act (Public Law 111-203), which was enacted in July 2010, requires the CFTC to establish position limits for exchange-traded derivatives on all energy, metal, agricultural, and other physical commodities. Consequently, if an allowance market developed as part of a nationwide GHG cap-and-trade program, that law would probably require the CFTC to set position limits on holders of allowance derivatives.[20] In addition, the law directs the CFTC and the Securities and Exchange Commission (SEC) to establish position limits for swaps, a type of derivative not previously regulated, in which parties exchange the financial benefits from two underlying products. Although many of the new law's definitions and interpretations have yet to be finalized, those requirements represent an expansion and centralization of efforts to regulate position limits.

Challenges and Drawbacks. Establishing and enforcing position limits pose two principal challenges. First, the optimum level of position limits involves difficult trade-offs and varies over time as the size and liquidity of a market and the characteristics of participating firms change. Adjusting position limits regularly is challenging for regulators. At any point in time, setting larger or smaller limits involves a trade-off between reducing the potential for manipulation and reducing costs for market participants. Position limits set at lower levels help prevent manipulation in a market that is illiquid, highly concentrated, or difficult to monitor and regulate. If limits are set too low, however, they are likely to reduce or eliminate trading by some participants, which can increase costs for the remaining participants by reducing liquidity and lessening the diversity and amount of information available in the market.

Second, enforcing position limits can be difficult and costly for contracts traded on more than one exchange, because regulators have to reconcile the entities and trading positions across exchanges. For example, in 2008, energy traders in the United States were able to avoid the CFTC's position limits on energy derivatives by holding some of their assets at a U.K. exchange. Closing that "London loophole" required an agreement between the CFTC and regulatory authorities in the United Kingdom to impose similar limits and reconcile positions across exchanges. In some cases, position limits might prove impossible to enforce—for instance, if a large share of the trading in a market occurred over the counter rather than on established exchanges.

Circuit Breakers

Circuit breakers (also known as price limits or trigger prices) place limits on the total size of price changes that can occur in a specified period. Many commodity markets use circuit breakers, and regulators are considering them for broader adoption, although their effectiveness varies depending on the causes of the price changes.

Uses and Benefits. Circuit breakers are intended to stabilize markets when price movements are rapid and large by giving participants time to sort out the causes of the price changes. As an example, if the price of corn futures on the Chicago Mercantile Exchange rises above the previous day's price by 30 cents per bushel (corn was selling for about $5.60 per bushel in early December 2010), trading at any price above that circuit breaker is prohibited for the rest of the day, although trading can continue at lower prices. On the following day, the price of corn is limited from rising more than 45 cents per bushel above the first day's closing price, and on the third day, from rising more than 70 cents per bushel above the second day's closing price. (Comparable circuit breakers apply if the price of corn falls precipitously.) Such price limits are not

18. Senate Committee on Homeland Security and Governmental Affairs, Permanent Subcommittee on Investigations, *Excessive Speculation in the Wheat Market* (June 24, 2009), examined whether speculators in the wheat market were creating price distortions between the futures market and the spot market. Senate Committee on Homeland Security and Governmental Affairs, Permanent Subcommittee on Investigations, *The Role of Market Speculation in Rising Oil and Gas Prices: A Need to Put the Cop Back on the Beat* (June 27, 2006), concluded that speculation may have contributed to increases in oil and gas prices, although limitations on data made it difficult to determine the extent of the impact.

19. See Interagency Task Force on Commodity Markets, *Interim Report on Crude Oil* (July 2008); and Commodity Futures Trading Commission, Office of Public Affairs, "Proposed Rulemaking Q&A" (January 14, 2010).

20. See Government Accountability Office, *Carbon Trading: Current Situation and Oversight Considerations for Policymakers.*

triggered often, and when they are, they rarely continue past a single day. In a recent 20-month period, for example, the Chicago Mercantile Exchange's price limit for corn was triggered only three times, without ever triggering the second day's limit.[21]

The SEC adopted a similar circuit breaker strategy after the Dow Jones Industrial Average dropped by 1,000 points on May 6, 2010. That strategy halts trading on certain securities for 5 minutes if their prices rise or fall by more than 10 percent during a 5-minute period.[22]

The main reason to halt trading in response to large price changes is to give market participants a chance to assess whether such changes reflect market fundamentals. In the case of allowances, some traders might react to a rapid decline in prices by selling their holdings—and thus drive down prices further—rather than waiting to sell but risking a continued decline. The temporary halt in trading that a circuit breaker offers could reduce the likelihood and severity of such episodes. For instance, in explaining its new circuit breaker strategy, the SEC stated that there was evidence of "irrational prices" (prices that did not reflect market fundamentals) in the rapid drop in the Dow Jones Industrial Average and that "by establishing a set of circuit breakers that uniformly pauses trading in a given security across all venues, these new rules will ensure that all markets pause simultaneously and provide time for buyers and sellers to trade at rational prices."[23]

Challenges and Drawbacks. Research suggests that the effectiveness of circuit breakers in reducing large price swings depends on the circumstances in which they are used.[24] If a price change is caused by an imbalance between buyers and sellers, a temporary halt gives all parties, particularly those who were initially absent, an opportunity to join the market, evaluate current conditions, and respond accordingly. In that situation, or when a halt gives participants who are active in the market but uninformed about fundamentals more time to understand the factors underlying a rapid price change, a circuit breaker is likely to improve the functioning of a market.

In other circumstances, however, a circuit breaker may be ineffective or even detrimental to a market's functioning. For example, it may have either no impact or an adverse impact if a price swing is caused by some change in market fundamentals that will ultimately lead the price to rise or fall beyond the range of the circuit breaker. In that case, a circuit breaker slightly impedes the market's ability to reflect market fundamentals. If identical circuit breakers are not implemented on multiple exchanges that trade the same derivatives contract, trading may shift from one exchange to another, limiting the circuit breaker's effectiveness. Finally, a circuit breaker can reduce liquidity by exacerbating an imbalance between buyers and sellers. For example, if the price of a security is falling, buyers who believe a halt in trading is imminent will be unwilling to buy because they do not want to be left holding the security. In addition, sellers may want to speed up their trades in order to complete them before trading comes to a halt. Such actions produce greater price variability, which can harm a market.

Limits on Derivatives

Allowance derivatives would give market participants a means of reducing their exposure to price risk, as such contracts do in existing cap-and-trade programs in the United States and Europe.[25] The recent financial crisis,

21. Public statistics regarding the frequency that price triggers stop trading are not available; that statement is based on analysis by CBO of the difference between each day's high and low price and the previous day's closing price between January 1, 2009, and September 1, 2010.

22. The new circuit breaker applies to securities that are part of the Standard & Poor's 500 and Russell 1000 indexes. It is in effect on a pilot basis, although the Chairman of the SEC has stated that circuit breakers are likely to become permanent. See Mary L. Schapiro, "Strengthening Our Equity Market Structure" (speech to the Economic Club of New York, September 7, 2010), www.sec.gov/news/speech/2010/spch090710mls.htm.

23. Securities and Exchange Commission, "SEC Approves New Stock-by-Stock Circuit Breaker Rules" (press release, June 10, 2010), www.sec.gov/news/press/2010/2010-98.htm. Also see Commodity Futures Trading Commission and Securities and Exchange Commission, *Findings Regarding the Market Events of May 6, 2010* (September 30, 2010).

24. See Lawrence E. Harris, "Circuit Breakers and Program Trading Limits: What Have We Learned?" in Robert Litan and Anthony Santomero, eds., *Brookings-Wharton Papers on Financial Services: 1998* (Washington, D.C.: Brookings Institution Press, 1998).

25. For information about the U.S. markets, see Potomac Economics, *Annual Report on the Market for RGGI CO_2 Allowances: 2009* (New York: Regional Greenhouse Gas Initiative, August 2010). For information about the European market, see Jonas Monast, Jon Anda, and Tim Profeta, *U.S. Carbon Market Design: Regulating Emission Allowances as Financial Instruments* (working paper, Duke University, Nicholas Institute, February 2009).

however, highlighted some concerns about the role that mortgage-related derivatives played in reducing transparency and creating systemic risk. The Dodd-Frank law responded to those concerns with an array of regulatory changes aimed at increasing transparency and improving how markets operate. Those changes are designed to reduce systemic risk in all markets, although the extent to which they will achieve that goal—and the nature and significance of their unintended consequences—is unclear. In any event, some observers have called for more-aggressive limits on derivatives linked to potential GHG allowances.

Restrictions on allowance derivatives can range from an outright ban to less stringent limits similar to the ones contained in the Dodd-Frank law. Those limits include placing greater reliance on transparent and risk-reducing trading platforms (such as centralized clearing houses or exchanges) and increasing costs for transactions (such as over-the-counter trades) that do not occur in those settings.

Prohibition on Derivatives

Banning allowance derivatives would constrain market participants to trading only allowances in the secondary market. Such a prohibition would be likely to increase the costs for covered entities to comply with a cap-and-trade program. And although a ban would be aimed at addressing concerns about systemic risk and lack of transparency in allowance markets, it could end up creating a less transparent market that was harder to regulate and had a greater likelihood of contributing to wider economic disruptions.

Benefits of Derivatives. The availability of derivatives would lower a covered entity's compliance costs by providing increased convenience and flexibility in managing price risk. A covered entity that could lock in a future purchase price for allowances with a forward contract would reduce uncertainty about its future expenses and avoid the costs associated with that uncertainty—just as firms do in various other markets. The main alternative to using derivatives to protect against future price uncertainty would be to buy allowances in the primary or secondary market and hold them until they were needed. Derivatives contracts, however, would typically involve much lower transaction costs than borrowing to buy allowances would. Those lower transaction costs would be likely to attract a wide variety of participants, as has happened in derivatives markets for agricultural, energy, and financial products. Wider participation would increase liquidity, which would further reduce costs for covered entities.

Certain types of derivatives—such as short sales—that allow market participants to profit from a decline in prices provide a critical mechanism for keeping prices linked to market fundamentals and thus for keeping price bubbles in check. When market participants are seen to make many short sales, they send a signal to other participants that they believe prices should be lower. Short sales were temporarily banned in several markets in the United States and the United Kingdom during the financial crisis in an attempt to reduce price variability. Studies of those events concluded that eliminating short sales actually increased price variability because prices were more likely to become decoupled from market fundamentals.[26]

Unintended Consequences of Prohibiting Derivatives. Without access to allowance derivatives, covered entities would look for other ways to satisfy their desire to protect against uncertainty about allowance prices. One response might be the development of loosely related financial products that could trade legally on other derivatives markets in the United States but whose value would not be directly derived from allowance prices. For example, the price of natural gas has sometimes moved in the same direction as the price of allowances in the European GHG cap-and-trade program. If the price of allowances in a similar program in the United States also moved with natural gas prices, and if allowance derivatives were prohibited under such a program, market participants might buy or sell derivatives contracts related to natural gas to protect themselves against variability in allowance prices.

Although that approach of using derivatives on correlated commodities could provide some protection, it might also increase price variability in allowance markets. For

26. See Ekkehart Boehmer, Charles Jones, and Xiaoyan Zhang, *Shackling Short Sellers: The 2008 Shorting Ban,* Research Paper 34-09 (Ithaca, N.Y.: Cornell University, S.C. Johnson Graduate School of Management, September 25, 2009); and United Kingdom Financial Services Authority, *Short Selling,* Discussion Paper 09/1 (February 2009), www.fsa.gov.uk/pubs/discussion/dp09_01.pdf. Likewise, the Securities and Exchange Commission, in *Economic Analysis of the Short Sale Price Restrictions Under the Regulation SHO Pilot* (February 6, 2007), concluded that the presence of short selling reduced price variability for large securities and increased liquidity.

instance, during a period of high variability in natural gas prices, covered entities that used natural gas derivatives to protect against allowance-price uncertainty would be exposed to the high variability in gas prices. That exposure might affect trading in allowance markets—and thus the price of allowances—even if the sources of the variability in natural gas prices had no direct implication for the cost of cutting GHG emissions. Thus, although using correlated assets instead of allowance derivatives might prove cost-effective for covered entities at times, over the long term, the indirect basis of the correlation would be likely to raise the cost of a cap-and-trade program and could contribute to systemic risk.

Prohibiting derivatives in a U.S. allowance market could also give participants an incentive to move their transactions to overseas markets beyond the oversight of U.S. regulators. As an example, the Eurodollar market (where dollar-denominated deposits trade outside U.S. banking regulation) developed overseas in the 1960s to skirt U.S. regulations intended to limit dollar-denominated loans to foreign entities.[27] In that case, the effect of prohibiting a certain type of transaction was not to eliminate those transactions but only to reduce the United States' ability to regulate them. As with the Eurodollar experience, if the market for allowance derivatives was eliminated in the United States, similar derivatives might appear on a foreign exchange, such as IntercontinentalExchange Futures Europe—a derivatives market regulated by the U.K. Financial Services Authority that already trades U.S. energy derivatives.

If a new offshore market satisfied covered entities' demand for additional sources of liquidity and for opportunities to reduce price risk, the immediate result of a ban on allowance derivatives would only be increased costs for market participants to learn and transact business in a new overseas market under a different regulatory environment. Over the long term, however, the loss of U.S. oversight and the reliance on foreign regulatory agencies would probably increase program and compliance costs, relative to a U.S. allowance market that permitted derivatives, for several reasons. First, foreign regulatory agencies might be less effective at identifying manipulation because underlying market fundamentals would involve conditions specific to the United States. Second, U.S. regulators would be unlikely to respond quickly if the price of allowance derivatives changed to a large degree or appeared to be manipulated. Preventing such offshore activity would pose a difficult enforcement challenge (although to the extent that enforcement was unsuccessful, cost increases for covered entities would be smaller, unless partial enforcement produced other unintended consequences).

Reliance on Centralized Clearing

Instead of prohibiting all derivatives, the Dodd-Frank law expands the use of centralized clearing houses—institutions that facilitate the settlement of transactions between two parties. Centralized clearing has benefits for the stability and transparency of markets, but greater reliance on it could raise transaction costs for participants while not entirely eliminating systemic risk.

Uses and Benefits. Centralized clearing is designed to address concerns about systemic risk and market transparency at a lower economic cost than banning derivatives would. The benefits of a clearing house stem from its primary functions:

- Serving as a conduit between the two parties in a transaction (the counterparties), and
- Accepting legal responsibility for resolving any liabilities if one party defaults on its commitments.

Those functions can be especially important to market stability if a defaulting party has many counterparties, in which case the clearing house can combine offsetting gains and losses among counterparties to determine the defaulting party's net liability. The presence of a clearing house means that market participants do not need to spend resources to determine the financial strength of their counterparty in a transaction, and thus they can more easily enter into transactions with unknown parties on the basis of evaluations by the clearing house. To be effective, clearing houses must assess the financial viability of each transacting party and set appropriate margin requirements (deposits that traders make to a clearing house on a daily or more frequent basis to cover some or all of the risk that they will not be able to pay their counterparties). In providing those services, a clearing house maintains a centralized data repository where details about the holdings and liabilities of market participants

27. See Hal B. Heaton, "The Euromarket" (working paper, Brigham Young University, Marriott School of Management, 2009); and J. Orlin Grabbe, *International Financial Markets* (Englewood Cliffs, N.J.: Prentice-Hall, 1996).

are stored. That repository makes regulatory oversight easier and reduces counterparty and systemic risk.[28]

Challenges and Drawbacks. The services provided by clearing houses can result in higher costs for traders than would otherwise be the case in bilateral transactions. For example, two parties that frequently traded allowances with each other could determine without a clearing house, and with a high degree of confidence, that the other party was sufficiently creditworthy to waive any margin requirements. In that case, having to pay the costs associated with the credit evaluation, margin requirements, and settlement procedures imposed by centralized clearing would increase the overall cost of those transactions. However, for transactions in which a pair of counterparties did not know or have experience trading with each other, a clearing house could reduce both parties' overall costs by coordinating the transaction, performing credit analyses, and determining appropriate margin requirements and settlement procedures given the specific nature of the transaction and the parties involved.

In addition, some researchers have suggested that centralized clearing could increase systemic risk in several ways. The settlement assurances offered by a clearing house could encourage some market participants to engage in riskier transactions because they would know that the costs of potential defaults on those transactions would be absorbed by the clearing house and distributed over all transaction fees.[29] Similarly, because clearing houses serve as a central counterparty to each trading entity, they could increase systemic risk by concentrating market risk rather than diversifying it throughout the economy. That is, the clearing house would bear the totality of the market's overall risk, and thus, if it lacked sufficient capital or was slow in reconciling accounts, and counterparties lost faith in the settlement process, market liquidity could be reduced dramatically and the market could become unstable.[30] Although that concern could be partially addressed by having multiple houses provide clearing services for the same type of derivative, such an arrangement would be less effective at protecting against counterparty risk, because counterparties would be spread across those multiple clearing houses.[31]

Trading Through Formal Exchanges

The Dodd-Frank law complements the use of clearing houses to reduce systemic risk with the increased use of exchanges—organized markets where standardized financial transactions take place. Exchanges can offer many of the same benefits as centralized clearing as well as additional advantages, but those benefits generally arise only for contracts with large trading volumes.

Uses and Benefits. Trading derivatives on exchanges, when possible, can increase market transparency and lower costs relative to centralized clearing. Exchanges such as the New York Stock Exchange and the Chicago Mercantile Exchange often incorporate the services of a clearing house, but they also establish standardized margin requirements and enable market participants to observe the current market price and trading volume both before and after a trade is executed.[32]

The increased transparency and standardization offered by exchanges make trades easier to execute, reduce the costs and risks of trading, and help participants see the effects of market fundamentals on prices. In the case of an allowance derivatives market, such increases in transparency would reduce the likelihood that allowance prices could become decoupled from market fundamentals.

28. See Craig Pirrong, *Market Oversight for Cap-and-Trade: Efficiently Regulating the Carbon Derivatives Market,* Energy Security Initiative Policy Brief 09-04 (Washington, D.C.: Brookings Institution, September 2009).

29. See Craig Pirrong, "Mutualization of Default Risk, Fungibility, and Moral Hazard: The Economics of Default Risk Sharing in Cleared and Bilateral Markets" (working paper, University of Houston, February 2010).

30. See John W. McPartland, "Clearing and Settlement of Exchange Traded Derivatives," *Chicago Fed Letter*, no. 267 (October 2009); and John Kiff and others, *Credit Derivatives: Systemic Risks and Policy Options,* Working Paper 09/254 (Washington, D.C.: International Monetary Fund, November 2009), www.imf.org/external/pubs/ft/wp/2009/wp09254.pdf.

31. See Darrell Duffie and Haoxiang Zhu, *Does a Central Clearing Counterparty Reduce Counterparty Risk?* Research Paper 2022 (Stanford, Calif.: Stanford University Graduate School of Business, June 5, 2010), www.stanford.edu/~duffie/DuffieZhu.pdf.

32. Information about price and trading volume after trades are executed is an example of posttrade transparency. Some exchanges also offer pretrade transparency: information about the best prices at which buyers and sellers are willing to transact business. The Dodd-Frank law also creates swap execution facilities, which are not exactly exchanges according to the CFTC's definitions but contain many similar features in terms of transparency, margin requirements, and clearing.

Exchanges are best suited to contracts that are liquid (frequently traded) because such contracts would be expected to capitalize on all of the benefits offered by an exchange. Illiquid contracts might not be traded often enough for market participants to benefit from the transparency that an exchange provides. For example, an allowance derivative that traded once a day would display a day-old price that did not incorporate new information made available to the market since the previous transaction; therefore, the most recent transaction price could not necessarily be relied on as a basis for the next transaction price. Illiquid contracts could still benefit, however, from the clearing functions and margin requirements offered by exchanges. Liquidity is improved when contract terms, such as delivery dates and quantities, are standardized. But standardization does not guarantee liquidity, as evidenced by the many standardized contracts available on the Chicago Mercantile Exchange (such as for pork bellies and crude palm oil) that have little trading activity.[33]

Many of the derivatives likely to be used in a U.S. allowance market would be standard and thus amenable to exchange trading. (Some $71 billion in European allowance derivatives were traded on exchanges in 2009, as shown in Table 1 on page 3.) Standardization is not possible for some types of derivatives, such as many mortgage derivatives, because of the complex nature of the underlying product. (Mortgages vary by the terms of the loan, the condition of the property, and the characteristics of the borrower, all of which can affect how quickly the loan is repaid and thus the value of derivatives to the buyer and seller.) But allowances would be a homogeneous commodity, meaning that all allowances from a particular year would be equivalent in value. That homogeneity would reduce traders' ability to construct complex allowance derivatives that could not be standardized.

Challenges and Drawbacks. Analysts have many of the same reservations about exchanges that they have about centralized clearing. Concentrating transactions in a small number of exchanges could create systemic risk. In addition, to reap all of the benefits of exchanges, allowance markets would need to be regulated in ways that discouraged traders from moving derivatives transactions away from exchanges. For example, exchanges charge fees to offset the services they provide, and those fees give participants an incentive to move transactions off exchanges to over-the-counter markets. Further, market participants that had an information advantage might shift to OTC or other markets that lacked transparency so they could earn higher profits from their information advantage. Such a shift appears to have occurred after the transparency of the corporate bond market was increased, when many traders and their counterparties moved to the OTC market.[34] Consequently, to preserve the benefits of centralized clearing and exchange trading in reducing systemic risk and increasing transparency, the OTC market would need to be regulated to a similar extent.

Increased Regulation of Over-the-Counter Trading

Like markets related to agricultural and energy commodities, the secondary allowance market and the market for allowance derivatives would probably contain customized and unique contracts that were neither liquid nor standardized but were still an important part of a covered entity's strategy to hedge against variability in prices. Such nonstandard contracts would benefit less from trading through centralized clearing houses or exchanges and thus would tend to trade on the OTC market. Concerns about allowance markets could be addressed by designing regulations to further two aims:

- Increase the transparency of OTC trading, which would improve regulatory oversight; and
- Encourage participants to move OTC transactions to exchanges or clearing houses, which could reduce systemic risk.

Uses and Benefits. In the case of OTC trading of allowances themselves (rather than derivatives), one way to simplify regulatory oversight would be to increase the tracking of such trades and reconcile them with similar transactions occurring simultaneously under the oversight of exchanges or centralized clearing houses. That could be done in the secondary market by using a registry (a list of allowance owners and their holdings). Important

33. See CME Group, "Volume and Open Interest Report, 8:00 A.M. Final Report" (updated daily), available at www.cmegroup.com/market-data/volume-open-interest.

34. See Hendrik Bessembinder and William Maxwell, "Transparency and the Corporate Bond Market," *Journal of Economic Perspectives,* vol. 22, no. 2 (Spring 2008), pp. 217–234. That paper analyzed a sample of corporate bonds before and after the implementation of the Transaction Reporting and Compliance Engine (TRACE) system, which substantially increased publicly available information about the prices and volume of bond trading. TRACE was found to reduce traders' costs but also to spark a shift of transactions to other, less transparent markets.

design features for such a registry include ensuring that it is updated frequently enough, such as daily or weekly, to capture the flow of allowances between owners, and making sure that it assigns allowances to the "beneficial owner" (the entity that controls the decision to buy or sell the allowances, independent of who has actual title to them). Several registries for GHG allowances are currently active in the United States, including the Climate Registry and the California Climate Action Registry. Following adoption of one of the current registries or development of a new nationwide OTC registry for allowances, regulators could combine registry information with information about allowance transactions available from exchanges and clearing houses to more easily monitor allowance markets for manipulation or other threats to stability.

Tracking could also be used to improve regulatory oversight of the OTC market for allowance derivatives. For example, the Dodd-Frank law establishes several new approaches for regulating OTC derivatives that would be applicable to allowance derivatives (although how those approaches will be implemented is still unclear). The law defines many derivatives not previously traded on an exchange as a type of swap that would have to be traded in an exchangelike setting (called a swap execution facility) or, if not suited to that, would have to be registered with a swap data repository (a list similar to a registry but exclusively for swaps). The law also establishes mechanisms to aggregate OTC transactions so that regulators can more easily observe beneficial owners and trading volumes.

Another approach to regulating the OTC market for allowance derivatives would be to increase the cost of OTC transactions in the hope that participants would shift them to exchanges or clearing houses. The Dodd-Frank law does that by raising capital requirements for banks and other institutions that hold deposits and by increasing margin requirements for institutions that trade in OTC contracts. Specifically, the law requires the CFTC to impose higher capital and margin requirements on institutions (typically banks or investment banks) that carry out a sufficient volume of OTC transactions to be called dealers, as well as on firms that have large enough OTC holdings that they are considered important to the stability of the financial system. As a condition for operating in the OTC market, dealers and large institutions alike must comply with those capital and margin requirements, subject to periodic audits. The resulting increase in compliance costs for OTC transactions is designed to serve as an incentive to standardize contracts and move them onto exchanges or clearing houses. (Regardless of the effects on any particular market, capital and margin requirements are intended to decrease systemic risk by reducing the chance that the bankruptcy of a single entity will trigger the bankruptcy of any counterparty or bank from which it has borrowed.)

Challenges and Drawbacks. Increasing regulation of OTC transactions could result in some unintended behavior on the part of banks and market participants that might undermine the intent of such regulation. For example, if regulations differed between jurisdictions (such as between the United States and the United Kingdom), banks and their covered-entity counterparties could shift transactions to less regulated or less costly jurisdictions. In addition, higher capital requirements would probably prompt banks to reduce their lending or raise more capital. Historical evidence suggests that higher capital requirements cause banks to shift toward riskier investments (within a given class of investment) to compensate for the higher costs imposed by those requirements. At the same time, banks have sometimes reduced their lending to small businesses and individuals in response to such requirements.[35]

35. For a more thorough discussion, see Patricia Jackson and others, *Capital Requirements and Bank Behaviour: The Impact of the Basel Accord,* Basel Committee on Banking Supervision Working Paper 1 (Basel, Switzerland: Bank for International Settlements, April 1999), www.bis.org/publ/bcbs_wp1.pdf; and Basel Committee on Banking Supervision, *An Assessment of the Long-Term Economic Impact of Stronger Capital and Liquidity Requirements* (Basel, Switzerland: Bank for International Settlements, August 2010), www.bis.org/publ/bcbs173.pdf.