Developing an Efficient Carbon Emissions Allowance Market

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Abstract
Carbon trading works only if markets for carbon provide enough liquidity and “pricing accuracy,” i.e., markets provide prices that are useful for hedgers and other users of carbon markets. Further the creation of a de novo market for carbon assumes that the incentives to create such markets exist and that these markets will occur in the form that regulators desire. We argue that while regulators should receive all relevant information on trades (a trade repository), some discretion is necessary in the structure of markets. We suggest that regulators follow a “hybrid” approach to regulation, where regulators require some markets to be exchange-traded centralized limit order books, require trades between large financial intermediaries to be centrally settled but allow for some contracts to be over-the-counter with the right to move markets to a different reporting or settlement structure as they develop. Such an approach requires the regulator to have genuine discretion in decision making. Some recent examples involving the CFTC and ICE are discussed.
At the heart of recent proposals to trade carbon allowances is a cap-and-trade system in which carbon allowances and underlying derivative instruments would be traded. While such a system has worked on a much smaller scale with respect to SO2 allowances and in Europe (see Ellerman and Joskow [2008]), the de novo market that would trade such allowances represents a significant challenge to regulators, market participants and legislators. Recent legislation in the House of Representatives (The American Clean Energy and Security Act (H.R. 2454), henceforth the Waxman-Markey bill) and potential legislation in the Senate (Carbon Market Oversight Act of 2009 (S. 1399), henceforth the Feinstein-Snowe legislation) both define the rules and regulations that the carbon allowance trading system must meet.

Markets work well when they aggregate the diverse information of market participants (an idea that goes back to Hayek’s seminal work [1945]) and provide “pricing accuracy;” “Market efficiency” is not sufficient for “pricing accuracy”; a market that is being manipulated may be efficient in the sense that the price accounts for the high probability of manipulation but is extremely inefficient from the perspective of “pricing accuracy” (see Kyle and Viswanathan (2008) for a discussion of these issues). In the case of “cap and trade” the market for emitter allowances would allow the aggregation of diverse information about cost abatement across firms and over time and consequently allow emitters to find the price of the marginal abatement technology at each point in time; this would play an important role in deciding which technologies for abatement should be used in the short and long run.

Given the great heterogeneity in abatement technologies, there could be significant volatility in the price of carbon emission permits until the uncertainty over abatement technologies is resolved. This resolution of uncertainty could take some time as known low-cost technologies are used initially, the greater uncertainty is over longer run technological progress in abatement. This makes it even more important that the market structure for carbon trading leads to “pricing accuracy”; this would allow emitters (utilities, industrial firms, etc.) to hedge the long term emission liabilities that they will have under the law.

Such a market-based approach to emissions trading requires appropriate regulation of the trading market, especially since the regulatory authority (or some related regulatory authority) has to receive the actual amount of emissions abatement that is required by a law. Eventually all owners of emission permits must deliver, i.e., delivery failures cannot occur. Further, the carbon emissions market is a de novo market (spot, futures, and derivatives) and thus would have a different life cycle than most successful current markets. All this requires that the regulatory approach to trading carbon is successful in two key regards:

1. It regulates the market rigorously so that the market is not manipulated or cornered and in fact has accurate pricing.

2. It allows for sufficient innovation and investment from exchanges and financial intermediaries to be sufficiently liquid.

These two objectives go hand in hand. A non-transparent market with large volumes that is manipulated would defeat the whole intent and purpose of the carbon emissions legislation. Similarly, a market that met all regulatory requirements but had little trading would not help market participants meet their hedging requirements, defeating the purpose of having such markets.
Given these legislative objectives, the regulatory authority would have to ensure that a carbon market meets three key objectives:

1. **Transparency** – Market participants need accurate prices and the volume associated with those prices, the externality that prices offer to other market participants is one of the most important aspects of information aggregation in markets.

2. **Proper risk management and settlement** – Markets should allow participants to properly manage risk. This requires proper settlement of risks and regulatory knowledge of the systemic risk that exists. Not only should individual players be able to conduct proper risk management, the regulator also needs to minimize the systemic risk that is collectively borne.

3. **Vigilant regulation and elimination of market manipulation** – Markets must provide “pricing accuracy.” This requires the elimination of market manipulation. In turn, the regulator must know or be able to access the information needed to accomplish this purpose; further some discretion to make rules to ensure that markets that are important in an “informational” or “hedging” sense is essential to a well regulated market.

More specifically, the nature of the carbon trading needs three key de novo markets to come to fruition:

1. A vigorous spot market, since the trading of allowances is the key to the “cap-and-trade” system.

2. A very liquid futures market, both in the short and intermediate term. It is possible that most of the volume could land up in the very short term futures markets (as is the case for many commodities) and not in the spot market.

3. An approach to hedging long term risks for emitters, especially since the float in the market when it starts is small, though proposals to issue some future emissions allowances and to issue options could mitigate this issue.

All three aspects of the overall carbon market are important. Spot or near futures trading is needed to ensure that the commodity is traded. Intermediate term futures are needed to ensure that the delivery and settlement of annual emissions allowances occurs efficiently. Long term contracts are needed to ensure that emitters can hedge their short positions (the emissions that must be taken care of) in an appropriate manner.

**Settlement and Risk Management**

One key aspect of the Waxman-Markey bill (and in fact the Treasury plan for derivatives) is the requirement that all contracts be generally exchange settled. Most trading in derivatives involves two kinds of trades – trades between financial intermediaries (generally investment banks) and trades between the customer (industrial firms) and the financial intermediaries. In the market for interest rate swaps, the largest market for over-the-counter swaps, only trades between financial intermediaries are cleared. Even here, clearing is relatively recent and occurs only for standardized contracts.

The key advantage of centralized clearing is the reduction of systemic risk—the regulator (having to pay attention to a few clearing houses) has a much better idea of what exposures exist for each financial intermediary and what margins are appropriate for uncleared (before collateralization and clearing) and cleared positions. Since clearing does not occur in real time, some within day
risk still remains even with clearing and netting. Second clearing is costly as it requires standardization and setting up of systems that aggregate all trades. Thirdly, if clearing has to be extended to customer contracts with financial intermediaries, there has to be greater standardization in such contracts. Fourthly, if the logic of clearing and netting is carried to its conclusion, there should one clearing house for all contracts; with multiple clearing houses, full netting may not occur because offsetting positions may be in two different clearing houses (see Duffie and Zhu (2009) for this argument).

**Transparency and Trade/Positions Reporting**

Transparency is an important dimension of “pricing accuracy.” Transparency affects markets in a number of different ways – it limits the monopoly position of market insiders, it fosters better competition across different market venues. In general, transparency reduces bid-ask spreads and increases the liquidity in markets (though it may not be necessarily beneficial for customers with large positions). The introduction of the TRACE system for post-trade reporting in the market for bonds led a dramatic reduction in bid-ask spreads for municipal bonds.

A second aspect of trade reporting is effective regulation. To successfully oversee markets, the regulator must be aware of all trades, especially trades that move the market and are marginal in determining the price. Further the regulator must be aware of the size of large positions that may have the potential to have monopoly power. Lack of such information can have significant negative consequence. The best example of this is the rapid increase in volume in the Intercontinental Exchange (ICE) relative to the NYMEX on a number of contracts, especially in natural gas and oil. Even thought the underlying spot contract was a US based contract (US crude or natural gas), the actual trading occurred in London. The CFTC’s position reporting system based on the NYMEX was flawed because it did not include positions on ICE. In particular, in August 2006, when the CFTC asked Amaranth to reduce its positions on NYMEX, Amaranth simply increased its positions on ICE while reducing its positions on NYMEX (see the Levin-Coleman report on excessive speculation in the Natural Gas market). Lack of relevant regulation with the appropriate regulator hampers the measurement of systemic risk and the elimination of market manipulation.

**The Debate over Over-the-Counter Contracting**

The current version of the Waxman-Markey bill (H.R.2454) has language that seems to prohibit over-the-counter (OTC) contracting. In practice, for derivative trades, the size of exchange-traded contracts is small relative to OTC contracts (see Table 1 based on BIS data). For foreign exchange derivative contracts, it is close to zero. For interest rate contracts (mainly interest rate swaps), it is around 10%. Only for equity linked contracts are exchange-traded contracts significant (76%). Hence, as of now, substantial amounts of derivatives trades, especially customer-intermediary trades seem to be OTC trades.

Many emitters unambiguously prefer OTC contracts (see the statement by Joseph Glace of Exelon before the Senate Agricultural Committee and National Association of Manufacturers) to exchange settled contracts. Further, exchange-settled contracts do not exist for long dates in many markets.

The preference of hedging firm for OTC contracts over exchange contracts stems from three factors:

1. **Credit risk versus collateral issues** – Firms do not want to post collateral in the exchange continuously over the life of the contract. Effectively the counterparty in the OTC takes their credit risk and posts collateral while hedging his/her position.
2. **Long-dated contracts** – For long-dated contracts, the use of exchanges effectively requires synthetic hedging because long-dated contracts don’t exist. The intermediary is willing to engage in synthetic hedging while the firm itself gets a long-dated OTC contract.

3. **Accounting and mark-to-market issues** – Participation in an exchange and engaging in synthetic hedging exposes the firm to mark-to-market accounting one side of the hedge (the other side of the hedge is the natural long or short position that the firm is trying to hedge). The natural long or short position is not marked to market.

The first reason, though often mentioned by industry participants (see the Exelon testimony), is somewhat of a “red herring” because it suggests a failure in the lending market. Essentially the argument is that the collateral available with industry participants would not be acceptable to an exchange and the investment banks are intermediating this collateral heterogeneity by undertaking the OTC contract and then hedging on the exchange. However, this argument fails to explain why there are no direct lenders who give the industry participants facilities that ensure their ability to post collateral, i.e., it is unclear why the lending and trading cannot be unbundled. The more subtle issue could be that investment banks have deeper access to capital than industry participants and hence can avoid the problems caused by mark-to-market – in particular the one sided mark-to-market problem faced by industry participants could create large interim payments because the natural long position is not marked to market (see Metallgesellschaft for a case where a large default occurred partly due to a large collateral call, more details in Culp and Miller [1995]).

The second reason is perhaps more convincing because long-dated derivatives are still not traded on exchanges even in very liquid commodities. Various reasons given for this include settlement related issues, risk related issues. Without going through the merit of these issues, it is clear that forcing long-dated contracts on an exchange may make it difficult to for some hedgers to participate.

One approach to resolving some of the objections raised by hedgers like utilities to making all contracts exchange contracts is have a hybrid approach to regulation that is detailed later in the paper.

**The Creation of De Novo Markets**

Another inherent risk in climate markets is that they are going to created de novo. The presumption in the Act is that markets will appear in the form that regulators desire. The reality of markets is that they generally start as OTC markets (because innovators want to maximize their profits) but remain OTC markets for too long. This occurs because the original innovators are able to get substantial profit and the externality induced by pooling all liquidity makes it difficult for new participants to enter (see Foster and Viswanathan (1990) or Admati and Pfleiderer (1988) for discussions of this idea). In rare cases, innovation does occur and the markets do move to exchanges. This leads to the regulatory failure that some markets stay under-regulated even when they are important for “pricing accuracy” – the recent examples of credit default swap markets comes to mind in this regard. From a regulatory perspective, the question arises as to what is the best approach to take to ensure that:

1. The required markets are created and available to legitimate participants who want to hedge

2. The regulation of these markets changes as they transform and become more important from the perspective of “pricing accuracy.”
By its very nature, the regulation of such de novo markets requires some flexibility. We suggest a hybrid approach to regulation that is detailed below.

**A “Hybrid” Approach to Regulation**

One possible approach to regulating markets is to take a “hybrid” approach. Under this approach, the regulator does the following:

1. Requires the reporting of all trades to the regulator (including OTC trades and foreign trades on US spot contracts). This ensures that the regulator has the information necessary to make decisions over time that will improve the “pricing accuracy” of the market.

2. Designates the spot and short run futures market as public markets in which all trades are executed on a consolidated limit order book (CLOB) and all trades, quotes and prices are publicly disseminated.

3. Allows some long-dated contracts and customer contracts to be traded OTC but reserves the right to transfer them to exchanges. However, all such contracts are still reported to the regulator. The regulator may force some of these contracts to be settled in a central clearing house if the regulator feels this is necessary for risk management.

4. Sets up transparent rules on moving the OTC market to an exchange based on triggers – volume, pricing accuracy, etc.

A critical aspect of this “hybrid” regulatory approach is that the regulator must have both the relevant information and the regulatory authority to move OTC markets to exchanges. The CFTC’s failures in the Amaranth case (where Amaranth moved trades from the CME to the ICE when told by the CFTC in August 2006 that they were too big, see the Levin-Coleman report) and its subsequent difficulties to regulating offshore contracts suggest that a “hybrid system” is bound to fail unless there is reporting of all trades and sufficient regulatory powers to make the required dynamic changes.

The CFTC originally exempted from regulatory oversight electronic trading between large counterparties under the Commodity Futures Modernization Act of 2000 (this is the so called “Enron exemption”). While originally the volume on such markets was low, look-like contracts similar to high volume started to appear especially on the Intercontinental Exchange (ICE). By 2005, it was clear that in fact substantial “price discovery” occurred in the ICE market, especially in natural gas contracts. Recognizing this, Congress passed the CFTC Reauthorization Act of 2008 that allowed the CFTC to govern the regulation of “significant price discovery contracts.” In response to this Act, the CFTC implemented rules based on three criteria – “arbitrage, material price reference, and material liquidity” – for determining whether a contract should be regulated like an exchange contract. Recently, the CFTC extended its regulatory power over the ICE natural gas contract using this approach.

The above discussion suggests that the lack of relevant information and the lack of regulatory powers (either because they are not given to the regulator or because they are not used due to political pressures) would make such a hybrid system ineffective. It is critical that the regulator be given the necessary authority and tools to make such a hybrid approach work. However, the recent regulatory changes and the CFTC’s use of this authority suggest that a hybrid system is capable of success with the relevant information and power.
Restricting Speculation

Another issue that has received much attention in the context of carbon markets is the restriction of manipulation and excessive manipulation. Manipulation in commodity markets can occur in many ways (see Kyle and Viswanathan (2008)). One approach to hoard the commodity and ask for delivery; in the case of carbon this would require buying up a large number of permits and then asking counterparties in derivatives transactions to actually deliver the permit. Even with a large number of permits, this could happen if most holders of permits do not trade them or lend them, i.e., the actual float is quite small. In Treasury securities, at times issued securities are “special” – i.e., command a premium because there is insufficient float, this occurs because some issuers do not trade the Treasury security, they simply hold them and do not make them available for lending (see Duffie (1996) for a discussion). The usual approach to reduce such manipulation is two-fold – (1) the issuer has the right to issue additional carbon permits and (2) the regulator has right to force cash settlement and end actual delivery of permits to the speculator (see Merrick, Naik and Yadav (2005) for a discussion on how the Bank of England stopped a squeeze in the long gilt futures market by making the security available for repo at 0% to those market participants unable to find bond to deliver).

A second issue that irks legislators is high market volatility, there is contentious debate whether such volatility is “excessive.” In the case of carbon, it would be unclear whether this high volatility is due to speculation or manipulation or to legitimate fundamental uncertainty about abatement technologies in the long run (about which there could be substantial uncertainty). Various suggestions to deal with these issues include a price cap and a price collar. A price cap is essentially a carbon tax as the emitter can always purchase permits from the authority at that price; carbon trading then allows a lower price. Collars or price limits in general do not perform well if they are not sustainable, i.e., the regulator or issuer is willing to sell enough permits at the high price and buy at the low price when these limits are hit. Finally, if the marginal cost of abatement is truly very high, a price cap defeats the purpose of using market prices. In general, the value of such price limits is rather limited, if Congress wanted to tax carbon, it could directly have done so rather than using a cap-and-trade system.

A related concern raised has been that the size of the float initially could be too small and this in turn could lead to a squeeze. One approach to resolve such concerns to give emitters options are various strike prices; they could exercise these options directly from the government by paying the strike price. Hence any subsidy would be directly given to a set of emitters rather than the whole market. This has been suggested by Anda, Monast, Profeta, and Keohane (2009).

Conclusion

If the cap-and-trade system is to succeed, the underlying markets for spot, futures and long-dated contracts must emerge and must provide prices that enable market participants to make appropriate decisions on abatement technologies. Constructing a market that is transparent, aggregates the disparate information of participants and provides “price accuracy,” i.e., it recovers a good estimate of the marginal cost of abatement at various points in time needs careful thought and regulation. This paper suggests a “hybrid” approach to regulation that provides sufficient regulatory information for the regulator to make decisions and yet allows for market innovation and some flexibility in the market design. We discuss the minimal elements necessary for the success of such a “hybrid” approach – that the regulator has all the available information to make socially efficient decisions and the authority the change the nature of reporting and settlement and market structure for various contracts.
Table 1. Fraction of derivative contracts that are exchange-traded.

<table>
<thead>
<tr>
<th>Security</th>
<th>Notional amount</th>
<th>Exchange-traded</th>
<th>Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Exchange Contracts</td>
<td>49753</td>
<td>220</td>
<td>0.44%</td>
</tr>
<tr>
<td>Interest Rate Contracts</td>
<td>418678</td>
<td>52712</td>
<td>12.6%</td>
</tr>
<tr>
<td>Equity-linked Contracts</td>
<td>6494</td>
<td>4945</td>
<td>76%</td>
</tr>
<tr>
<td>All (excluding commodity contracts)</td>
<td>587266</td>
<td>57876</td>
<td>9.85%</td>
</tr>
</tbody>
</table>

Source BIS, Gyntelberg and Mallo (2009)
References


Testimony of Tim Profeta, Senate Agricultural Committee, 2009.

Testimony of Joseph Glace, Vice President and Chief Risk Officer, Exelon, Senate Agriculture Committee, September 9th 2009.