

## **Waxman-Markey: Unintended Consequences of the Auction Reserve Price**

June 2009

Jürgen Weiss  
Mark Sarro

## **EXECUTIVE SUMMARY**

A marked-up version of the American Clean Energy and Security Act of 2009 passed out of the House Committee on Energy and Commerce on May 21, 2009 as H.R. 2454.

The revised draft bill is 932 pages and covers a broad range of big-picture energy issues, including energy efficiency, renewable energy, and a federal cap-and-trade program to reduce greenhouse gas emissions.

In this short comment, we focus on the cap-and-trade part of the Waxman-Markey bill. In particular, we consider the implication of the auction price provision in Section 791 (d), which imposes a minimum price for auctioned allowances of \$10 in 2012, escalating by the rate of inflation plus 5% per annum.

We argue that the minimum auction reserve price functions as a parameter that sets the effective reserve price, which in turn is determined by a no-arbitrage condition. This condition depends critically on the market's beliefs about the stability of the program and many other factors. The impact of the approach is to increase carbon prices and provide larger windfalls to those who are given allowances in early years. The provision essentially turns the cap and trade system into a complex carbon tax. Unfortunately price certainty is lost to a large degree, since the effective price depends heavily on beliefs about government actions and technological progress in future years.

Price certainty would be improved if the 5% escalation rate is reduced to a level equal or lower than the real riskfree rate on comparable assets. Thus, an improvement, although potentially difficult politically, would be to raise the initial reserve above \$10 and reduce the 5% escalator to achieve the same price path with less risk of price arbitrage.

## WAXMAN-MARKEY SECTION 791 (D)

Section 791 (d) of the Waxman-Markey “clean energy” bill (“H.R. 2454”) states the following:

“(d) RESERVE AUCTION PRICE.—The minimum reserve auction price shall be \$10 for auctions occurring in 2012. The minimum reserve price for auctions occurring in years after 2012 shall be the minimum reserve auction price for the previous year increased by 5 percent plus the rate of inflation (as measured by the Consumer Price Index for all urban consumers).<sup>1</sup>”

Providing price certainty for carbon is often mentioned as one of the key advantages of a carbon tax over a cap-and-trade approach. Along the same lines of argument, the decline of carbon prices under the European Union Emissions Trading Scheme (EU ETS) in the fall of 2008 led many to advocate for the setting of a price floor on carbon so as to provide the price signal necessary for continued investment in greenhouse gas emissions lowering technologies.

Section 791 (d) of H.R. 2454 as it currently stands can therefore be seen as an attempt to address this very issue by providing some amount of price certainty for investors under a cap-and-trade policy.

But as we show in this paper, the current draft may lead to inter-temporal arbitrage with the result of increasing near-term prices. While this would not hurt investments in greenhouse gas lowering technologies, it would potentially increase the near-term cost of the cap-and-trade program as currently designed.

The rest of this paper will lay out the rationale for the inter-temporal arbitrage opportunities opened by Section 791 (d) as currently drafted, outline some potential

implications for the carbon price path under the current bill, suggest a simple policy option to address this issue.

## CARBON PRICES, UNCERTAINTY, AND ARBITRAGE

The current minimum reserve auction price provision will likely set a floor price for carbon prices. This is because as long as compliance entities need to purchase at least some allowances through the auction process, no holder of allowances would be willing to sell those allowances for less than the expected reserve auction price, which, assuming no changes to the bill over time, can be calculated for each auction year in real terms, and in nominal terms assuming a rate of inflation.

Therefore, the price of carbon under H.R. 2454 will be equal or higher than the minimum reserve auction price unless one of two things happens:

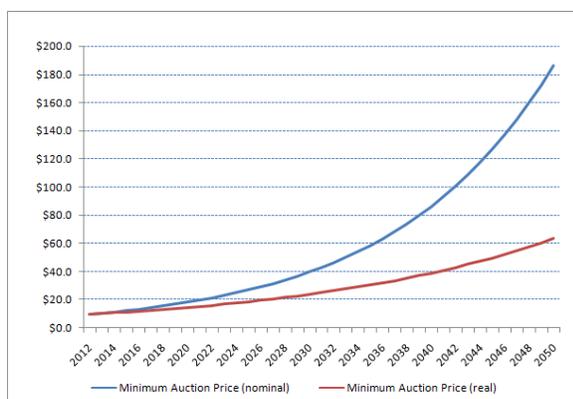
- (1) Section 791 (d) or other provisions of the bill are changed by the legislature in ways that have an impact on the minimum reserve auction price
- (2) Some technological change makes the carbon limits imposed by the bill no longer meaningful, i.e. the United States essentially figures out a way to eliminate greenhouse gas emissions and save money by doing so, absent climate change considerations or, more precisely, to lower emissions below the level of available and allowed offsets.

While there is always some chance of either of those two things happening, the likelihood of either (1) or (2) would be extremely low for quite some time after enactment of the bill.

<sup>1</sup> H.R. 2454, “American Clean Energy and Security Act of 2009”, page 946

Therefore, for likely many years (and more on the timing issues below), the minimum reserve auction price provision would likely lead to carbon prices being at least as high as the minimum reserve auction price path with something close to certainty.

More concretely, assuming a 3% rate of inflation (which is consistent with the average growth in the Consumer Price Index), the price of carbon would be at least \$10 in 2012, \$10.80 in 2013, etc. Figure 1 below shows the minimum carbon price paths with and without inflation (at 3%).



**Figure 1: Minimum Auction Price (real and nominal)**

While it will probably be interesting for some to observe that this implies a minimum carbon price in 2050 of over \$180/t, we want to draw attention here to the fact that anybody able to buy a carbon allowance at auction in 2012 for \$10 would be able to sell it for at least \$10.80 in 2013, realizing an 8% return on an essentially riskfree investment.

The bill offers at least a 5% real rate of appreciation for carbon allowances. While there is some discussion around the real rate of return on relatively riskfree assets, there is substantial consensus that it is significantly below 5%. For example, the average real rate of return on long-term

Treasury bills as reported by the U.S. Treasury is 2.26%<sup>2</sup>.

This compares very favorably to current Treasury yields, ranging from the 1-year US T-bill (less than 0.5% as of early June 2009) to the 30-year T-bill (roughly 4.5%).

This means that buying allowances at auction, if they can be purchased at the minimum reserve price, yields much higher returns than investment in other securities with similar risk characteristics (i.e., riskfree investments).

Of course, the “if” in the above paragraph is an important one. A very well established principle in economics and finance is the “no arbitrage condition”, i.e. the notion that supply and demand for commodities will equate returns to assets with similar risk. Realizing that next year’s carbon price will be at least 8% higher than this year’s minimum reserve auction price, people will be willing to pay up to an amount that will give them a return equal to what they receive on an asset of similar risk.

To simplify the analysis, let’s assume with real riskfree rate of return is indeed 2.26%. At that riskfree rate, investors will be willing to pay up to \$10.26 at auction in 2012 to receive at least \$10.80 in 2013 and realize a one year real return of 2.26%, making them indifferent between holding allowances and Treasury bills.

**TIMING, TIMING**

It is pretty safe to assume there won’t be a scientific break-through between 2012 and 2013 and the bill won’t be changed right

<sup>2</sup> Long Term Real Rate Average between 1/2/2003 and 6/5/2009, as reported by the United States Treasury, defined as “the Long-Term Real Rate Average is the unweighted average of bid real yields on all outstanding TIPS with remaining maturities of more than 10 years and is intended as a proxy for long-term real rates.” (www.ustreas.gov)

away. Hence, the assumption that buying an allowance in 2012 would be a riskfree investment yielding a price of at least \$10.80 in 2013 is very likely reasonable.

However, the exact same argument can be applied for arbitrage over longer time horizons. Figure 2 below shows the minimum carbon price path that meets the no-arbitrage condition for various time horizons between 2020 and 2050, assuming a 3% inflation rate and a 2.26% real riskfree rate of return.



**Figure 2: Nominal Carbon Price Paths with Arbitrage**

As the graph shows, the longer the time horizon, the higher the price investors are willing to pay in 2012 and, consequently, the higher the price path of carbon that results from investors bidding up the carbon price at auction to earn at least a 2.26% real rate of return over time.

There certainly are investors with a time horizon of 30 years or more, so the “Arbitrage to 2050 scenario” in Figure 2 may not be unrealistic. The appendix provides at least one argument that suggests that even if time horizons are shorter, 2050 may be an appropriate anchor point for arbitrage.

Using the shorter-term yields on Treasury bills would increase the price in scenarios with shorter arbitrage horizons somewhat more than Figure 2 suggests.

It is not clear what the appropriate time horizon for any potential arbitrageur would be. As just mentioned, investor time horizon itself would likely be one determining factor, but so would investor assessment of how “risky” the investment becomes over longer and longer time horizons. This perceived risk in itself may well be tied to absolute levels of carbon prices, since they will influence the likelihood of transformative innovation and the temptation of government to “ease the burden” by revising the bill.

### NO LIMIT TO MADNESS

H.R. 2454 does of course not have a sunset provision. Unless and until Congress repeals the cap-and-trade program, it is in effect indefinitely. After 2050, the bill freezes total allowances at just over 1 billion per year and continues to allow up to 2 billion tons of offsets for compliance. All the while, the minimum reserve auction price continues to escalate at 5% plus the rate of inflation each year.

Not only does this mean the minimum reserve price (at 3% annual inflation) will be \$8,735 per allowance in 2100 and \$19,216,135 in 2200,<sup>3</sup> it also suggests that if some investors with really long time horizons are out there, the 2012 auction prices that satisfy the no-arbitrage condition are \$182 for an arbitrage time horizon through 2100 and \$4,896 for an arbitrage time horizon through 2200, clearly higher than the current EPA projections of carbon prices in the early years of the program.

<sup>3</sup> We’ll stop here. In real dollars, the prices would be \$732 and \$96,292 respectively.

## CONCLUSIONS

This short note demonstrates that the minimum reserve auction price provision in Section 791 (d) may encourage financial arbitrage, which in turn is likely to increase carbon prices particularly in early years. Depending on the perceived risk resulting from the threat of legislative corrective action and/or technological break-through innovation rendering climate legislation meaningless, the price impact could be significant.

One obvious and simple correction to the current draft would be to change the escalation rate of the minimum reserve auction price to a rate that closer resembles the long-term real riskfree rate of return. While there is some theoretical disagreement on what this unobserved rate actually is, a real escalator closer to 2-3% would likely make the arbitrage problem less severe. Depending on the need to support an average carbon price signal over time, the 2012 minimum reserve auction price could be raised somewhat.

## APPENDIX: STARTING AT THE END

We argue above that the impact of the minimum reserve auction price on the near-term trajectory of carbon prices depends on the time horizon of arbitrageurs. If the time horizon is long, the impact on prices in the early years under H.R. 2454 is bigger than if investors' time horizon is shorter.

It turns out there is at least one theoretical argument that suggests that the time horizon of investors doesn't matter, but rather that the impact of the no-arbitrage condition on prices depends only on beliefs about whether and when the law will either be modified or made meaningless through technological progress.

This is because of what economists call a backward induction argument. Pick a year

you believe to be the last one prior to a technological break-through and assume that the law will never be changed. Assume this year is 2049 and that an investor in that year believes that 2050 will be the last year before some technological breakthrough will make the limits imposed by H.R. 2454 no longer binding, i.e. that in 2051 and later nobody will have to buy allowances at auction however, but that available offsets are enough to cover remaining emissions.

An investor in 2049 would know that the minimum price for allowances in 2050 will be \$63.85 (in 2012 dollars – it would be \$130.80 in nominal terms assuming 3% inflation). Assuming that the one-year real rate of return on alternative riskfree investments will be 2.26%, approximately equal to the average long-run real rate of return as reported by the U.S. Treasury, one-year investors will be willing to pay up to \$62.44 for an allowance at auction in 2049 and earn a 2.26% real rate of return. This establishes that the minimum price in 2049 will be \$62.44.

Knowing this, a one-year investor in 2048 will be willing to pay up to \$61.06, resell for \$62.44 and make a 2.26% real return. And so on, all the way back to 2012, when a one-year investor will know that in 2013 the minimum price will be \$27.93 and hence will be willing to pay \$27.31 for an allowance at auction in 2012.

This argument suggests that if we believe technology will not have made our efforts to reduce greenhouse gas emissions essentially costless by 2050, the no arbitrage rule, coupled with a backwards induction argument, suggests minimum carbon prices in 2012 to be not \$10, but over \$27.

It is anybody's guess when at the earliest we think a technological breakthrough will happen that will put a stop to the arbitrage impact on early carbon prices.

## ABOUT BRATTLE

*The Brattle Group* provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world. We combine in-depth industry experience and rigorous analyses to answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

We have offices in Cambridge, Massachusetts; San Francisco, California; and Washington, DC. We also have offices in Brussels, London, and Madrid.

## ABOUT THE AUTHORS



**Dr. Mark Sarro**, a principal of *The Brattle Group*, specializes in the financial and strategic aspects of energy- and carbon-related risk analysis, investment, and business decisions. His climate change work includes project-specific financial modeling, modeling markets for conventional and renewable energy, analyzing climate policy, and advising on the availability and pricing of emissions allowances and offsets.

**P:** +1. 617.864.7900

**E:** [Mark.Sarro@brattle.com](mailto:Mark.Sarro@brattle.com)



**Dr. Jürgen Weiss** is a principal of *The Brattle Group* and heads the firm's climate practice. He specializes in climate change and carbon market analyses, renewable energy, and electric utility economics. He advises clients on climate change policy, strategy and risk, changes in the value of existing assets, integration of renewables, market design and performance analysis, and efficient retail incentives and rate design. Dr. Weiss has consulted and written substantially on issues related to carbon pricing and the demand side of electricity markets, including topics such as efficiency, conservation, storage, retail rates, renewable power, and Renewable Portfolio Standards.

**P:** +1. 617.864.7900

**E:** [Jurgen.Weiss@brattle.com](mailto:Jurgen.Weiss@brattle.com)