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BRIDGING THE GAP:
INTEGRATING PRICE MECHANISMS INTO INTERNATIONAL CLIMATE NEGOTIATIONS

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EXECUTIVE SUMMARY

The Parties to the United Nations Framework Convention on Climate Change (UNFCCC) continue their efforts to forge a new binding international agreement by 2015. The negotiations face daunting odds, but the 2009 Copenhagen Accord's shift towards heterogeneous national commitments was a positive step forward for climate policy. The prior presumption that binding commitments could only take the form of a percentage reduction relative to historical levels alienated rapidly industrializing countries and led to unproductive disputes over base years and other issues of target formulation. However, the disparate approaches now under discussion complicate comparing the likely emissions reductions and economic efforts required to achieve the commitments.

This paper makes two points. First, we offer good reasons and ways to adapt international negotiations to allow for price-based commitments. The economic uncertainty surrounding target-only commitments is enormous. Combining a clear cumulative emissions target with limits on the cost associated with achieving the target would balance the environmental objective with the need to ensure that commitments remain feasible. This economic insurance could foster greater participation in the agreement and more ambitious commitments. Specifically, we suggest that in addition to their cumulative emissions targets for the 2013 to 2020 period, major economies could agree to a "price collar" on greenhouse gas emissions in their domestic economies. This would include starting floor and ceiling prices on a ton of CO_2 and a schedule for real increases in those prices. All major parties would need to show at least a minimum level of effort regardless of whether they achieve their emissions target, and they would be allowed to exceed their target if they are unable to achieve it in spite of undertaking a high level of effort. The paper provides an example of how a price collar would work in the US context under a cap-and-trade system.

Second, analyzing proposed climate commitments in terms of their implied economic stringency, as measured by the implied price on carbon necessary to achieve the targets, offers transparent and verifiable assurance of the comparability of effort across countries. It possible to calculate "carbon price equivalents" of climate commitments in a conceptually similar way to the tariff equivalents used in international trade negotiations.

In sum, the lack of transparency in the level of effort involved in achieving particular emissions targets highlights the potential value of allowing for price-based commitments and argues for greater economic transparency in the international negotiation process.

1. INTRODUCTION: THE POLICY PROBLEM

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) met in Doha in late 2012 to continue the process of forging a new binding international agreement to be completed by 2015. As talks stumbled from Copenhagen in December 2009 through subsequent meetings in Cancun and Durban, it has become increasingly clear that countries are moving away from the targets and timetables approach towards more disparate national actions. The negotiation framework, though, is still largely stuck in the mindset of the Kyoto Protocol. This paper offers a way forward that builds on what has been achieved so far but also takes into account the desire of countries to adopt differentiated national strategies. Moreover, it provides a transparent mechanism for evaluating the comparability of efforts to reduce global emissions.

The UNFCCC's 2007 Bali Plan of Action calls for the next agreement to ensure the "comparability of efforts" across developed countries while "taking into account differences in their national circumstances." Trends in national emissions and economic growth vary widely between countries, as do year-to-year fluctuations around those trends. This means that achieving similar reductions relative to historical base years can require very different levels of efforts in different countries. These differences have greatly hampered climate cooperation because it means that commitments that are similar in effort *look* inequitable. Further, divergent underlying trends make it difficult to know the effort that any particular commitment will require. The failure of the G-8 to set a base year for its agreed 80 percent reduction of emissions by 2050 illustrates the contention in formulating even collective targets.

The presumption that binding commitments can take only the form of a percentage reduction relative to historical levels has dimmed the long term prospects for stabilizing the climate, not least because it alienates rapidly industrializing countries such as China and India. Parties could negotiate emissions levels rather than reductions relative to base years, but even then they are not assured of comparable efforts because many things that affect the burden of achieving the target can happen between the year of negotiation and the commitment period. The recent financial crisis and global economic downturn are clear reminders of the volatility in the underlying economic environment. Additional uncertainties include unanticipated economic growth, technology breakthroughs, prices for renewables and natural gas (a lower-emitting alternative to coal), and political instability. To properly protect the climate, the international regime should endure through any number of economic and political fluctuations.

To illustrate the disparities between the apparent and actual stringency of commitments, McKibbin, Morris and Wilcoxen (2011) model the commitments that Parties made at Copenhagen in December 2009 at the fifteenth Conference of the Parties (COP) to the UNFCCC. The Copenhagen Accord breaks away from the targets and timetables approach by allowing each country to choose its own base year and to express its commitment in terms other than absolute reductions in emissions. This flexibility promoted consensus and allowed an agreement to be reached. At the same time, however, it complicates comparing the emissions reductions and economic efforts implicit in the commitments made by the participants.

McKibbin, Morris and Wilcoxen (2011)[1] compared the level of effort necessary to achieve those commitments using the G-Cubed model of the global economy focused on fossil-fuel-related CO_2 and assumed targets were achieved domestically. The results show that alternative ways of expressing a commitment can make a single set of targets appear strikingly different in stringency. Moreover, they show that the actual stringency of the Accord, as measured by either GDP or consumption loss relative to a reference case, differs sharply across countries. This is because the economic consequences of each target depend importantly on a number of factors: the size of each country's economy in 2020; the internal structure of its economy; the extent to which carbon-intensive energy sources are a critical part of the energy system in 2020; the endowment of fossil fuels in each economy; and the ease or difficulty of substituting between energy sources for energy-intensive goods in production and consumption bundles. All of these factors affect the ambition embodied in the Accord's commitments.

Commitments by Japan and Europe imply high carbon prices and relatively high GDP losses. The United States and China both have moderate carbon prices and moderate GDP effects. The authors also find that for many countries the domestic price on carbon is a poor predictor of the welfare implications of the overall agreement. For example the United States has the third highest estimated carbon price but nearly no loss of consumption. On the other hand, Australia and Eastern Europe/Former Soviet Union have relatively large GDP effects despite small or zero carbon prices because their terms of trade decline. OPEC suffers a large drop in GDP from a sharp decline in world oil demand.

The main conclusion from McKibbin Morris and Wilcoxen (2011) is that it is possible to calculate "carbon price equivalents" of climate commitments in a conceptually similar way to the tariff equivalents used in international trade negotiations. For example, their methodology could be used to compute a carbon price equivalent to the Obama Administration's corporate average fuel economy increases. In addition, the paper shows that the level of effort involved is not at all transparent. It also shows that the economic impacts from other countries' commitments can have as large or larger an effect on a country's economic welfare as meeting its own commitment. This argues for greater economic transparency in the international negotiation process, and it highlights the potential value of allowing for price-based commitments.

2. HOW TO GET FROM KYOTO TO A NEW 2015 AGREEMENT

Here we offer a way forward. Parties could break the stalemate around hard targets and ensure the comparability of efforts by supplementing commitments on emissions with commitments for price signals on carbon. Under our proposal, all major parties would need

[1] Jotzo (2011) uses a different methodology but reaches similar conclusions on the stringency of Copenhagen targets using a range of benchmarks.

to show at least a minimum level of effort regardless of whether they achieve their emissions target, and they would be allowed to exceed their target if they are unable to achieve it in spite of undertaking a high level of effort.

Specifically, in addition to a cumulative emissions target for the 2013 to 2020 period, major economies would agree to a "price collar" on emissions in their domestic economy comprised of:

1. a starting floor price on a ton of carbon dioxide-equivalent emissions for 2013
2. a starting price ceiling on a ton of carbon dioxide-equivalent emissions for 2013
3. a schedule for real increases in the price floor and ceiling, such as 4 percent per year.

The floor and ceiling prices need not be uniform across countries as long as all Parties were comfortable with any differences. To comply with their commitments, Parties must demonstrate two things. First they must show that they have imposed a price on carbon equivalent emissions at least at the agreed floor price to an agreed extent, for example over most or all of the commitment period across all or most of their domestic economy. Second, Parties must show that their cumulative emissions are no higher than their announced target OR that their domestic price on emissions has reached or exceeded the ceiling price to an agreed extent.

This price-based framework has several advantages. It allows Parties to negotiate explicit bounds on the level of effort they undertake, ensuring that all Parties' efforts are serious and that no country's commitment is infeasible. It also makes comparing effort across countries more transparent, and it greatly simplifies compliance for Parties that choose a tax on greenhouse gas emissions as their primary domestic climate policy. Parties with cap-and-trade systems can choose a ceiling price that would have no effect as long as the level of effort required to achieve their emissions target is what they expect.

The price floor ensures that no Party's commitment is unduly lax, as were the targets for the former Soviet countries under the Kyoto Protocol. To the extent that Parties adopt similar price signals, the approach helps lower the overall cost of achieving a particular level of climate protection by equalizing marginal abatement costs across economies. Competitive concerns could provide some incentive to converge over the long run.

The upper bound on required effort in our proposal allows Parties to comply with their commitments even if their targets turn out to be unduly stringent. On one hand, this could lower the expected environmental performance of the agreement once targets are fixed, but on the other hand it could allow Parties to take more ambitious targets than they otherwise would. It also helps keep Parties within the agreement when they may have otherwise simply dropped out.

Allowing price-based commitments under a UNFCCC agreement could have special advantages for the United States. If the United States adopts a carbon tax as part of a broader fiscal reform package, the tax level in that legislation could offer the U.S. a way to participate in a binding international commitment. Conversely, making a carbon tax part of a treaty commitment could bolster the long run viability of the tax domestically because it would make it harder for Congress to unravel.

In our proposed approach, Parties can implement their commitments as they see fit domestically, including through a tax or cap-and-trade system that provides transparent price signals. The domestic mechanics of the price collar could work in a number of ways within a cap-and-trade system. For example, a central bank of carbon could intervene by buying or selling permits to keep the price within bounds[2]. This is similar to the open market operations of the Federal Reserve in short term money markets. Alternatively the government could place a reserve price on allowances that it auctions and offer additional permits at a price no lower than the agreed ceiling value. Parties could control any revenues generated by their domestic climate policy and use it to offset other tax burdens as they see fit. The effects of these domestic programs would be measurable, reportable, and verifiable much earlier in the commitment period than emissions levels, giving an early indication of treaty compliance.

The flexibility of a price-based commitment is especially well-suited to developing countries that are uncomfortable with hard emissions caps but might be open to imposing a carbon tax or a cap-and-trade system with a safety valve, for example. One option would be to allow such countries to begin by adopting a price floor alone, without an explicit emissions target, and then later transition to commitments more like those of industrialized countries.

Establishing comparable national price targets across countries means that international trading of permits would be unnecessary, adding to the system's robustness by avoiding a fragile international regime based on a common allowance market. McKibbin and Wilcoxen (2002) and McKibbin, Morris and Wilcoxen (2009) explain the advantages of coordinated national institutions over global institutions for creating a robust policy regime.

Some environmentalists are uncomfortable with a price collar approach, domestically or internationally. Some believe that any limit on the price of allowances undermines the environmental integrity of the commitment. However, this belief gives moral status to the cap, an essentially political decision. Even if climate science can inform policymakers about the relationships between greenhouse concentrations and climate impacts, science alone cannot balance the tradeoffs across the benefits and costs of particular short run targets for individual countries. Further, if Parties can only adopt hard targets as commitments then they may choose looser caps or none at all rather than risk excessive stringency or non-compliance. Moreover, an explicit upper bound on prices can prevent a disorderly collapse of domestic programs, perhaps the worst possible outcome for the environment.

Others argue against putting an upper limit on carbon prices on the grounds that very high carbon prices could spur technologies that will eventually provide low cost abatement, thus obviating the apparent cost savings of a limit on carbon prices. Clearly, a limit that is lower than the expected carbon price can discourage investment in abating technologies relative to

[2] For example this is a core feature of the McKibbin-Wilcoxen Hybrid Approach (see McKibbin and Wilcoxen (1997, 2002).

the case without the limit. However, by establishing a price floor as well as a price ceiling – at appropriate levels – a price collar both prevents the collapse of the program and limits the downside risk for investors in low carbon technologies. Both factors bolster investment confidence. Further, we question the notion that volatile near-term prices for carbon will induce sufficient technological development to lower prices in the long run by an amount sufficient to provide positive net present value. Rather, the economic literature has long supported the cost-minimizing case for gradual and predictable price increases for emissions.

Several implementation details would be required for our proposal to work. First, the UNFCCC would have to develop guidelines on demonstrating compliance with the agreed price range. This would include methods of verifying price signals and the extent to which they were in effect. The treaty must also ensure that excess emissions are reasonably proportional to the degree to which the price ceiling binds, measured for example by the duration over which the price ceiling applies, the share of total allowances the government sells at the ceiling price, or the share of emissions taxed at that rate or higher. For example, high excess emissions would need to be accompanied by a long duration of prices at the ceiling and/or a relatively large share of emissions that are taxed.

Second, regulatory (non-price) climate policies, such as low carbon fuel standards, would require special rules to determine their price equivalent. The UNFCCC could develop methodologies to calculate a shadow price on emissions analogous to the way the World Trade Organization converts trade protection policies into tariff equivalents. Parties could count towards their price signals any existing fossil energy taxes, but such credit would have to be net of any subsidies to fossil energy or other greenhouse gas emitting activities.

In our approach, the price floor ensures that no party can use terrestrial sinks or government-financed offsets alone to meet its commitments. However, the agreement should specify how parties will account for land-based carbon stock changes when targets are set. Another important element of the agreement is the level of technology transfer and financial assistance to developing countries. Given the complexity of developed country commitments, our view is that these issues are best handled separately from the target-setting negotiations.

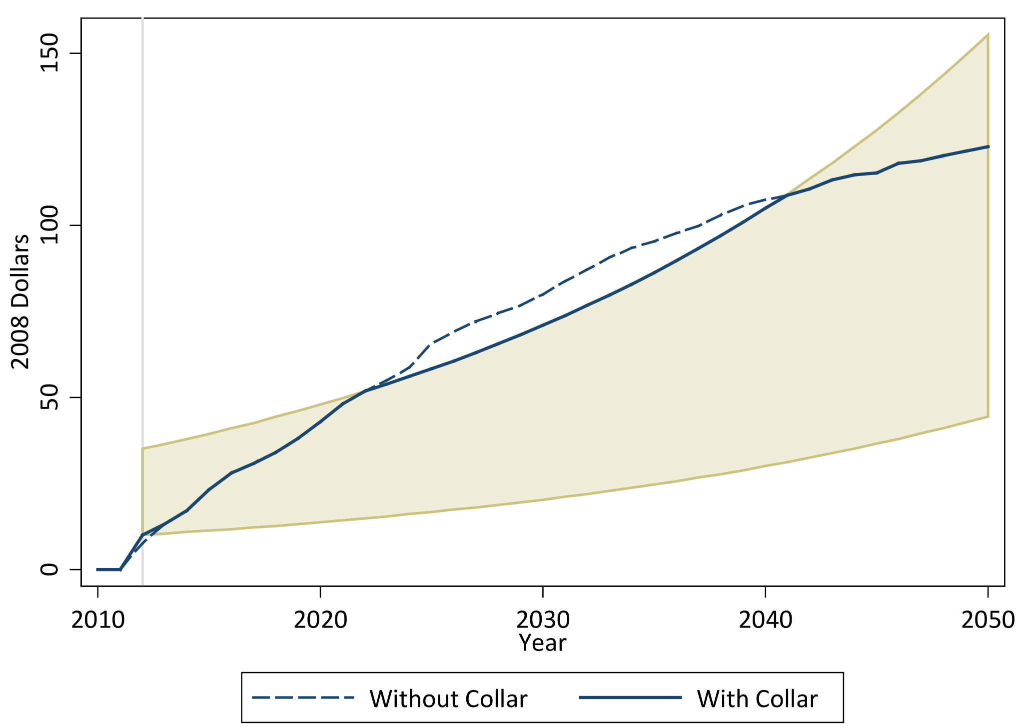
3. AN ILLUSTRATIVE PRICE COLLAR FOR THE U. S.

To illustrate how a price collar could work, McKibbin Morris Wilcoxen and Cai (2009) constructed several representative climate policy scenarios using the G-Cubed intertemporal general equilibrium model, a widely used model of the global economy. First we established a "reference scenario" that reflects our best estimate of the likely evolution of each region's economy based on the relationship between economic growth and emissions growth in model's regions over the last decade. The reference scenario also included the effects of climate policies already announced or implemented by governments other than the United States.

The first U.S. policy scenario we present is an illustrative target path for U.S. emissions. This approximates the Obama administration's early 2009 proposed targets for 2020 and 2050 of 14 percent and 83 percent reductions, respectively, from 2005 emissions levels. Details appear in Table 4 of McKibbin, Morris, Wilcoxen and Cai (2009). The scenario assumes a cap-and-trade program with a linear path of emissions caps from 2012 to 2020, and then another linear path from 2020 to 2050. It requires the U.S. to hit each year's emission target exactly, with no flexibility about when the emissions reductions would occur. Also the scenario includes no offsets or other cost containment provisions. Although cap-and-trade legislation is no longer under discussion and the proposals that were under consideration were more flexible, this stylized scenario is useful because it produces a price path that can illustrate how the price collar could work.

In our second scenario, we supplement the targets with a price floor and ceiling that are $10 and $35 respectively per ton of CO_2 emissions in 2012, both rising at 4 percent annually. Figure 1 shows the allowance prices that emerge in the two scenarios. The dashed path labeled "Without Collar" is the price of a ton of carbon dioxide that would emerge if the economy is required to achieve the emissions targets in each year, without allowing banking, borrowing, or offsets. The shaded region shows the range between the price floor and price ceiling defined above. The solid line labeled "With Collar" shows the price that would prevail with the collar in place. It and the "Without Collar" curve coincide in the range between the price floor and the price ceiling.

Figure 1. Price per ton of CO_2



The price floor triggers briefly at the start, during which time the government would remove some permits from the market. Over the subsequent decade the permit price stays within the price collar. By 2023 the strong demand for permits causes the market price to hit the ceiling and the government offers additional permits at the ceiling price as described above (this is similar to the McKibbin and Wilcoxen (2002) Hybrid proposal). By 2042, the price ceiling has become high enough that it rises above the market price of allowances. At that point, demand for additional permits drops to zero and emissions no longer exceed the annual cap.

Figure 2 shows annual U.S. CO_2 emissions for the two scenarios. Under both policies, emissions fall in every year. With the price collar in place, emissions fall somewhat more slowly when the ceiling is binding. The additional permits are shown by the shaded area.

Figure 2. Annual U.S. CO_2 Emissions

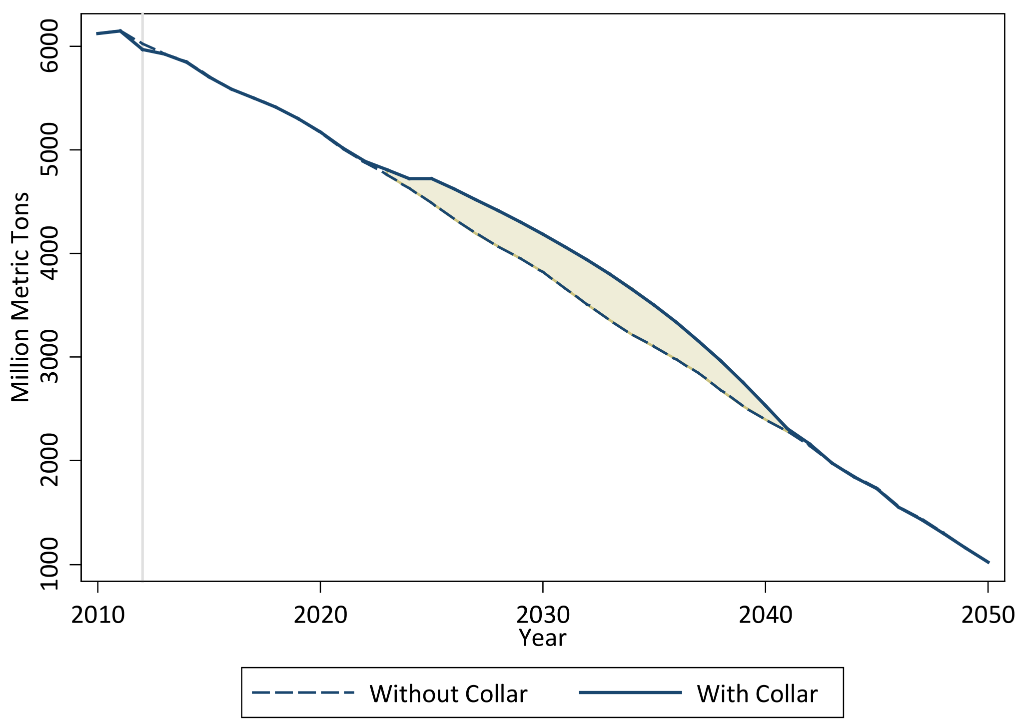
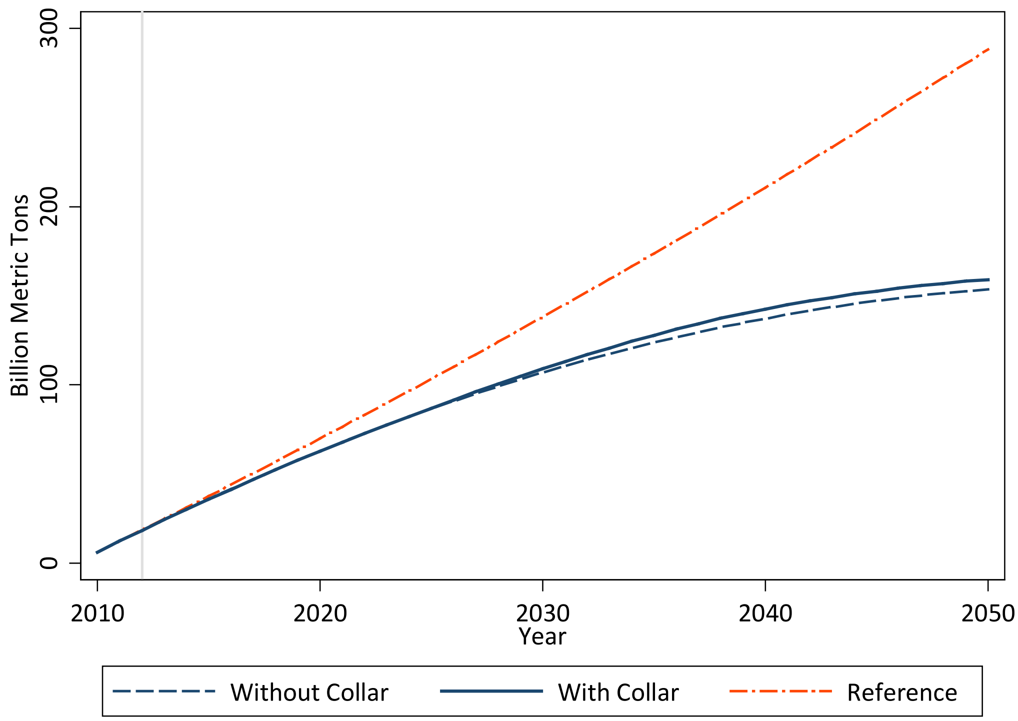


Figure 3 shows the effects of both scenarios on cumulative U.S. emissions through 2050. Both reduce emissions substantially relative to the Reference scenario and are generally very similar. In this example, introducing the price collar increases projected cumulative emissions by about 4 percent, or 6 billion metric tons, relative to the cap-and-trade scenario without the price collar. By imposing an upper bound on compliance costs, the collar increases the net present value of personal consumption (a measure of welfare) by $80 billion relative to the scenario without the collar.

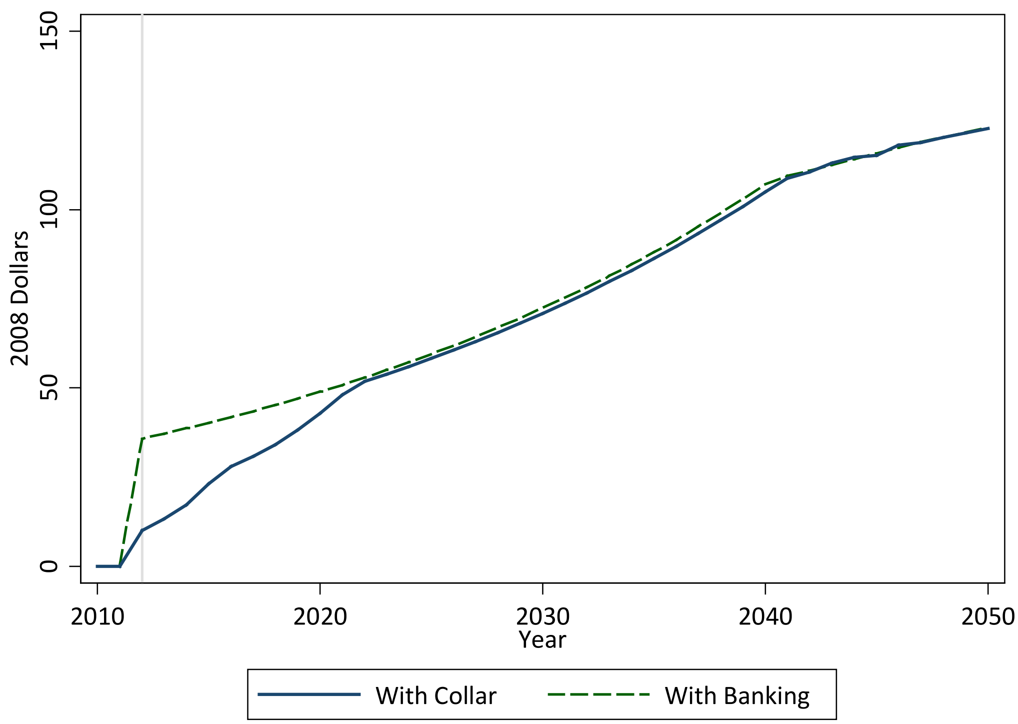
Figure 3. Cumulative U.S. Emissions of CO_2



The cap-and-trade legislation considered by the U.S. Congress in 2009 included an important additional provision known as "banking" that allows firms to save unused allowances. Banking provides an incentive for firms to abate some of their emissions earlier than absolutely necessary in order to have more allowances in future years when caps are tighter. To examine the relationship between banking and a price collar, we constructed a third policy scenario in which firms were required to achieve the same cumulative emissions as the first simulation (without the price collar) but were allowed to bank emissions when it was profitable to do so.

Figure 4 compares the estimated price trajectory of carbon allowances under the banking scenario (the dashed curve labeled "With Banking") to that for the price-collar case (the solid curve labeled "With Collar"). Each scenario includes only one of the two mechanisms: no price collar is imposed in the banking case and banking is not allowed in the price collar case. From 2012 through 2023, the price-collar case lies below the banking case, indicating that the original emissions targets are relatively loose during the first decade. If permitted to do so, firms would want to do more abatement in order to bank allowances. The reduced number of allowances available for contemporaneous use would drive up the equilibrium price to the level shown by the "With Banking" curve.

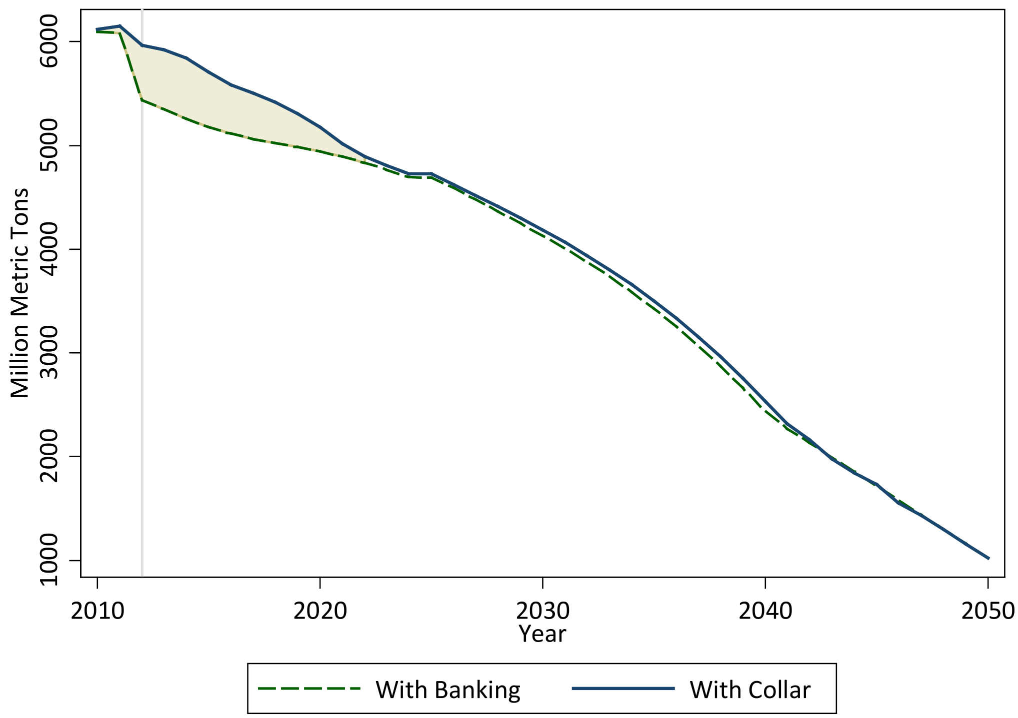
Figure 4. Price per ton CO_2
(Banking and No Price Collar) and (No Banking with a Price Collar)



From 2023 on, however, the two curves are essentially identical. Both rise at the interest rate until 2042 and after that they follow the original price trajectory. The reason the curves are similar is that our price collar is designed to be very similar to the cost-minimizing path (see McKibbin, Morris, Wilcoxen and Cai 2009 for discussion of the relationship between the banking and cost-minimizing paths). Had the initial price ceiling been higher, say $36 per ton, the two curves would have crossed; the collar trajectory would have risen above the banking path.

By design, the banking scenario achieves the same cumulative emissions target as the original scenario, or 6 billion metric tons less than the price collar case. As shown in Figure 5, the additional abatement occurs entirely during the first decade, when emissions are lower in the banking case than the price collar case (the shaded region in the figure). In subsequent years, allowance prices and annual emissions are equal in the two simulations.

Figure 5. Emissions
(Banking and No Price Collar) and (No Banking with a Price Collar)



A policy combining banking with a price collar will have the advantageous features of both. As long as no macroeconomic surprises occur, banking allows firms to manage their abatement efficiently and thereby minimize the overall cost of achieving the desired emissions reductions. As long as the price collar is set—as it was above—so that the expected market price and the ceiling would be consistently very close, there would be little or no incentive for firms to purchase additional allowances from the government. However, if unexpected events make abatement more difficult than expected, the price ceiling would come into effect, providing protection against sharp spikes in allowance prices. Moreover, our illustrative results above suggest that the consequent increase in cumulative emissions would be very modest.

4. CONCLUSION

The move towards heterogeneous national commitments is a very positive step forward for climate policy. However, this development requires adapting international negotiations to allow for price based commitments. At the same time "price equivalence" provides a mechanism for comparing national effort. Incorporating a price collar into a framework focused on long-run cumulative emissions targets is an effective and politically viable way to move international negotiations on climate policy forward. The economic uncertainty surrounding target commitments is enormous, and combining a clear cumulative emissions target with a price collar optimally balances the environmental objective with the need to ensure that commitments remain feasible. Using plausible assumptions, the example in this paper illustrates how a price collar does this.

Focusing exclusively on reductions from historical emissions as the only meaningful form of commitment has greatly hampered negotiations on climate commitments, especially for developing countries where the uncertainty about the future and the cost of inadvertent stringency is greatest. In contrast, the price collar can ease Parties into the system by allowing them to adopt only a price floor in the early years. It also offers a transparent and verifiable assurance of the comparability of effort across countries. Further, parties can design price collars so that they have no effect if predictions about the level of effort required to achieve a target are correct. Incorporating price-based commitments into the treaty along with an emissions goal also demonstrates compliance during, as well as after, the commitment period.

REFERENCES

Burtraw, Dallas, Karen Palmer, and Danny Kahn, "A Symmetrical Safety Valve," Discussion Paper RFF DF 09-06, Resources for the Future, February 2009. Downloaded from http://www.rff.org/RFF/Documents/RFF-DP-09-06.pdf

Jotzo, F. (2011) "Comparing the Copenhagen Emissions Targets" Crawford School Centre for Climate Economics & Policy Paper No. 1.10 . Available at SSRN: http://ssrn.com/abstract=1878905 or http://dx.doi.org/10.2139/ssrn.1878905

McKibbin, W. Morris, A., Wilcoxen P. and Y. Cai (2009). "Consequences of Alternative U.S. Cap and Trade Policies," The Brookings Institution. http://www.brookings.edu/~/media/Files/rc/reports/2009/07_cap_and_trade/0727_cost_containment.pdf

McKibbin W. and P. Wilcoxen (1997) "A Better Way to Slow Global Climate Change" *Brookings Policy Brief* no 17, June, The Brookings Institution, Washington D.C..

McKibbin W.J and P.J. Wilcoxen (2002) *Climate Change Policy after Kyoto: A Blueprint for a Realistic Approach,* Brookings Institution, Washington D.C..

McKibbin, W., Morris, A. and P. Wilcoxen (2009) "Expecting the Unexpected: Macroeconomic Volatility and Climate Policy", in J Aldy and R. Stavins (eds) *Implementing Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World,* Cambridge University Press (forthcoming).

McKibbin W. Morris A. and P. Wilcoxen (2009) "Achieving Comparable Effort through Carbon Price Agreements" Policy Brief, Harvard Project on International Climate Agreements, Belfer Center for Science and International Affairs, Harvard University.

McKibbin W, Morris A, and Wilcoxen P (2011), "Comparing Climate Commitments: A model-based analysis of the Copenhagen Accord", *Climate Change Economics*, Vol 2, No 2.

Stavins, R.N. and S. M. Olmstead (2006). "An International Policy Architecture for the Post-Kyoto Era." *American Economic Review Papers and Proceedings* 96, no. 2 (May 2006): 35-38.

United Nations Framework Convention on Climate Change, Bali Action Plan, Decision 1/CP.13, 13th Conference of the Parties, December 15, 2007. Downloaded from http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3.

White House Office of Management and Budget (2009) *Jumpstarting the Economy and Investing for the Future*, White House Office of Management and Budget, Fiscal Year 2010 document, February 26. page 21. http://www.whitehouse.gov/omb/assets/fy2010_new_era/Jumpstarting_The_Economy.pdf.

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