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Price Floors for Emissions Trading

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Summary

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Working Paper

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Abstract:

Price floors in greenhouse gas emissions trading schemes can have advantages for technological innovation, price volatility, and management of cost uncertainty, but implementation has potential pitfalls. We argue that the best mechanism for implementing a price floor is to have firms pay an extra fee or tax. This has budgetary advantages and is more compatible with international permit trading than alternative approaches that dominate the academic and policy debate. The fee approach can also be used to implement more general hybrid approaches to emissions pricing.

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1. Introduction

Price ceilings are a widely recognised option to limit the risk that carbon prices exceed acceptable levels if constraining emissions turns out to be more expensive than expected, and so provide greater certainty to emitters. The mirror instrument is a price *floor*, which would ensure a minimum price on carbon, thereby providing more certainty for investors in low emissions technologies. It would also allow emissions to go lower than a target set by the administrator, thus providing more abatement if costs are lower than expected. Both price ceilings and price floors can reduce risk and price volatility in carbon markets, which has been of concern in the EU ETS (Grubb and Neuhoff, 2006).

However, such ‘hybrid’ instruments also present specific challenges for scheme design and for trading of permits between countries, and in terms of their budgetary impacts.

There has been considerable discussion of approaches that include a price ceiling, also known as a ‘safety valve’ (Aldy et al., 2001; Jacoby and Ellerman, 2004; Pizer, 2002; McKibbin and Wilcoxon, 2002; McKibbin *et. al.*, 2009). Price ceilings have been proposed for various carbon trading schemes, for example in Australia (Commonwealth of Australia, 2008), and in less direct ways for the US Regional Greenhouse Gas Initiative (RGGI, 2008) and the Waxman-Markey Bill as passed by the United States House of Representatives in June 2009 (H.R. 2454, 2009).

The academic and policy debate on price floors is much less developed. One of the novel aspects of the Waxman-Markey Bill is that it stipulates a reserve price (of US\$10/tCO₂-e) when permits are auctioned, which will increase by 5% above the consumer price index each year. This reserve price could function as a price floor.

Calls in early 2009 for a price floor to be introduced to the EU emissions trading scheme, via an auction reserve price, were rejected by the European Commission. The European Commission claimed that “a floor price may unduly interfere with the market” (Gardner, 2009). However, this argument holds little water as permit markets are entirely the product of government regulation in the first place. It also runs counter to stated EU interests to achieve ambitious climate mitigation outcomes. The proposed Australian ETS also does not include price floor provisions.

In this paper we examine the rationale for incorporating a floor price in emissions trading schemes and propose that the best way to implement them is to have firms paying a tax or extra fee as well as buying permits. Compared to the alternatives, it has budgetary advantages, and in contrast to the alternatives, it is compatible with international trading of permits. It can also be used to implement more general hybrid approaches to putting a price on emissions.

2. A rationale for price floors

A range of arguments can be made in favour of price floors, relating to price volatility, innovation, and management of cost uncertainty.

Price floors (and ceilings) truncate the possible range of permit prices in the market and hence can reduce price volatility. Price volatility can also be reduced by banking and borrowing of permits, with short term market fluctuations tempered through longer term price expectations. But recent experience with the EU ETS suggests that volatility still remains. Between July 2008 and February 2009, when banking and borrowing were available, the EU permit price declined from around €30 to less than €9.

Investments such as power plants, buildings, and infrastructure involve long term time horizons. A price floor gives investors in low-emissions assets greater certainty about the minimum return to their investments – it effectively provides insurance against low carbon prices, analogous to the insurance function of a price ceiling against cost blow-outs to owners of existing high-emissions assets.

Successful technological innovations lower the carbon price for a particular emissions target, or increase the amount of emissions reductions achievable at a particular carbon price. The economically efficient response is to increase the amount of abatement, to keep the abatement cost in line with the social cost of emissions. Under a pure cap-and-trade approach, innovation will only increase abatement if the regulator adjusts emissions targets in response to the lower, or lower than expected, carbon price. A price floor by contrast provides a mechanism for additional emissions reductions to be achieved automatically.

Uncertainty about abatement costs affects the relative performance of abatement mechanisms in terms of their expected welfare impacts, as shown by Weitzman (1974) for the comparison between price and quantity instruments. Hybrid approaches under uncertainty were studied by Roberts and Spence (1976), who examined pollution reduction when the costs of pollution reduction are uncertain, but the benefits are known. It was found that the expected net benefits of using a hybrid approach with both a price floor and a price ceiling are significantly higher than for a purely price or quantity based approach. Quantitative modelling for climate change mitigation (Burtraw *et. al.*, 2009; Philibert, 2008) is consistent with this conclusion.

3. Mechanisms for a price floor

Two main mechanisms have been proposed for a price floor in an emissions trading scheme:

1. The administrator commits to buy back licenses at the floor price, thereby reducing the amount of permits in the market (Hepburn, 2006). A similar approach is for the administrator to commit to pay a subsidy to firms that possess more permits than required to cover their emissions, the subsidy being proportional to the number of excess permits (Roberts and Spence, 1976).
2. A reserve price applies when permits are auctioned, again limiting the amount of permits available to emitters (Grubb and Neuhoff, 2006).

We propose a third option:

3. Emitters have to pay an extra fee (or tax) for each ton of carbon emitted, in addition to having to surrender a permit. The effective carbon price then becomes equal to the sum of the permit price and the extra fee.

3.1. A commitment to buy back permits

A commitment to buy back permits may be theoretically the ‘neatest’ way to implement a price floor, because it allows for the price floor to be implemented exactly with just one instrument. The market price will never go below the threshold price, and the administration of the floor price remains within the cap-and-trade scheme. However, the option would likely be unworkable in practice because of budgetary aspects and because it would stand in the way of international permit trading.

A buy-back commitment would create potentially large contingent liabilities to governments, through budgetary costs of buying back permits in the market. This would be especially problematic where large shares of the total permits available are given out freely to start with, or where revenue from the initial sale of permits is earmarked for other purposes – one or both being the case for most existing and proposed emissions trading schemes.

International trading in permits would exacerbate the budgetary problems faced by any one country, as it would potentially create an unlimited liability for the administrator (Garnaut, 2008, p. 310). Even if the buy-back commitment is limited to domestic permits, international permits could be used by domestic emitters to substitute for domestic permits, effectively extending any one government’s liability overseas. For a commitment to buy back permits to be compatible with international trading, it would be required that all of the schemes involved have the same price floor (PricewaterhouseCoopers, 2009). These are serious obstacles, akin to those inherent in linking emissions trading schemes with price ceilings (Jotzo and Betz, 2009). One way to address these issues is to not have international permit trading (McKibbin *et. al.*, 2009), but this would fly in the face of a general trend and widespread desire by policymakers to link schemes internationally (Tuerk *et. al.*, 2009).

3.2. A reserve price at auction

The reserve price approach is the one proposed for the United States under Waxman-Markey, and the one considered but rejected by the European Union. It would imply that there is no strict price floor, because although there would be a minimum price that firms would pay at auctions, the market price subsequent to auction could fall below the reserve price.

To what extent a reserve price translates into a floor price in part depends on the share of permits auctioned. If a large proportion of permits is given out freely, then a situation could occur where few or no permits are in fact auctioned, given the reserve price. In this

case, the market price would be above what it would be in a ‘pure’ cap-and-trade scheme with the full amount of permits available to emitters, but below the reserve price.

International trade of permits could also result in the reserve auction price no longer being a floor price. If permits from another country’s scheme, or offset credits such as from the Clean Development Mechanism, can be imported at a price lower than the reserve price, then this will become the source of purchased permits in the domestic scheme rather than permits bought at auction from the government. In turn, there is a negative budgetary impact for the country attempting (but failing) to uphold a price floor, by way of lacking auction revenue.

3.3. An extra fee or tax

Under this option, emitters have to pay an extra fee (or tax) for each unit of emissions, independently of or in addition to their permit obligations, we can write this as

$$MC = p + t$$

where MC is the marginal cost of abatement (the effective carbon price), p is the permit price, and t is the extra fee or tax.

There are fundamentally two ways that the price of the extra fee could be set:

- a) A fixed fee on emissions. The fixed fee is equal to the floor price:

$$t_{fix} = p_{min}.$$

- b) A variable fee on emissions. When the permit price in the market is less than the price floor, the extra fee is equal to the difference of the permit price and the floor price; when the permit price is above the floor, the fee is zero. We can write this as

$$t_{variable} = \begin{cases} p_{min} - p & \text{if } p < p_{min}, \\ 0 & \text{otherwise;} \end{cases}$$

where $t_{variable}$ is the extra fee, p_{min} is the floor price, and p is the permit price.

Under the fixed fee approach, the effective carbon price is prevented from falling below the level of the fee, but it is always higher than it would be if there was only the permit trading scheme. The approach is similar to what transpires when both a carbon tax and an emissions trading scheme are in place simultaneously. Permit trading in any case already interacts with various taxes and subsidies that discourage or encourage activities that incur carbon emissions – in that sense, the effective carbon price, relative to a hypothetical situation of no taxes and subsidies, differs from the permit trading price in any case (Babiker *et. al.*, 2004).

Several countries that take part in EU emission trading scheme also have a carbon tax, including Sweden, Finland, and the Netherlands (Stavins, 2003). In September 2009, France announced that it would introduce a carbon tax in 2010 (Portail du Gouvernement,

2009). The fixed fee approach is similar to ‘emission permit rental charge’ proposed by Grafton and Devlin (1996).

The variable fee approach by contrast more closely achieves the effects of a ‘classic’ price floor, as it would be in operation only if and to the extent that the market price falls below the threshold level. A complicating factor is that permit prices fluctuate. There are several options for deciding what permit price is used when determining the extra fee. One option would be to use the permit price on the permit surrender date. Another option would be to use the permit price that was paid by the firm. Yet another option would be to use the average permit price over the time period in which emissions are being accounted for (usually a year).

It is important to note that an additional fee/tax implemented in a purely domestic scheme (and without banking or borrowing) would leave the effective domestic carbon price unaffected, as it would reduce the domestic permit price (Figure 1). By contrast, with unrestricted international permit trading, the fee gets added to the international permit price, and thereby directly affects the effective domestic carbon price.

It could be argued that combining fees/taxes with permit trading would unnecessarily increase transaction costs. However, given that general taxation systems for emitters already exist, and that permit trading systems are (about to be) in existence also, the extra cost impost is likely to be small. The main transaction costs are associated with measurement, reporting and verification, which are incurred only once for both aspects of carbon pricing.

Importantly, the budgetary impacts of the fee models are positive or neutral, and there are no risks of budgetary outlays. A fixed fee (or tax) will yield a highly predictable revenue stream; a variable fee will yield revenue in the event of low permit prices. In the aftermath of large fiscal stimulus spending in all countries that have or are considering emissions trading schemes, implementing an emissions tax in addition to permit trading may well become an attractive option to help replenish public finances. Additional carbon taxes might prove a politically easier route to raise revenue than to reduce the share of permits given away freely, which are arrangements arising from hard political bargaining by concentrated lobby groups, as Australia’s recent experience has shown (Pezzey *et. al.*, 2009).

Perhaps the greatest advantage of the fee/tax approach is that it can be fully compatible with international trading of permits. A domestic fee or tax on domestic emissions can be implemented in any one country without affecting the international tradability of permits, and affects the price of permits in the international market only indirectly. What the fee will do is to lower emissions independently of the trading scheme, and so reduce the demand for permits relative to the situation without a fee or tax. In the case of a country that imports permits from overseas, imposing an emissions fee will result in lower emissions and therefore fewer permit imports (Figure 1). This will tend to lower the (international) permit price, but only to the extent of that country’s share in international permit markets. An extra fee or tax also does not affect arrangements for banking and borrowing of permits.

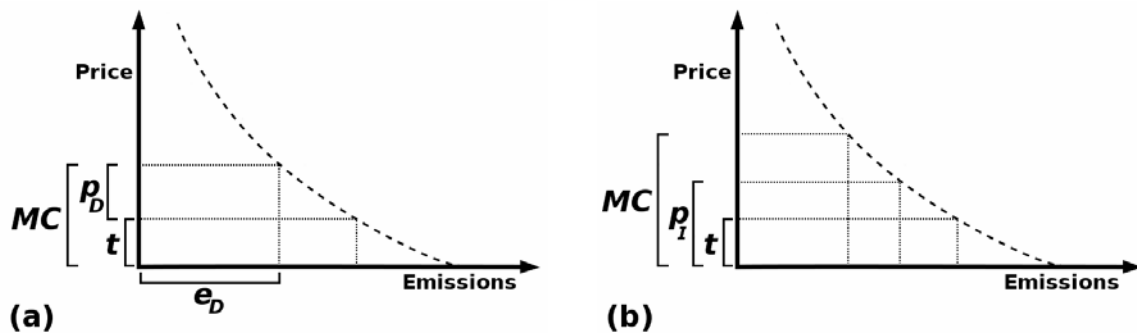


Figure 1. We compare a purely domestic permit market with a large scale international permit market. The curved dashed line denotes the marginal cost of abatement. With a purely domestic permit market (a), the government sets a quantity of emissions e_D , and an extra fee (tax) t . These quantities determine the carbon price, MC , and the permit price is given by $p_D = MC - t$. Thus, the effective domestic carbon price is unaffected. By contrast, with unrestricted international trading of permits (b), the international permit price p_I is determined in international markets. The domestic carbon price is given by $MC = p_I + t$. Hence, the tax/fee directly influences the effective domestic carbon price.

The situation regarding international tradability would be different if the requirement to pay a fee were made an integral feature of the emissions permits issued by any one country. If different countries attach different fee conditions to their permits, then emissions permits from different countries are no longer the same commodity. International trading could still occur, either with different prices for permits from different countries, or with equal prices achieved through cross-border arrangements between countries on the charging, exempting and remitting of fees. Insofar as economic distortions are sizeable or administrative arrangements too complex, it may be preferable to separate fees or taxes from permits.

4. Price floors and ceilings

Some proposals for putting a price on emissions combine both a price floor and a price ceiling, in what has been termed a ‘price collar’ (McKibbin *et. al.*, 2009). Roberts and Spence (1976) showed that an approach with (possibly multiple) price floors and price ceilings would be effective for minimising expected costs under uncertainty. We now look at how such schemes could be implemented, using approaches for price floors discussed above.

A fixed price ceiling is beset by similar problems of tradability and government liabilities as price floors implemented through buy-back provisions, as discussed above. One way to address these issues is to modify the price collar by limiting the amount of extra permits. Under this approach, the ceiling is no longer strict; if all of the extra permits are used, the carbon price could exceed the ‘ceiling price’. The mechanisms described for implementing a price floor can also be used for implementing a modified price collar. The extra permits could be auctioned with a reserve price that is higher than the price floor; alternatively, firms could be required to pay a higher ‘extra fee’ if they use the extra permits to account

for their emissions. Under the latter approach, the requirement to pay a fee would be an integral feature of the permit issued.

In an approach along these lines, the Waxman-Markey Bill includes an approach that is similar to a modified price collar, known as the strategic reserve. Each year a small amount (1-3%) of permits are added to the 'Strategic Reserve Fund'¹¹. Each quarter, there is a strategic reserve auction, which auctions these permits at a higher reserve price than the reserve price of the rest of the permits.

In their appendix, Roberts and Spence (1976) show that by issuing an arbitrary number of different kinds of permit, it is possible to approximate any convex damage function arbitrarily closely. This could further reduce expected costs. This approach can be implemented by auctioning different types of permit at different reserve prices, or having firms pay different fees when they surrender different types of permit (Figure 2). Under the second approach, extra administrative arrangements would be required for international permit trading, similar to those mentioned above.

A modified price collar could facilitate international cooperation to reduce greenhouse gas emissions. International environmental agreements on issues such as acid rain and pollution of the North Sea have had weak binding commitments, but also have had ministerial level non-binding commitments that are significantly stronger (Victor, 2007). A modified price collar could have the total number of permits based on a binding commitment, and the number of extra permits based on the difference between the binding and the non-binding commitment.

¹ We are referring here to the version of the Bill that was passed by the U.S. House of Representatives on June 26, 2009 (H.R. 2454, 2009). The Strategic Reserve can also be replenished with unsold permits from auctions, and proceeds from Strategic Reserve auctions can be used to purchase offsets in order to replenish the Strategic Reserve.

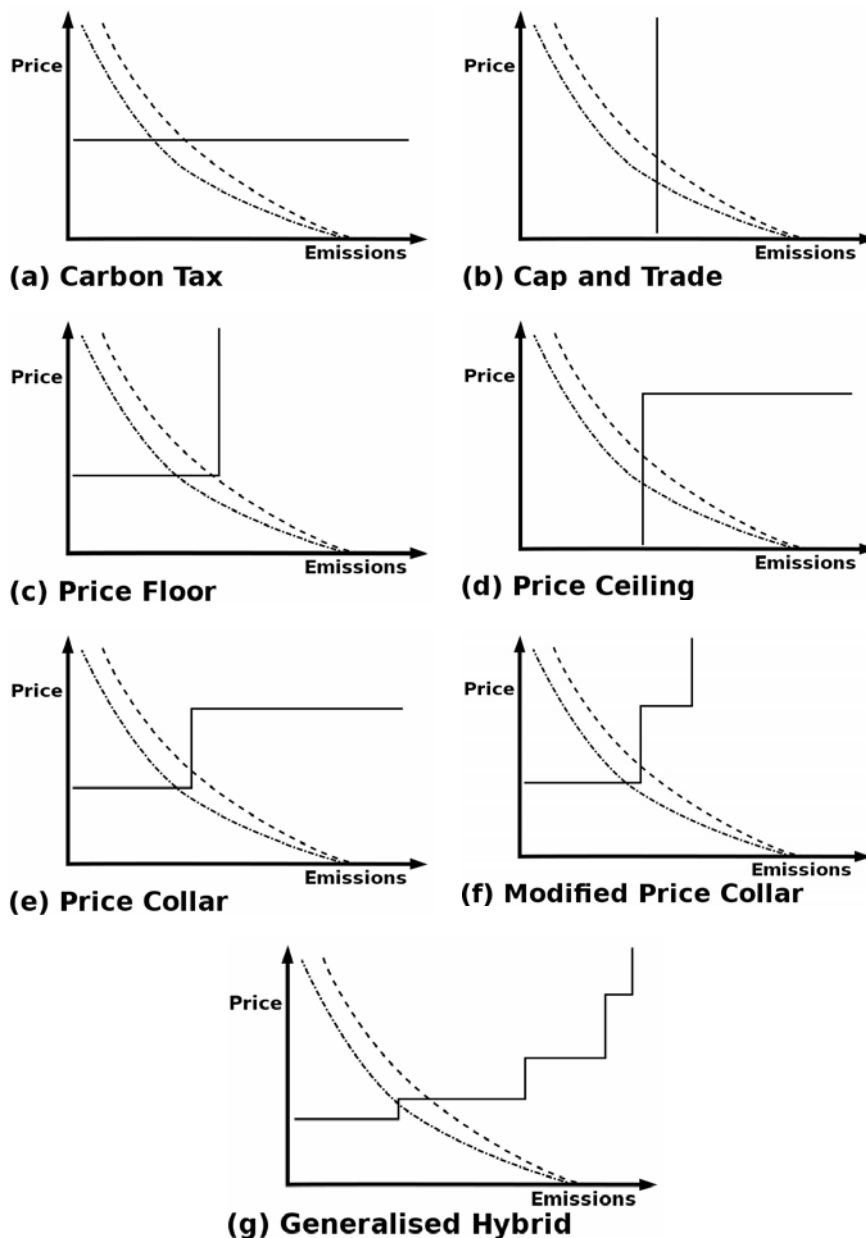


Figure 2. The curved dashed lines represent alternative marginal abatement cost functions. The solid line illustrates the carbon price for some of the policy options described here. The carbon price and emissions level are determined by the point where the curves intersect. The marginal abatement cost schedules will be unknown in advance, so two possible curves are shown. The lower curve corresponds to abatement being cheaper. We illustrate a carbon tax in (a), the carbon price does not change for different marginal benefit curves but the amount of emissions can change significantly; for cap-and-trade (b), the carbon price can vary but the amount of emissions does not change; for cap-and-trade with a price floor (c), if the cost of abatement is sufficiently low, the amount of emissions will decrease; for a price ceiling (d), because there is less upside risk of the carbon price being too high, the administrator may further reduce the amount of emissions; a price collar (e) combines a price ceiling with a price floor; the price collar can be modified (f) so that there is still a strict limit on emissions, and no longer a strict limit on the carbon price; more general price curves (g), as described in the appendix to Roberts and Spence (1976), could also be implemented.

5. Conclusions

There are sound arguments for including price floors in emissions trading. Advantages include less price volatility, automatic climate benefits from innovation, and better management of cost uncertainty.

Price floors need to be carefully designed to avoid budgetary liabilities, and to avoid barriers to international trade in permits. The most direct approach of a government commitment to buy back permits at a threshold price is unlikely to be viable, especially in the context of international permit trading. An alternative approach of a minimum reserve price for auctioned permits, as pursued in the Waxman-Markey Bill and earlier considered by the European Union, could yield the desired effect, but could be ineffective if the share of auctioning is small.

We propose that a superior option is to require the separate payment of a fee or tax on domestic emissions, in addition to cap-and-trade. This approach carries desirable budgetary implications for national governments, and is fully compatible with international permit trading. In fact, this is precisely what governments do where they have levy a carbon tax in addition to emissions trading. The fee or tax could be fixed or variable, and its impact on the effective domestic carbon price depends on whether permits are traded internationally or not.

The mechanisms proposed for a price floor can also be used to implement a modified 'price collar', as well as more complex hybrid approaches. The addition of a price ceiling, with unlimited permits sold at the ceiling price, eliminates the upside price risk from an emissions trading scheme. The manifold problems in implementing this approach can be addressed by limiting the amount of extra permits available to be issued. The extra permits can be auctioned at a reserve price that is higher than the price floor, or can be associated with an extra fee that is higher than that for a price floor.

In summary, price floors are likely to fulfil an important supporting role in ensuring effective and efficient climate change mitigation, they can be implemented without compromising vital aspects of emissions trading, and their budgetary properties may turn out to be highly attractive to governments cash-strapped in the aftermath of fiscal stimulus spending. The Waxman-Markey Bill has important design innovations that could support minimum carbon prices, but alternative approaches could perform even better. The reform of the EU ETS for the post-2012 period offers an opportunity to do better, as does the ongoing process of designing emissions trading schemes in Japan, Australia, and other countries. As emissions trading schemes are refined and reviewed, price floors may prove to be an attractive option for governments.

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