Price Floors in Emissions Trading to Reduce Policy Related Investment Risks: an Australian View

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Abstract
The merits of floor prices in emissions trading schemes (ETS) depend on the problem addressed. Traditional hybrid approaches emphasise automatic response to lower than anticipated abatement costs, but we find adjusting emissions targets over time is the better way to deal with this in the context of climate policy. We find, however, that a price floor is well suited to addressing policy generated carbon price risk as domestic and international policy frameworks mature, reducing the risk of unintended low carbon prices. Reducing such downside risk can encourage cost effective investment in low-emissions assets that might otherwise be precluded by perceived policy risks, even if the price floor is never actually triggered. In Australia's planned ETS, a price floor could support investments that lower the national emissions trajectory, and boost policy stability and credibility. A price floor in operation can increase the static costs of achieving a given emissions target, but reduce economic costs over time. Assessment of implementation options suggests a domestic reserve price for auctioned permits along with a periodically adjusted fee on the conversion of international permits for use in the domestic ETS. This approach minimises administrative complexity and avoids arbitrary interventions in carbon markets.

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1 Introduction

This paper explores the case for including some form of price floor in emerging carbon pricing policy arrangements. Price floors feature in current carbon pricing policy proposals in the United Kingdom and North America (HM Treasury 2010, WCI 2010, CEPA 2011), and are under consideration by Australia's Multi-Party Climate Change Committee (MPCCC 2011, Jotzo 2011).[1] These approaches have the potential to balance concerns about economic impacts, environmental effectiveness and access to international permits.

The traditional rationale for a price floor has been to strike a middle ground between price based and quantity based approaches to determining the level of pollution reduction (Roberts and Spence 1976, Pizer 2002, Philibert 2009), given uncertainty about abatement costs and difficulties in achieving agreement to long run emissions targets that are consistent with limiting global temperature increases to no more than 2°C (Dietz and Stern 2008). More recent proposals have emphasised the advantages of making investments in lower-carbon options more attractive by reducing downside price risk and thereby supporting low-emissions investments (HM Treasury 2010, Wood and Jotzo 2011, IRG 2011, IIGCC 2010).

We argue that the logic of these recent price floor proposals suggests the central rationale is to guard against uncertainty about policy outcomes (particularly the risk of very low carbon prices as market arrangements mature), rather than to manage uncertainty about the costs and benefits of achieving emission reductions (as emphasised by the Roberts-Spence arguments). We are not aware of any previous analysis highlighting this distinction. Crucially, avoiding the risk of unintended policy failure provides opportunities for net welfare gains that are additional to the potential benefits of a Roberts-Spence once and for all 'target and price floor' approach.[2]

This paper assesses the potential benefits of price floors against the more complex policy design and implementation they require, potential risks of market interference or reduced confidence in policy stability, and the trade-off between potential higher costs of meeting a given short term national target and lower long run costs. Section Two examines the traditional 'belt and braces' rationale for a price floor, based on long run uncertainty about abatement costs. Section Three examines the investment certainty rationale, which relates to price uncertainty arising from institutional design and international coordination issues, and finds potential for a price floor to provide benefits as market arrangements mature. Section Four explores implementation options in the context of emissions trading with imports of international emissions credits, and suggests a new potential approach involving a periodically adjusted fee on the use of international permits, to prevent low international prices

[1] The proposed architecture for Australia's planned carbon pricing scheme is a permit scheme starting with a government-determined price trajectory, which converts to market-based emissions trading with a floating price after a number of years. The timing of this transition would be informed by "the availability, integrity and price of international units" (MPCCC 2011).

[2] As discussed in Section 2, the benefits of the Roberts-Spence approach derive from the advantages of adjusting to new information automatically (avoiding sovereign risk) rather than through discretionary policy adjustments.

undercutting the domestic floor price. Section Five concludes.

2 Managing uncertainty about long run global abatement costs

A price floor is a *minimum price under emissions trading*, guaranteed by government. It is an element of 'hybrid' schemes of combined quantity and price control of emissions. As established by Roberts and Spence (1976) and elaborated by others (such as Pizer 2002, Philibert 2009, McKibbin et al 2010, Fell et al 2010), hybrid schemes can improve economic efficiency when there is uncertainty about the costs and benefits of emissions controls, by bringing global abatement closer to the optimal level. Where quantitative emissions targets have been set on the basis of projected costs and benefits, a price floor could provide net benefits by automatically increasing abatement if the actual unit cost of abatement is lower than expected – just as a price cap would yield benefits by automatically decreasing abatement if costs are higher. Lower than expected abatement costs could occur, for example, as a result of unanticipated technological breakthrough, or because ex ante assessments typically overstate economic costs and understate abatement potential (Goodstein 2005, Daley and Edis 2010). The Roberts-Spence approach would also avoid potential sovereign risks associated with iterative discretionary adjustments to pollution control policies (Baumol and Oates 1971:45), which would risk arbitrary impacts on investments in long lived assets that had relied on previous policy settings.

More generally, the inclusion of a price floor may have political economy advantages where used to complement a target that is perceived as weak by environmentally concerned constituencies, as the floor price drives additional abatement if this can be achieved a lower than projected costs – reassuring constituencies concerned to achieve emission reductions, without exacerbating the concerns of those focused on economic impacts (see Jotzo 2011).

In the climate change context, the Robert-Spence approach is most relevant to a long term global emissions agreement, such as for 2050, that is fixed or difficult to change (see Pizer 2002). In this circumstance, low abatement costs would result in low permit prices in individual countries and international carbon markets.[3] In the absence of policy change, this would result in the agreed emissions target being met, but would forgo higher levels of abatement providing net benefits.

In principle, this risk of forgone benefits in a 'once and for all' global agreement could be reduced by agreeing both to a quantity target (or set of targets) and to some form of internationally harmonised price floors. In practice, however, the ex ante agreed price floor would be subject to similar uncertainties as the target setting process. This implies that while a 'target plus floor price' strategy would be expected to perform better than a 'target only'

[3] Well-functioning emissions markets would be expected to dissipate short-term and localised effects of technological surprises on abatement costs.

strategy, it would still be expected to be sub-optimal.

If there also is an expectation that future targets will be tightened in response to lower abatement costs, then emissions markets would translate lower abatement costs into greater amounts of near term abatement, and bank some additional permits for future use. The wider context of climate change negotiations supports the view that progressive tightening of global targets is more likely than relaxing targets (Garnaut 2008, DCC 2008), consistent with the trend for successive scientific assessments to revise up severity and probability of potential climate impacts (Smith et al 2009), and for successive economic assessments to revise down projected abatement costs and to recommend more stringent global targets as providing net benefits (Stern 2008, Nordhaus 2010, Smith 2011).

This suggests that it would be preferable – if politically possible – for uncertainties about long run greenhouse gas abatement costs (such as the impacts of technological surprise) to be dealt with by adjusting emissions targets over time, rather than adopt a Roberts-Spence approach and seek prior agreement to a once and for all internationally harmonised set of price floors. A first reason for this conclusion is that target risks are asymmetric, with targets more likely to tighten over time, reducing the expected costs of discretionary adjustment to policy settings. A second reason is the evidence that societal inertia and normal political economy considerations are resulting in significant lags between the identification and the implementation of worthwhile national and global emissions targets (Garnaut 2008),[4] implying later agreements are likely to be closer to optimal than earlier agreements even in the absence of improved information.

3 Managing the risk of low carbon prices in maturing international markets

More recent discussion of hybrid policy have given particular attention to motivating low carbon investment (HM Treasury 2010, CEPA 2011, Wood and Jotzo 2011) and wider political economy issues (Tatsutani and Pizer 2008, Murray et al 2009). Calls by investors for higher or more certain carbon prices (IIGCC et al 2010) are consistent with the experience that relatively short run (international or external) carbon price signals may not aligned with near term investment requirements implied by long term (domestic) goals. An example is the UK Treasury view that the "EU ETS ... carbon price has not been stable, certain or high enough to encourage sufficient investment in low-carbon electricity generation in the UK" (HM Treasury 2010:8). Experience also indicates that policy settings can result in periods of very low prices which have little to do with underlying abatement costs or the long run balance of supply and demand, such as when the permit price dropped to near-zero in the first phase of the EU trading scheme due to unanticipated design and implementation issues, and the dampening effect of recent

[4] Assessments also indicate that current pledges under the Copenhagen and Cancun agreements are not sufficient to limit global warming to the widely accepted goal of less than 2°C (Rogeli et al 2010).

slower economic growth on EU permit prices (see Figure 1).

This raises the possibility of using a domestic price floor to manage the risk of low carbon prices arising from maturing national and international policy settings. Price floor provisions would seek to address price risks that are created by the policy process, in an entirely policy created market, rather than intrinsic risks that derive from uncertainties about future abatement costs and volumes. This goal implies a focus on potential carbon price discontinuities, where policy arrangements may lead to low near term prices that provide a misleading signal about medium and long term prices.[5]

This is turn gives rise to a risk that investors informed by observed current or expected near term carbon prices may underestimate medium to long term carbon prices, and thus commit to long term assets that are excessively emissions intensive. This risk is relevant at both enterprise and national scales: investors risk a lower return over the life of the asset, and the nation risks deadweight losses from stranded assets or higher abatement costs from lock-in of inappropriate physical assets.

A domestic price floor could manage this risk and provide confidence that the domestic permit price will not fall below a prescribed level. This may be valued by investors even if other market design features such as banking of permits are thought to safeguard against a very low price outcome. It would also assist the transition from an administrative determined price trajectory to internationally linked emissions trading (when international markets are likely to be still maturing), as is proposed in Australia.

The potential for low international permit prices

Integration of domestic emissions trading with international markets through the use of international permits is a key advantage of emissions trading and hybrid policy approaches, as it allows access to cost effective international abatement and allocates risks arising from business decision making to those businesses (Jotzo 2011). While the introduction of a carbon price is expected to result in substantial domestic abatement in Australia and the United States, it is very likely that this will need to be supplemented by imports of permits from other jurisdictions to meet 2020 emissions targets cost-effectively (Garnaut 2008, Australian Government 2008, US EPA 2010, CEPA 2010). This is true for most Annex I developed countries, other than Russia and the Ukraine (den Elzen et al 2011).

While it is likely that a broad based system of international carbon markets will emerge in coming years,[6] a single international carbon price may not emerge ahead of a system of well

[5] The focus on potential carbon price discontinuities arising from policy settings distinguishes this issue from other types of price stabilisation mechanisms, such as for agricultural products, which seek to address intrinsic or underlying price risks (Richardson 2001, Larson et al 2004) or to insulate domestic prices from international volatility (Anderson and Nelgen 2010), and from policies that seek to maintain low domestic prices for essential commodities.

[6] Effective international emissions has a central role in achieving adequate global emission reductions, to provide access to abatement opportunities in developing countries and to take advantage of

coordinated or integrated national schemes. Market fragmentation may arise through major buying countries recognising different types or sources of international offset credits, or limiting the overall amount of international units that can be used in their domestic schemes. This could result in lower prices for some types or sources of offset credits and permits that are available for use in other domestic systems. More generally, a lack of transparency, differential carbon prices across major jurisdictions, and limits to banking of permits (which smooths carbon prices over time) could result in current carbon prices in some domestic markets failing to provide a reasonable guide to long run prices.

The future market for offset credits from the Clean Development Mechanism (CDM) appears likely to be subject to such fragmentation. The EU is the major buyer, and already excludes certain project types and is putting a limit on overall use of CDM credits that may be triggered from 2013 onward. The EU also wants to see the CDM phased out from 'advanced' developing countries and has ruled that in future it will accept credits from new CDM projects only from least developed countries (EU Commission 2011). Similar buyers' constraints might apply in future markets for types of emissions units, for example from reduced deforestation (REDD) or sectoral crediting schemes in developing countries.

Importing markets thus may face price distortions, where prices are set by a subset of abatement costs that do not match overall marginal global marginal costs (given the aggregate demand for emissions reductions). All else equal, this risk appears most acute for nations with smaller carbon markets and a greater expected reliance on international emissions units – both of which are true for Australia.

Improved confidence for low-emissions investments – evidence from Australia

A well designed domestic floor price would provide greater confidence and encourage investment in low-emissions assets (Wood and Jotzo 2011), by acting to "limit the downside risk for investors in low carbon technologies" (McKibbin et al 2009).

An Australian survey of studies on investor behaviour with regard to carbon pricing (Lambie 2010) finds that uncertainty about future permit prices increases the value of waiting, and hence tends to delay investment decisions. Other recent analysis of investment risks and the impact of policy uncertainty in Australia's power sector (IRG 2011) concludes that "unlike project and market risks, (policy risk) cannot be effectively hedged or bounded by investors" and that "it will be important to that the transition from a fixed price to an emissions trading scheme is managed to avoid too much price discontinuity". Quantitative modelling supports these qualitative arguments. Brauneis et al (2011), for example, find that a price floor could significantly speed up investment in low-carbon options in the power sector.

differences in marginal abatement costs (Stern 2008, Zenghelis and Stern 2009). The Copenhagen and Cancun pledges are sufficient to motivate substantial demand for international permits, requiring material reductions relative to business-as-usual for most large countries (Jotzo 2010, McKibbin et al. 2010, den Elzen et al 2011). Opportunities for trade may also arise in advance of a full global climate agreement, including through regional agreements (Garnaut 2011a).

Providing clear forward price signals is central to the design of an effective emissions reductions policy (Hatfield-Dodds 2007). Australia's emissions continue to grow strongly, while our national emissions targets call for significant reductions in emissions. In the absence of new mitigation policies, particularly the introduction of a carbon price (Garnaut 2011a), Australia's national emissions are projected to be 24 per cent above 2000 levels by 2020 (DCCEE 2011).

According to the 2008 Treasury modelling (Australian Government 2008), stabilising domestic emissions will require carbon prices that are higher than the \$20-30/tCO_2 range commonly referred to in public debate (see Garnaut 2011a). Expected future carbon prices and their probability distribution, has a significant impact on the risks and returns associated with potential investments in power generation from coal, low-and high-efficiency gas, and renewables, , and on other energy or emissions intensive activities such as resource processing.

The importance of these impacts is underlined by the role of investment certainty in driving the *timing* of Australia debate on carbon pricing, which has been played out against the need to need to commit to significant new investments in electricity generation (ABRCC 2006, PMTGET 2007) – decisions with significant long-term implications for Australian emissions and abatement costs (Garnaut 2011b). Investment decisions have already been delayed because of carbon price uncertainty, or taken with inefficiently short time horizons. There is evidence this has led to more costly investment choices in Australia's electricity supply systems (Nelson et al 2010). Recent quantitative estimates put the cost of carbon policy uncertainty at one to two billion dollars per year until 2020 due to delayed investment in baseload gas generation, and up to five billion dollars per year until 2025 (Deloitte 2011).

In practice, the major near-term impact of an Australian price floor would be to lower the risks associated with investing in gas fired generation, displacing potential coal generation. Additional investment in renewable energy (above the level mandated by the Renewable Energy Target) would only be likely to be attractive with sustained relatively high carbon prices, at or above carbon prices associated with a 450ppm global stabilisation trajectory (see Australian Government 2008), and significantly higher than projections of global prices based on the commitments in the current international negotiations (den Elzen et al 2011).

This suggests that the major economic impact of a price floor is likely to be through narrowing the expected range of the carbon price over the period of the floor without necessarily having a material impact on the 'most likely' carbon price trajectory.

Safeguarding against unexpectedly low permit prices implies that the level of a floor price could be set well below expected market prices. The actual price will then be determined by the market all or most of the time.

Implications of a floor price for economic costs

Adoption of a floor price would be expected to result in increased economic costs, if the floor price comes into effect, but may also reduce costs by reducing risk premiums and improving dynamic efficiency.

At any point in time, if the price floor is operational then domestic carbon prices will be above prices in international markets, raising the costs of achieving a given national emissions target. The extra cost arises from the difference between the international price and domestic abatement costs, for each unit of additional abatement undertaken in Australia.

A guaranteed minimum carbon price may also promote lower cost abatement over time, however. First, domestic costs could be reduced by narrowing the range of risks and thus reducing risk premiums that would otherwise be incurred in transitioning to lower carbon economy. These savings may be achieved even if the price floor is never operational (that is, even if the market price is always above the price floor).

Second, a price floor may encourage investment in cost effective domestic abatement (or sequestration) that would otherwise not occur due to the risk of low carbon prices, particularly in the first few years. This implies a price floor could result in more efficient long-term investment choices if carbon price related financial risks prevent the least cost investments in long lived assets, such as power generation capacity, particularly where these already face significant cost uncertainty.

Third, a price floor may reduce the impacts on investment of potentially misleading forward price signals arising from fractured international permit markets.

Hence, the introduction of an emissions trading scheme by itself may not address one of the fundamental objectives of this reform – to provide the policy clarity required for the next wave of investment in Australia's electricity sector – if business investors are not confident about the minimum level of the carbon price over the next 10-15 years.

Reasoning along these lines is behind the UK proposal to introduce an emissions fee for the power sector, in addition to emissions trading (HM Treasury 2010). Confidence about the minimum level of the carbon price could also reduce the risk of future fiscal outlays to subsidise the replacement of refurbishment of high-carbon generation capacity in order to maintain energy security while achieving future national emissions targets.

Implications of a floor price for emissions levels

In contrast to Roberts-Spence logic of use of a floor price to complement a quantity target, implementing a floor price to support investment confidence would not be expected to impact on Australia's national emissions for the period already covered by an emissions target. This is because the operation of the floor price, if it comes into effect, would act to increase domestic abatement in that period, but with a corresponding decrease in the use of international emissions permits.

A secondary effect is that a floor price would, at the margin, encourage investment in less emissions intensive assets, lowering annual emissions into the future. This would occur even if the floor price does not come into effect. This would not affect national emission for periods when a target has already been set. But it may allow more ambitious future targets than would otherwise be agreed, and allow to meet them at lower cost.

Relationship to other aspects of scheme design

It has also been argued that there would be benefits from providing a maximum price cap, protecting investors, including those owning existing emission intensive assets (see Pizer 2002, Murray et al 2009). Combining a price cap with a floor price has sometimes been called a 'price collar' (McKibbin et al 2010, Fell et al. 2010).

Against this, in small open markets such as Australia, most of the advantages of price cap would be provided by unlimited use of international permits, which effectively caps the domestic carbon price at the price prevailing in other major domestic schemes (DCC 2008). We thus consider, in small markets with international linking, that the practical disadvantages of a price cap outweigh any additional benefits, particularly the difficulties in reconciling a price cap with banking of permits and full international linking (which does not apply to a price floor, see Section 4 below). There may, however, be a case for providing for a high price 'safety valve' in major markets, such as through a reserve allowance (Murray et al 2009, CEPA 2010).

Non-cost arguments against a price floor

The literature and recent Australian debate has also identified a range of potential arguments against various forms of price floor, in addition to the concerns about static costs discussed above.

Market interference. The most fundamental potential argument against price floors is that they amount to undue interference in markets. Such arguments overlook that permit markets are entirely created by government regulation. Price floors (or their absence) are one of many elements of design and parameters of an emissions trading scheme. Direct involvement in the operation of markets can be avoided almost completely, depending on the design chosen for a price floor (see Section 4). We consider potential market interference is thus more productively considered in the context of sovereign risk and administrative complexity.

Sovereign risk and policy stability. It might be argued that price floors could itself foster concerns about policy stability, as the level of the floor might become the focal point of political pressure. A degree of policy uncertainty is an inevitable feature of a carbon pricing scheme, given the highly contested political context. The overriding policy uncertainty at this stage in Australia relates to the possibility of a future government rescinding the scheme or altering key parameters. If a price floor was set unrealistically high, or unsuitable implementation options were chosen, credibility would be low. However as outlined below there are suitable implementation options, and basic objectives of a price floor could be achieved at floor price levels well below the expected permit price in a trading scheme, with little concern raised about policy stability.

A more fundamental consideration is that a price floor could work to enhance policy certainty, by reducing the risk that a protracted period of low carbon prices could threaten the credibility and stability of policy settings.

Secondary permit markets. It has been argued that price ceilings and floors limit the emergence of secondary permit markets (Garnaut 2011, p.24). It would appear that this is an issue only if price floors increase policy uncertainty. Provisions for a price floor can be implemented without impeding the operation of forward markets, and markets would continue operating if the floor price was triggered.

Inter-temporal and international flexibility. It has also been argued that price ceilings and floors may limit inter-temporal flexibility (banking and borrowing permits from one year to the next) and international flexibility (trading with other countries), and hence may do more damage than good (Garnaut 2011:24). These issues are of concern for a price ceiling (Jotzo and Betz 2009), but not for a price floor. A price ceiling, when active, reduces the stringency of a country's commitment, while a price floor increases it – the international credibility is increased rather than compromised. A price floor does not preclude international market linkage if the right design is chosen. It also poses no problems for permit banking, again as opposed to a price cap.[7]

Administrative complexity. Introducing additional features to the carbon pricing scheme obviously increases complexity, and potentially increases administrative burdens in its operation. These need to be weighed against the advantages that price floors might bring. The following section identifies options for implementation of price floors that minimise complexity and the extent of intervention in markets.

4 Implementation of a price floor to reduce investment risks

A price floor can be implemented in a variety of different ways, and within each there are options for the specific design.[8] The approach that appears most suitable for implementing a price floor in Australia's emissions trading scheme is to set a reserve price at auction of domestic permits, coupled with arrangements to support the floor price for imported offset credits or permits.

Australian permits: reserve price

A floor price could be implemented by government issuing permits at auction with a reserve price equal to the floor price. No bids are accepted below the reserve price. This option is

[7] The only inter-temporal issue with price floors is the possibility of excessive borrowing against future permits, in the expectation that the government would rescind on its commitment to the price floor.

[8] See also Wood and Jotzo (2011). Grüll and Taschini (2011) provide analysis of properties of a wider range of hybrid mechanisms.

administratively very simple, and does not interfere with trading of permits in the market. The market price could dip below the reserve price subsequent to an auction, however the reserve price will be a close proxy of the minimum price in the market if a large enough share of permits is auctioned and permits can be banked for future use.

Reserve prices feature in the main US carbon pricing proposals. The Californian emissions trading scheme, slated for introduction at the start of 2012, features an auction reserve price of US\$10/tCO_2, increasing at a rate of 5 per cent plus consumer price index per year (CEPA 2011). The same provision applied in the Waxman-Markey Bill (2009), which was passed by the House of Representatives but not pursued in the Senate. Furthermore, the Western Climate Initiative, an emissions trading proposal that would cover eleven States and Provinces in the US and Canada, foresees a reserve price (WCI 2010).

International units: management through accreditation decisions, government gateway, or a periodically adjusted conversion fee

The most challenging aspect of implementation of a price floor is to make it work in conjunction with purchases of emissions offsets or permits from other countries. International units should not be allowed to undercut the Australian floor price.

Option A. Excluding or 'gearing' specific types of international permits

The marginal supply price of permits eligible for use in Australia could be influenced by excluding international emissions units from certain project types, mechanisms or countries, so they are not eligible for use in the domestic scheme, as illustrated by EU policy on CDM credits. Another option, which we refer to as gearing, would be to require surrender of more than one permit for every domestic permit granted. Gearing could also be used to address quality concerns, and is a more flexible approach than binary acceptance or exclusion of permits.[9]

There are several reasons, however, why neither of these approach is well suited as a primary approach to maintaining a minimum domestic permit price. The most fundamental concern is that is likely to be very difficult to implement this approach in a way that effectively matches the relevant international price (at the margin) to the desired domestic floor price. Additional concerns include that this approach would risk undermining international confidence that quality issues are being managed in a transparent and even handed way. Second, excluding specific types of international permits on the basis that they are low cost (despite them providing acceptable quality) runs counter to the objective of harnessing cost effective abatement wherever it can occur. A last additional concern is that the discretionary nature of the exclusion approach could create domestic market uncertainty and implementation

9 Gearing international units would improve the environmental effectiveness of using international offset credits, as more offset credits would be acquitted in return for a tonne of emissions in Australia. In contrast to exclusion, this would convert the cost advantage of cheap emissions offsets into greater global abatement effort, or to a higher level of confidence that claimed emissions reductions are in fact achieved (see Schneider 2008), while providing incentives and resources for this abatement to occur.

difficulties.

Option B: Government gateway

A second approach to maintain domestic prices would be to channel all purchases of international units for domestic use through a government agency or independent authority. The offsets or permits would be bought at going rates internationally, and sold to domestic emitters at the same price as the market price or reserve price for Australian permits. A similar outcome could be achieved by selling unlimited domestic permits at the reserve price, and then purchasing international permits as required to meet Australia's national emissions targets.[10]

This model achieves a very similar outcome to the reserve price system for domestic permits, ensuring a minimum price at release into the Australian market with relatively simplicity and no interference in subsequent market transactions. It also ensures that profits from arbitrage between international and domestic carbon prices accrue to government, rather than to sellers, buyers or financial intermediaries. It does, however, require operation of the government gateway for all international permit purchases transactions at all times, whether or not the price floor is active. It also involves a degree of fiscal risk if market movements result in permits being sold domestically at less than the price they were purchased at internationally.

Option C: Fee on conversion

A third approach would be to leave international trades to market participants, but require a fee on 'conversion' of an international offset or permit into a domestic unit, if the price of international units is below the floor price. On conversion, government would rescind the international unit and issue a domestic unit which would be subject to the same rules and provisions as unit purchased at auction – implying it can be traded, banked and acquitted without restrictions.

The conversion fee would be set approximately equal to the shortfall between the floor price and the international purchase price. The fee would be set and announced in advance for a fixed period, such as six months. The fee could be set with regard to a benchmark price in international markets, and could differ for different classes of offset credits and permits. The fee would be zero if the international price is above the floor price, as the price floor does not apply.[11] The result in the domestic market is an approximate price floor.

Emitters and other market participants could lock in their option to use an international permit at any time, by converting it to a domestic permit. Alternatively they can hold international permits, retaining the option to sell these back in the international market..

[10] This is already required in relation to higher than anticipated emissions from sources that are not covered by the emissions trading scheme (DCC 2008).

[11] The 'fee on conversion' model has evolved from the 'variable fee' proposal by Wood and Jotzo (2010).

Under the 'fee on conversion' approach there is no intervention at all in emissions markets unless the floor price is triggered, and even then domestic emissions markets can operate unfettered. It requires only the monitoring of international benchmark emissions prices and setting of a fee at intervals. We envisage announcements would occur at regular times, linked to the auction schedule. The 'conversion' aspect does not increase administrative burdens, as arrangements for the acquittal of international units in Australia's scheme will be required also without a price floor. The approach also channels arbitrage profits to government if the price floor is active, but not at other times. Lastly it avoids the fiscal risks associated with active government participation in international permit markets.

For these reasons, we consider this to be the most suitable approach to implementing the international aspects of a domestic price floor.

Price levels and timing

The analysis above suggests that any floor price should be set below the expected market permit price. Two options for setting and adjusting the floor price appear of particular merit:

Option 1: Start the floor price at a level equal to a percentage of the fixed price at the end of the fixed price period (illustrated in Figure 1). Depending on the level of the fixed price and the objectives pursued, the floor price could be anywhere from significantly below the final fixed price level, to equalling the fixed price. The floor price would rise by a set amount or percentage each year.

Option 2: Set the floor price equal to a percentage of benchmark domestic carbon prices applying in other countries, for example as a weighted index of prices in major carbon pricing schemes, or of effective carbon prices in countries that meet defined criteria for the ambition of their schemes. The floor price would need to be adjusted periodically.

The period over which price floor arrangements should be in place is a matter of judgment. In order to have the desired effect of providing greater confidence to investors, a price floor would ideally need to be in place over a reasonable period of time, perhaps up to fifteen years. Its most important role would be in the early phases of emissions trading, to provide confidence in the transition to a floating price.

The floor price provisions should be put in place at the same time as other major aspects of carbon pricing and emissions trading arrangements. If a floor price is intended, this should be announced as early as possible, so investors can factor it into their considerations.

5 Conclusions

This paper has examined the case for a price floor in domestic emissions trading, in the context of the proposed scheme for Australia.

We find that while a traditional Roberts-Spence ‘belt and braces’ approach of addressing uncertainties about carbon abatement costs through price floors and ceilings has benefits over a ‘target only’ approach, it would be preferable – if politically possible – to deal with long run climate policy uncertainties by adjusting national and global emissions targets over time. This conclusion reflects that policy changes are more likely to tighten than loosen targets over time, both because of the tendency to overestimate future abatement costs, and because of lags in achieving the consensus required to implement ambitious global emission reductions that would provide net benefits.

We find, however, that there is a case for a domestic price floor to limit the policy-generated price risk. A domestic price floor can safeguard against inefficiently low carbon prices that might arise from unintended and unforseen aspects of policy design, or the interactions between carbon market arrangements in different nations, as carbon markets are evolving and maturing.

We find such a price floor could provide benefits through encouraging cost effective investment in low-emissions assets that might otherwise be precluded by perceived policy risks. This could facilitate a shift to a lower-carbon trajectory, improve dynamic efficiency, and reduce long run abatement costs – even if short-run costs of complying with a specific national target are higher in the event that the price floor comes into operation.

We also find for Australia that providing a price floor could avoid the possibility of introducing a carbon price, only to find that uncertainty about our national ambition or international carbon prices undermines the very investment certainty needed for investments in the electricity sector and other sectors that have big implications for Australia’s emissions trajectory. A last potential advantage is that a price floor could boost policy stability and credibility, by guarding against pressure for more arbitrary policy changes should there be a protracted period of low international carbon prices.

These advantages have to be weighed against possible increased complexity in design and scheme administration. However, appropriate scheme design can address these concerns. Our assessment of implementation options does not favour the EU approach, which seeks to influence domestic prices by excluding some types or sources of international credits and placing overall limits on imports of international emissions units. Instead it suggests a combination of a reserve price for domestic permits and a fee on conversion of international emissions units to domestically eligible units would minimise administrative complexity, avoid arbitrary interventions in carbon markets, and would not require constant monitoring of international permit prices.

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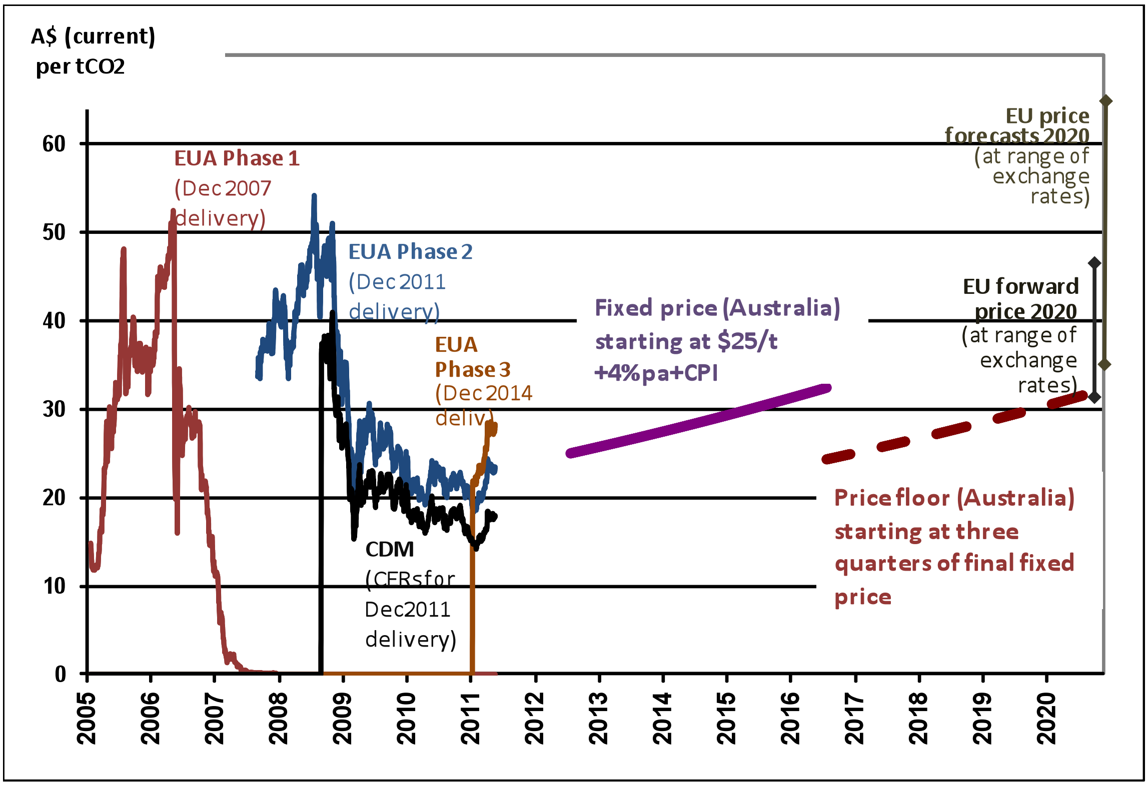
Figure 1: **Carbon prices: Illustrative trajectories of floor price and fixed price, compared to EU ETS trading prices**



Notes: All prices in nominal A$. EU ETS daily price data from PointCarbon, currency conversion using data from Reserve Bank of Australia.
Illustrative fixed price trajectory starts in mid-2012 at $25/t and increases at 4% per year plus inflation assumed at 2.5% per year. Illustrative price floor trajectory starts in mid-2016 at $24/t (three quarters of final fixed price at mid-2016) and increases at 4% per year plus inflation assumed at 2.5% per year.
Forward price: EUA for December 2020 delivery, €26 at 9 May 2011 (source: ICE ECX from barchart.com), equating to between A$31 and A$47/t assuming the full historical range of exchange rates (between of 0.56 and 0.86 A$/€).
Price forecasts: Assuming €30/t to €37/t (Lewis 2011) and exchange rates as above, equating to A$35 to A$66.