

TAXATION AND MULTI-PERIOD GLOBAL CAP AND TRADE

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The motivation for market-based approaches to climate change is simple. If one's goal is to reduce greenhouse gas concentrations, it makes sense to seize upon the least cost emissions abatement opportunities first. Within the framework of a cap and trade regime, the theory of permit trading tells us that, in principle, the bigger the market, the better. That is, if one wants to capture the least cost abatement opportunities through a market mechanism, then the market should encompass as many different candidate abatement strategies as possible. Two of the most important dimensions across which one can expand the market are space and time.¹ The potential for cost savings along these dimensions reflects the simple fact that various low cost abatement opportunities may exist in some places but not others (the spatial dimension), and other low cost abatement approaches may, for a variety of reasons, be available in the future but not at present (the temporal dimension). Unfortunately for the prospect of a well functioning permit market, time and space are also two of the key margins along which taxation frequently distorts economic behavior. With the goal of furthering our understanding of well-designed permit markets, this paper analyzes the tax issues that arise from the possibility of differential taxation of permit markets across space (particularly across different *national* jurisdictions) and across time. By the "taxation of permit markets" I have in

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¹ See, e.g., WILLIAM NORDHAUS, A QUESTION OF BALANCE 195–204 (2008).

mind an expansive notion. From an analytical perspective one must consider not only the tax treatment of permit trades but also the treatment that applies to the full range of permit transactions that have potential tax relevance. This includes permit acquisition, borrowing, banking, and surrender to the regulatory authority to meet compliance obligations. Moreover, a constant theme in this paper is that a comprehensive analysis of the taxation of permit markets requires one to take account not just of permit taxation but also the tax treatment of the various greenhouse gas emissions abatement activities for which permits function as substitutes.

As compared to the overall level of attention being paid to the architecture of permit markets, the level of attention devoted to the *taxation* of such markets has to date been exceedingly thin.² This lack of attention is surprising. The taxation of tradable permit markets is not just an issue of academic interest but rather has substantial and immediate real world relevance. There are a number of tradable permit markets up and running. The largest of these is the European Union Emissions Trading System (EU-ETS). In 2005, the annual value of allocated permits was estimated at 37 billion Euros.³ The EU-ETS includes both international and inter-temporal components, thus introducing the prospect of tax-induced distortions to permit trading and permit pricing. Regulated actors in these systems are making daily decisions regarding the tax consequences of actions within the market with scant guidance from government regulators. Where guidance does exist, it is likely to have been drafted by tax administrators in the absence of any overarching conceptual frame linking the prescribed tax treatment to the overall environmental goals underlying the

² For major contributions in the literature on taxation of permit markets, see Jonathan Remy Nash, *Taxes and the Success of Non-Tax Market-Based Environmental Regulatory Regimes*, in CRITICAL ISSUES IN ENVIRONMENTAL TAXATION: INTERNATIONAL AND COMPARATIVE PERSPECTIVES 735 (Nathalie J. Chalifour et al. eds., vol. V 2008); Gerald Auten, Edith Brashares & Horst Frisch, *Would Taxes Reduce the Benefits of a Tradable Emissions Permit Program for Greenhouse Gases*, 92 NAT'L TAX ASS'N PROC. 85 (2000); Carolyn Fischer, *Multinational Taxation and International Emissions Trading*, 28 RES. AND ENERGY ECON. 139 (2006); Ethan Yale, *Taxing Cap and Trade Environmental Regulation*, 37 J. LEG. STUD. 535 (2008); and Thomas Eichner & Ruediger Pethig, *Efficient CO₂ Emissions Control With National Emissions Taxes and International Emissions Trading* (CESifo, Working Paper No. 1967, 2007).

³ PEW CENTER ON GLOBAL CLIMATE CHANGE, THE EUROPEAN UNION EMISSIONS TRADING SCHEME (EU-ETS) INSIGHTS AND OPPORTUNITIES 4 (2005).

establishment of the permit market in the first instance.⁴ Discrepancies in the tax treatment of permits across time and across countries thus pose potentially substantial obstacles to the cost-effective abatement of greenhouse gas emissions within what might otherwise be a well-functioning permit market in the absence of tax considerations.

The overarching goal of this article is to provide an analytical framework that policymakers can use when approaching questions regarding the taxation of permit markets. At the highest level of abstraction one can readily say that the tax system ought not to introduce distortions to an otherwise well-functioning permit market. But when it comes to operationalizing this basic truism about minimizing tax distortions, we must make an initial assessment about the precise condition that we are trying to satisfy, which in turn is ultimately a question about how much of a given regulatory regime we take as held constant and how much we take as up for grabs. Thus, as a first step in laying out an analytical framework, it is helpful to distinguish between a broader sense of efficiency that tax policy could strive for versus a narrower sense.

Under a broader sense we might say that the desired *pre-tax* condition for a well-designed market is that in equilibrium the marginal abatement cost of a unit of greenhouse gas emissions should equal the marginal benefits from an additional unit of emissions abatement. Under such a broad approach the goal of a well-designed tax policy would be for taxes not to alter the pre-tax equilibrium condition of equality between marginal benefits and marginal cost. Setting tax policy in this broad context is an exceedingly complex problem that can be analyzed from within the existing literature on the optimal provision of public goods. That literature teaches us that an optimal cap is not simply a function of costs and benefits on the environmental side but depends as well on the *use* of revenues generated in the permit market.⁵ Taxation of permit markets can, in turn, tie into this set

⁴ For example, when the IRS considered parallel issues arising under the U.S. sulfur dioxide markets, there was little to no reference to the connection between tax policy and the overarching environmental goals. See Rev. Rul. 92-16, 1992-1 C.B. 15; Rev. Proc. 92-91, 1992-2 C.B. 503. Cf. STAFF OF JOINT COMM. ON TAX'N, 111TH CONG., CLIMATE CHANGE LEGISLATION: TAX CONSIDERATIONS 10-11 (Comm. Print. 2009) (discussing the possibility of "lock-in" distorting the market for allowances).

⁵ See, e.g., Ian W.H. Parry et. al., *When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets*, 37 J.

of questions about use of revenues. For example, the answer that one provides to the question about whether to tax gratis allocation of permits will bear upon the use of revenues generated by the permit market (because it affects the overall level of such revenues), which in turn is relevant to the conclusion one reaches about the level of an optimal cap. This type of broad efficiency analysis, which takes into account environmental costs and benefits as well as questions about use of revenue, is best suited to policymaking, where the big design questions, particularly the level of the overall cap, are taken as not settled.

One can also approach the problem of tax and permit markets from a narrower perspective. The requisite efficiency condition from the narrower standpoint is that marginal abatement cost be equal across firms. One could satisfy this condition while violating the broader condition that marginal abatement cost equal marginal benefits. However, adopting this criterion for policy analysis makes perfect sense if we take the cap to already have been set. This is an entirely plausible description of how matters will evolve in real world conditions. Permit market architecture and parameters may well be set without much thought to tax considerations. Policymakers will come along after the fact and be forced to determine how the permit market ought to be taxed. From within this more limited policy framework, the basic idea is that designing the tax system so as not to distort market incentives to equalize pre-tax marginal abatement costs will be consistent with the underlying point of the market mechanism in the first instance. Namely, for a *given* cap it is desirable to achieve the emissions reductions at least cost. Setting tax policy to be consistent with this narrower goal can be thought of in terms of cost-effectiveness, or what I often refer to as “abatement efficiency” in this article. For a given amount of abatement of greenhouse gas emissions, as compared to a business as usual (BAU) baseline, there will be some set of abatement opportunities (taking account of space and time) that has the lowest social costs. Call that the efficient abatement set. The tax system satisfies the condition of abatement efficiency when it leaves in place pre-tax incentives to undertake only those abatement decisions inside the

ENVTL. ECON. & MGMT. 52, 53 (1999) (“The second welfare effect arises under environmental policies that raise revenues to finance cuts in the marginal rates of preexisting distortionary taxes.”).

efficient set.

From the standpoint of structuring the tax system to be consistent with abatement efficiency, there may be a strong temptation to conclude that the solution to the problem is fairly easy to state, even if difficult to implement. Along the spatial dimension, the problem would seem to be the disparate tax treatment of permits under various national tax systems. The solution then would be harmonization of those tax systems. Along the temporal dimension, the problem would seem to be the typical sort of lock-in problem that can arise under any realization-based income tax. Thus a firm holding an appreciated permit may reject what would otherwise be the efficient sale of a permit because of the attendant tax costs. The solution then would be some type of accrual basis taxation. Cast in this way, there would not seem to be anything requiring novel analysis. These types of spatial and temporal distortions are standard fare in a world with cross-border trade in goods and services that brings transactions into contact with varied implementations of national-level income taxes.

This article claims, however, that taxation of permit markets *does* call for a more nuanced analysis. The basic reason for this is that the particular regulatory context in which permit markets arise allows for—and demands—an understanding of the precise way in which tax differentials affect prices. Where assets with differential tax treatment trade in the same market, one can expect such tax differentials to be capitalized into prices. A familiar example is the case of tax-exempt state or local bonds.⁶ The tax exemption on such bonds increases demand, thereby driving up price and driving down return. How do tax differentials affect permit prices? At first blush one might expect this to be solely determined by the tax treatment of permits relative to other market-traded assets. Such

⁶ See, e.g., David A. Weisbach, *Implications of Implicit Taxes*, 52 SMU L. REV. 373, 380 (1999) (“For example, if taxpayers were allowed to borrow to invest in tax-exempt bonds or other tax-favored assets, the price of these assets would be bid up, creating implicit taxes and eliminating the benefit of the shelter.”); see also MYRON S. SCHOLES ET AL., *TAXES AND BUSINESS STRATEGY: A PLANNING APPROACH* 131 (4th ed. 2009) (“[W]hen two assets give rise to identical pretax cash flows, but the cash flows to one asset are taxed more favorably than those from the other asset, taxpayers will bid for the right to hold the tax-favored asset. As a result, the price of the tax-favored asset will increase relative to the price of the tax-disfavored asset. And because the before-tax cash flows for the two investments are identical, the pretax rate of return to the tax-favored asset will fall below that for the tax-disfavored asset.”).

an approach, however, would fail to take account of the fact that regulated firms in a permit market are not merely trying to decide whether they should invest in tradable permits or some other market-traded asset. Rather, any regulated firm that holds permits in a quantity at or below the desired emissions level absent regulation (that is, at or below BAU) will necessarily face incremental actual abatement costs on the margin upon the transfer of permits. This is crucial because such firms face a constrained opportunity set (by virtue of the overall regulatory regime), which affects the way they value permits, including the tax treatment thereof. For example, suppose that permits were tax favored relative to other market-traded assets. By analogy to the tax exempt bond case we would expect increased demand for permits to drive permit prices up. However, to the extent that demand is driven by firms below BAU, purchasing permits equates to *not* abating on the margin.⁷ If actual abatement were *also* relatively tax favored then the firm purchasing a permit would enjoy the tax advantage of permit ownership but also simultaneously would forego the tax advantage applicable to actual abatement. Such effects should tend to offset one another. The precise interaction will depend on the actual relative tax treatment. But the central observation is simply that potential price effects on permits due to taxation must take account of the tax treatment of actual abatement.

A motivating theme of this article can thus be stated as follows: Given the regulatory obligations in the at or below BAU case, tax capitalization effects (that is, the way in which tax differentials are reflected in asset prices) are driven by tax differentials between permits and actual abatement in addition to the tax differentials between permits and all other market-traded assets. Tax capitalization effects are a function of the taxpayer's opportunity set. Thus, the premium a seller charges for a tax-

⁷ Note that even where non-regulated intermediaries make substantial permit purchases in the market, ultimate demand should still be driven by the regulated sector, because the permits held by intermediaries have *no* value unless eventually transferred to regulated parties who can use them to satisfy regulatory obligations. It is possible that a permit holder might attempt to privately enforce a lower cap than that mandated by the government by buying permits and letting them expire. To the extent such permit holders reduce aggregate supply of permits then this could be expected to produce a price effect. I bracket consideration of this effect here, however, on the assumption that it is likely to be small relative to the overall size of the market.

avored asset (or the discount a buyer demands for a tax-disfavored one) depends on the taxpayer's alternatives to sale or purchase. In a single period regime (one with no banking or borrowing of permits) a taxpayer below BAU has an opportunity set consisting of the two options of actually abating or surrendering permits. Thus the tax capitalization effects should be entirely determined by the relative tax treatment of permits and actual abatement. The multi-period case is substantially more complex because now the regulated actor must consider tradeoffs, for example, between holding permits for future use versus holding other market-traded assets. Here, tax capitalization effects will involve a complicated interaction between the tax treatment of permits, abatement, and other assets.

To assist the analysis of tax effects on permit price, this article identifies and develops two different approaches to tax policy design. Specifically, I distinguish "intra-firm neutrality" from "inter-firm neutrality." Intra-firm neutrality means that a given firm will face like tax treatment of all of the various options it faces (such as whether to use permits or to abate on the margin). Different firms may face different tax rates, however. Inter-firm neutrality means that different firms in the market will face like tax treatment of each particular option the firms face. Inter-firm neutrality and intra-firm neutrality are, I suggest, the key normative concepts that should guide policy with respect to taxation of permit markets. Crucially, to preserve the least cost abatement incentives introduced by the market one does *not* need like tax treatment of actual abatement and their substitute (permits) across all jurisdictions and across all times. It may be possible to structure tax policy to be consistent with environmental goals with much less coordination.

In light of these considerations, the article defends the basic normative proposition that inter-firm neutrality should be pursued within the context of a single country market, while intra-firm neutrality should be pursued within the context of a multi-country market. This prescription follows from the degree and type of coordination required in each case. Within a single market it is likely easier to coordinate tax treatment across firms than within firms. Across multiple jurisdictions, however, it becomes very difficult to coordinate treatment across firms, because those firms will face different rates structures under their domestic systems.

The Article proceeds in three parts. Part I elaborates upon the

basic distinction introduced above regarding the broader approach to analyzing tax policy, which implicates questions of optimal provision of public goods, and the narrower approach to analyzing tax policy, which implicates questions of cost-effectiveness. By using terms such as “broad” or “narrow,” I do not mean to imply a normative preference. As mentioned above, the choice of approach here should be understood in large part as a function of what parts of the system are plausibly up for debate. In cases where it makes sense to view the cap as exogenously fixed, analyzing tax policy from the standpoint of the narrower question of abatement efficiency makes perfect sense.

Part II is an extended analysis of the conditions required for the tax system to be consistent with the goal of abatement efficiency. It analyzes tax capitalization effects under the basic premise described above—that one must consider the interaction of the taxation of permits and the taxation of actual abatement. It also develops and explains the concepts of inter-firm neutrality and intra-firm neutrality, leading to the chief normative conclusions that (from the standpoint of abatement efficiency) inter-firm neutrality should guide tax policy in the closed market and intra-firm neutrality should guide tax policy in the open market.

Part III functions as a sort of case study of the way in which the analytical framework presented in this Article can assist in analyzing concrete questions that arise in the taxation of permit markets. I consider here a very important concrete question faced by policymakers: What is the appropriate tax treatment of permits allocated gratis? My analysis here shows that the problem is more complex than has been appreciated. As an initial matter it is crucial to distinguish the broader public goods question from the narrower abatement efficiency question. From the standpoint of public goods provision the question of taxation of gratis allocation ultimately depends somewhat on difficult to predict political factors, such as the interaction between the substance of the deal struck by legislative actors and the nature of enforcement by executive officials. From the standpoint of abatement efficiency the discussion draws heavily upon the analytic framework developed in Part II. If the appropriate framework is inter-firm neutrality (generally recommended in the single jurisdiction market), then the taxation of permits should match the taxation of investments in climate capital (understood broadly as capital investments which reduce actual emissions), if firms are below

BAU for the program but not for the period in question. By contrast, if the firm is below BAU for the period in question then permits should be likened to any other market-traded asset. If the appropriate framework is intra-firm neutrality (generally recommended in the multiple jurisdiction market), then the appropriate policy response depends upon an empirical analysis of the relative cost of distortions across firms within a period versus the cost of distortions within firms over time.

As noted, my chief concerns in this Article are with tax effects where permit markets span space and time. A word about the scope of each of these dimensions is in order. Regarding space, I have in mind the idea of multi-jurisdictional cap and trade, or what I will call global cap and trade from here on out. In truth, the permit market need not be global to motivate the issues that I take up here. All that one really needs is two jurisdictions with differential tax systems. But “global” is a more felicitous expression than “multi-jurisdictional,” and it also comports best with the basic insight that the overarching goal of cost minimization is meant to be best satisfied by the broadest market possible. Regarding time, I have in mind the temporal issues that arise when a permit market endures beyond a single taxable period. We can thus think of a single period regime as one in which all permits have duration only within a single *taxable* period. For this condition to hold, there would be no banking or borrowing of permits. Also, each taxpayer that is a regulated entity in the market (i.e., any party required to hold permits covering emissions) would have a taxable year (or whatever the fundamental tax period is) that fully encompassed the lifespan of all permits trading in the market. We can contrast the single period regime with the multiple period regime, in which permits have legal significance in more than one tax period. With these demarcations in mind we can now turn to a substantive analysis of taxation and “multi-period global cap and trade.”

I. PUBLIC GOODS VERSUS ABATEMENT EFFICIENCY

I begin by drawing a distinction between two different ways in which the tax system intersects with design of a tradable permit market. On the one hand, one confronts the set of issues related to the setting of an optimal cap and the use of funds generated by the permit market. The intersection with the tax system arises here both because the choice of tax rules will bear on the amount of

revenue raised by the regime and because, as a revenue-raising tool, one must assess how the regime affects the choice of other tax instruments in the system. Quite aside from this set of issues, the tax system intersects with permit markets in a rather different way. Specifically, once the decision about a cap has been made, the tax rules that one applies to transactions in permits will bear upon the incentives for efficient emissions abatement.

Consider first the set of issues related to the setting of an optimal cap. This is well understood to be an exceedingly complex problem. Clearly one can make no progress on that problem without substantial insights into the environmental benefits associated with the climate effects that follow from various emissions reductions and the associated costs required to achieve any given emissions target. Strictly from an environmental perspective, setting an optimal cap would require knowledge of the point at which the marginal cost of abatement is equal to the marginal benefit from such abatement. It is accepted, of course, that in reality we will have imperfect information about marginal costs and benefits. Quite aside from the difficulties of evaluating the private abatement costs and environmental benefits, though, there is also a complex problem of public finance that one must address. Suppose for the moment that we did have good information on marginal costs and benefits, which pointed in the direction of what would seemingly be an optimal cap. The basic problem is that one in fact *cannot* make a determination about optimality without also undertaking an analysis of the use of funds that the government raises through a permit market (for example, from the auction of permits).

This issue regarding the use of funds places the problem squarely within a longstanding debate in the public finance literature regarding the optimal level of public good provision. In one view, which begins with Pigou, the government should not provide public goods up to the level where the benefits of such goods equal their cost, because such cost must itself be raised through distortionary tax instruments.⁸ The optimal level of public good provision, then, must take account of the costs of funding the good through distortionary taxation. In a case like climate change, where the public good is the correction of an environmental

⁸ See ARTHUR C. PIGOU, A STUDY IN PUBLIC FINANCE 33–34 (3d (revised) ed. 1949).

externality, the revenue flows run in the reverse direction but the basic issue is the same. That is, the provision of the public good now *produces* revenue for the government (through, for example, the levy of a Pigouvian tax or the sale of property rights that internalize the externality). The question then is what to do with the revenue. Following the logic that the government must tax to provide the public good (which appropriately takes account of the distortionary costs of taxation in determining how much of the good to provide in the first place), the prescribed course on this view would be to use the revenue to reduce what is otherwise the most distortionary tax instrument in the system. The *gains* from shifting away from a distortionary instrument would, in turn, affect the initial decision regarding the amount of public good provision.

On a contrary view, which originates with Kaplow, the government should (under certain assumptions) *not* take account of the distortionary instruments that would finance the public good, but rather should provide the public good up to the point where benefits equal costs.⁹ The basic insight is that if the cost is funded through income tax adjustments that exactly offset the benefits accorded (a “benefits offsetting tax”), then the public good can be funded with no additional distortions. Not surprisingly, in the case where the public good provision involves the government’s receipt of revenue, the prescription under this view is likewise different. The goal would *not* be to reduce what are otherwise the most distortionary tax instruments but rather to use revenue to offset the costs and the benefits of the public good provision.

These alternate approaches to the optimal supply of public goods lie at the heart of the debates surrounding the so-called “double dividend” in the environmental tax literature. Proponents of the double dividend view claim that the revenue could be used to offset otherwise distortionary tax instruments. Opponents of that view note that one must also take account of the price effects in the market that the corrective tax is affecting, which will likely have not only the desirable environmental effect but also undesirable effects elsewhere (such as a contraction in labor supply). As with the case where the public good must be financed, this debate is to some extent resolved in the same way. That is, *if* we can use the revenues to completely offset the costs of the tax

⁹ Louis Kaplow, *The Optimal Supply of Public Goods and the Distortionary Cost of Taxation*, 49 NAT’L TAX J. 513, 524–25 (1996).

and the environmental benefits, then there will be no new distortion introduced by the environmental tax policy and we should provide the amount of the public good (determined by the level of the cap) such that the predicted permit price equals the environmental benefit at the margin (that is, apply a straight cost-benefit test). If we cannot use the revenues in this fashion (or if the assumptions underlying Kaplow's analysis do not apply), then this is no longer the case.¹⁰

The second way in which the tax system intersects with permit markets does not directly involve questions of optimal public good provision, but rather what can be thought of as abatement efficiency or cost-effectiveness. Market-based approaches such as cap and trade are meant to reveal superior information about least cost greenhouse gas emissions abatement opportunities, as compared to the information that is in possession of governmental regulators. Ideally, the tax system should not impede this process. Thus, if a properly functioning permit market in a world with no taxes successfully minimizes the cost of a particular amount of abatement, then it is a mark of a successful tax system that regulated actors choose the same set of abatement opportunities in the world with taxation. Tax instruments that lead actors to choose abatement opportunities outside this set produce abatement inefficiency. Regulated parties will have minimized their compliance burden on an after tax basis, but the aggregate social cost of achieving a given amount of emissions abatement (determined by the cap) will be higher than was necessary. This type of issue can be separated from the public goods questions. In other words, suppose that we did in fact have good information about the point at which marginal abatement costs and benefits equalize and that we set a cap accordingly, without taking account of how revenue generated under the permit system is used to offset benefits and burdens of the regime. This type of approach would likely involve sub-optimal public good provision. But even accepting this, it would still be the case that for a given cap, the desired policy would be to achieve the requisite abatement at the lowest possible social cost.

In considering the factors required for abatement efficiency

¹⁰ For a current endorsement of Kaplow's approach in the environmental context, see generally A. Lans Bovenberg & Lawrence H. Goulder, *Environmental Taxation and Regulation* (Nat'l Bureau of Econ. Research, Working Paper No. 8458, 2001).

we might begin with the observation that the firm is the central actor in this story. This follows from the fact that as a regulatory matter, the need for a *market* to achieve efficient abatement arises in the first place only because there are firm-specific low cost abatement opportunities. To state the obvious counter-factual, if there were never any firm-specific low cost abatement opportunities, then the regulator could simply demand the required emissions abatements from any random assortment of firms up to the level of required emissions reductions. There would be distributional issues, to be sure, but no efficiency concerns. In reality, the cost structure of abatement opportunities is deeply tied to the firm. There is a range of possible ways in which firm-specific low cost abatement opportunities can arise. Most obviously, firms employ different modes of production. Some firms may have low cost abatement opportunities because they have access to some proprietary low emissions technology. Other firms may have low cost abatement opportunities because they have not yet availed themselves of non-proprietary publicly available low emissions options. All of these factors can be expected to evolve over time. A firm that has relatively high abatement costs today may anticipate a sharp reduction in such costs in several years (perhaps when a new plant or equipment comes on line). Also, many firms will have relatively low cost abatement opportunities due to geographic factors. That is, they happen to operate in geographic regions where low cost abatement opportunities are disproportionately available.¹¹ Whatever the manner in which the firm-specific cost advantage arises, a simple glance at actual tax rules suggests that taxation may distort behavior along the relevant margins. That is, within a given country firms may face very different tax burdens due to factors that have little, if any, bearing on their relative advantage in abating at low cost. For example, firm burdens may vary depending upon their modes of production (as, for example, where there are sector specific tax preferences), their size, and their

¹¹ Gabriel Anandarajah, Fabian Kesicki & Steve Pye, *Carbon Tax vs. Cap-and-Trade: Implications on Developing Countries Emissions* 3 (Proceedings Paper for the 33rd International Association for Energy Economics International Conference, June 2009), available at http://www.homepages.ucl.ac.uk/~ucft347/Anandarajah_et_al_Cap-and-Trade.pdf (“Their participation hopefully means greater availability of cost-effective mitigation as developing countries also have cheaper carbon abatement opportunities than developed countries as their energy infrastructure is being developed.”).

organizational form. Crucially, as the focus of regulatory analysis becomes increasingly one involving multiple jurisdictions and longer lived permit regimes, the variance *across* national tax systems and time will introduce further disparities among the tax treatment of firms. Within the scope of multi-period global cap and trade, then, the basic tax policy goal of abatement efficiency would seem to necessitate the removal of tax induced distortions to the location of abatement activity across jurisdictions or the timing of abatement in a particular period. With that goal met, the tax system will not have interfered with the sought-after cost savings that motivate the adoption of an expansive market in the first instance. This is the basic policy prescription that informs all of what follows in Parts II and III of this article. In Part II below I undertake a detailed analysis of how to structure the tax system to be consistent with abatement efficiency. Part II does not undertake a further analytic discussion of the optimal public goods issue, which has been extensively covered by prior treatments in the literature. In the case study in Part III, however, we will see how the concerns relating to both public goods provision and abatement efficiency intersect to inform the analysis of the question of gratis allocation of permits.

II. TWO APPROACHES TO ABATEMENT EFFICIENCY: INTER-FIRM NEUTRALITY AND INTRA-FIRM NEUTRALITY

Consider the simple case of two firms, Firm 1 and Firm 2, which have *pre-tax* marginal greenhouse gas abatement costs equal to a_1 and a_2 , respectively. For ease of further exposition we can represent this with the following simple, stylized diagram:

Firm 1

Abate (a_1)

Firm 2

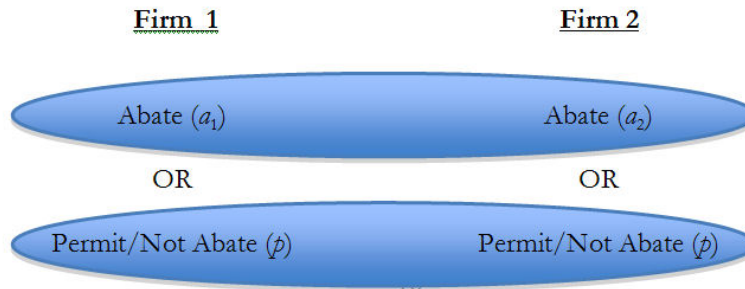
Abate (a_2)

To satisfy abatement efficiency, the quantities a_1 and a_2 should be equal in equilibrium. It is tempting to conclude that given this goal, the required goal for *tax* policy, assuming it is to comport with the goal of abatement efficiency, would be to treat abatement costs of firms the same on the margin. The problem with this simple depiction is that it ignores the various ways in

which firms can comply with their regulatory obligations and the different ways in which the tax system might treat the chosen mode of compliance. As a first elaboration, consider that under cap and trade, abatement and permits are substitutes for one another. That is, rather than incur abatement expense a_1 or a_2 on the margin, it is also open to a firm to buy a permit (that is, not abate) at the prevailing market price of p . This allows us to elaborate upon the simple diagram as follows:

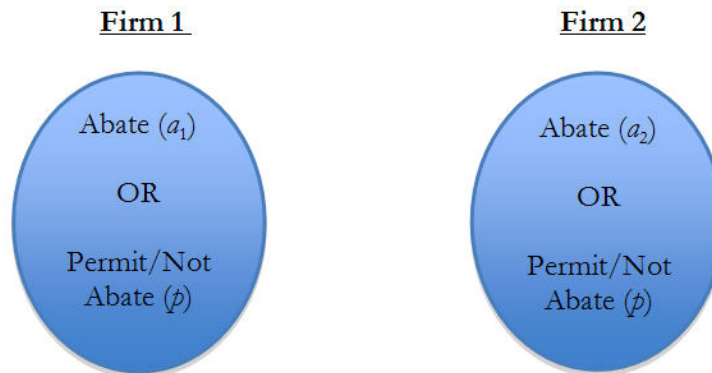
<u>Firm 1</u>	<u>Firm 2</u>
Abate (a_1)	Abate (a_2)
OR	OR
Permit/Not Abate (p)	Permit/Not Abate (p)

With this elaboration, what are the requirements for tax policy to instantiate the desired goal of abatement efficiency? The starting point of the analysis is to observe that although there are four basic types of actions depicted here (that is, abate or not, for each of two firms), it is not necessary to have like tax treatment of all four to achieve abatement efficiency. Rather, there are two different approaches that one might take, each of which is consistent with the goal. First, one can design the tax rules such that abatement costs are taxed in the same fashion across firms and such that permits are taxed in the same fashion across firms. I will call this approach inter-firm neutrality. Representing the required tax equivalences graphically, we would have the following, where the actions within a given oval receive like tax treatment:

Inter-firm Neutrality

Second, one can design the tax rules such that each firm faces the same tax treatment with respect to permits and abatement costs. I call this approach intra-firm neutrality. Representing the required tax equivalences graphically, we would have the following, again where the actions within a given oval receive like tax treatment:

In the following sections I describe the requirements of these

Intra-firm Neutrality

approaches in more detail, while at the same time describing why it is that these approaches comport with abatement efficiency.

A. *Inter-firm Neutrality*

Inter-firm neutrality, as the name suggests, takes as its goal the removal of tax distortions *across* firms with respect to the activity (i.e., emissions abatement) for which we are attempting to economize costs. There are two ways in which tax differentials could thwart the efficient outcome. Specifically, differentials that change the relative costs (across firms) of actual abatement may exist. That would be the case anytime otherwise similar firms engage in the same abatement activity but face different tax rates. Or, recognizing the fact that the holding of permits for surrender to the regulatory authority is the functional equivalent of *not* abating, tax differentials (across firms) to the holding of permits may also arise. Taking the two sides of the market (abating and *not* abating) together, it follows that for inter-firm neutrality to hold the tax system must satisfy two conditions: (i) actual abatement costs must receive the same tax treatment (regardless of the firm which undertakes the abatement) and (ii) permits must face the same tax treatment (regardless of the firm which acquires, holds, or surrenders them). Where these conditions obtain there is no *tax* reason for any regulated firm either (i) to engage in a particular abatement activity or (ii) to hold permits for surrender (i.e., to *not* engage in a particular abatement activity).

Note that to achieve allocative efficiency under the inter-firm neutrality approach it is *not* required that we tax permits the same as actual abatement costs. This may seem counterintuitive. On the margin the regulated firm views the purchase of additional permits and the incurrence of incremental abatement costs as substitutes. Generally, we think that if we differentially tax substitutes, then we get inefficient substitution into the tax-favored option. In this context, for example, such reasoning would seem to suggest that if a regulated firm faced relatively onerous taxation of permits then we would observe inefficient substitution away from permits. But that does not happen in a permit market where the conditions of inter-firm neutrality obtain because *all firms* are given the same incentives. If all firms attempt to move away from permits because of a tax disadvantage relative to actual abatement, then there will be a resulting effect on the pre-tax price of permits. However, on the margin all firms will still face the *same* after-tax price of permits and the *same* after-tax price of actual abatement. There would be no tax reason to shift actual abatement among firms and thus no threat from the tax system of foregone firm-

specific cost advantages in abatement.

To demonstrate the relationship between pre- and after-tax prices of actual abatement, pre- and after-tax prices of permits, and abatement efficiency, we can elaborate upon the two-firm scenario introduced above.¹² The standard economic models, which are premised on zero-transaction-cost Coasean bargaining, predict that regardless of initial allocation of permits, we should observe trading of permits up to the point where the marginal cost of abatement for Firm 1 (a_1) and the marginal cost of abatement for Firm 2 (a_2) are equal.¹³ Permits are simply the vehicle through which regulated firms swap abatement responsibilities. The maximum price a firm will pay for permits, p , is simply equal to its marginal abatement cost a . Thus firms will trade in permits (swap abatement responsibility) until they place equal value on the permits. At equilibrium in the two-firm scenario, permit price, p , will thus equal both a_1 and a_2 . Pre-tax marginal abatement costs are equalized and thus abatement efficiency is satisfied. These standard models generally do not discuss taxation.

Now let's introduce taxation. Consistent with the conditions required by inter-firm neutrality, suppose that the two firms face the same tax rate, t_a , on abatement and the same tax rate, t_p , on permits. Firms will now base their trading decisions on after-tax prices, and the equilibrium permit price will now reflect the point where Firm 1 and Firm 2 have equivalent *after-tax* marginal costs of abatement. The question, of course, is whether that equilibrium point also involves equalization of *pre-tax* marginal costs of abatement.

Suppose Firm 1 can abate one metric ton of greenhouse gas emissions on the margin at a pre-tax cost of a_1 dollars. On an after-tax basis, Firm 1 will view the cost as $a_1(1 - t_a)$. That is, assuming the cost of abatement gives rise to a deduction, then the cost of abatement, on an after-tax basis, decreases.¹⁴ What should

¹² My discussion here tracks the analysis in T.H. TIETENBURG, EMISSIONS TRADING: PRINCIPLES AND PRACTICE (2d ed. 2006). As Tietenburg shows, the insights that one can gain from a two-source model can be extrapolated to the multiple-source model. *See id.* at 25–40.

¹³ *Id.* at 29.

¹⁴ The prospect of a deduction here reflects the fact that within a properly defined income tax base, the cost should be deductible as a business expense under a provision such as I.R.C. § 162 (2006). In reality, many abatement costs may have to be capitalized and recovered through depreciation deductions. As the discussion in the text has not yet introduced time into the analysis, I defer

Firm 1 be willing to pay for a permit at this point? Recall that the permit is a perfect substitute for actual abatement. A given firm will thus value permits and actual abatement the same on an after-tax basis. Accordingly, to determine what Firm 1 will pay for a permit in pre-tax dollars, when its marginal abatement cost is equal to a_1 , we must gross-up the after-tax cost of actual abatement to reflect the tax treatment of permits. Thus on a pre-tax basis Firm 1 should be willing to pay $a_1(1-t_a)/(1-t_p)$ for a permit when its marginal abatement cost is a_1 .¹⁵ Likewise Firm 2 should be willing to pay $a_2(1-t_a)/(1-t_p)$ for a permit when its marginal abatement cost is a_2 . The firms should trade until they place equal value on permits, that is, until $a_1(1-t_a)/(1-t_p) = a_2(1-t_a)/(1-t_p)$, which simplifies to $a_1 = a_2$.

Two points follow. First, trade occurs until pre-tax marginal abatement costs are equalized. Thus we achieve abatement efficiency notwithstanding the introduction of taxation. Second, the equilibrium pre-tax permit price, p , will be equal to both $a_1(1-t_a)/(1-t_p)$ and $a_2(1-t_a)/(1-t_p)$. The meaning of this is simply that under inter-firm neutrality, differential tax treatment of permits and abatement will have a price effect on permits. This price effect does not distort abatement efficiency, however, because the firms still place the *same* value on permits at the equilibrium point where pre-tax marginal abatement costs are equalized. It does not matter that such permit value is different from the pre-tax cost of abatement. Because the firms place the same value on permits, there is no incentive to trade permits (i.e., shift abatement) across firms, which would have the consequence of moving the firms off of the efficient equilibrium.

B. *Intra-firm Neutrality*

A different type of approach to abatement efficiency might be termed intra-firm neutrality. The condition that one must satisfy under this approach is that any given firm faces the same tax treatment of actual abatement costs and permits, which operate as substitutes for *that* abatement. This condition does not require that a given source face the same tax rate on all possible methods of

discussion of capitalized cost for now.

¹⁵ This expression reflects the simple fact that a given firm will value abatement and permits the same on an after-tax basis. For Firm 1, $a_1(1-t_a) = p(1-t_p)$. Solving for p yields the expression in the text, $a_1(1-t_a)/(1-t_p)$.

abatement and permits that it might acquire. The point, rather, is that when a firm faces the choice between any particular method of abatement versus holding an additional permit on the margin, then the tax treatment of such abatement and of such permit be the same. Note, however, that it is *not* required (as it is required in the inter-firm neutrality approach) that methods of abatement be taxed the same regardless of who undertakes the abatement, *or* that permits be taxed the same regardless of who holds them.

The intuition here is that if every firm in the market is made tax-indifferent on the margin between abating and not abating, then the market taken as a whole should be efficient. If we differentially tax methods of abatement then this will, in isolation, cause an inefficient clientele effect. Sources who can undertake the tax preferred method of abatement will over-abate relative to those sources who cannot. The tax-favored sources, in other words, abate too much, which is the same as saying they sell too many permits. But if we exactly offset the tax advantage of actual abatement with a tax *disadvantage* from transferring permits, then we should create a balancing clientele effect for holding permits and thus re-achieve the efficient equilibrium.

We can again illustrate with a stylized example. Consider again two firms, Firm 1 and Firm 2. Consistent with the conditions of intra-firm neutrality, it is now the case that Firm 1 faces the same tax, t_1 , on both permits and actual abatement, while Firm 2 faces the same tax, t_2 , on permits and actual abatement. Following the logic discussed above, for a pre-tax marginal abatement cost of a_1 , Firm 1 will perceive an after-tax marginal abatement cost of $a_1(1 - t_1)$ and should be willing to purchase a permit, on a pre-tax basis, for a grossed-up amount equal to $a_1(1 - t_1) / (1 - t_1)$, or simply a_1 . Likewise, for a pre-tax marginal abatement cost of a_2 , Firm 2 will perceive an after-tax marginal abatement cost of $a_2(1 - t_2)$ and should be willing to purchase a permit, on a pre-tax basis, for a grossed-up amount equal to $a_2(1 - t_2) / (1 - t_2)$, or simply a_2 . Again, the firms will trade until they place equivalent value on permits, which occurs when $a_1 = a_2$.

Two points follow from this. First, as with inter-firm neutrality, trading occurs until pre-tax marginal abatement costs are equal, as required for abatement efficiency. Second, the equilibrium pre-tax permit price, p , is equal to a_1 and a_2 . The meaning of this is that, in contrast to the case of inter-firm neutrality, there is no tax-induced price effect on permits.

C. Time

So far the discussion has said nothing about time. That is, I have described the problem of abatement efficiency as if firms, confronted with their marginal abatement cost schedules and tax treatment of permits and actual abatement, reach an instantaneous decision about how to efficiently allocate permits and actual allocation. In the real world, of course, we have time and thus firms will hold permits while permit values are in fluctuation.

We can see the relevance of this in the following way. The above discussion, which bracketed the question of time, understood the goal of abatement efficiency to be the removal of all tax distortions to the allocation of abatement and non-abatement (i.e., permits) across firms. But abatement and non-abatement on the margin can take different forms. Specifically, a decision to abate on the margin can be manifested in one of two ways: (i) selling a permit and (ii) not buying a permit. Similarly, the decision to *not* abate on the margin can be manifested in one of two ways: (i) not selling a permit and (ii) buying a permit. To the economist there would be no significance to the distinction between selling/not buying on the margin or to the distinction between not selling/buying on the margin. But once we introduce tax and time, the situation changes drastically because a realization-based income tax is not generally neutral across a buy-sell margin.¹⁶ Thus it would appear that here we encounter the typical sort of lock-in problems that are endemic in any realization-based tax system. Indeed, this is precisely the issue that has garnered the most attention in prior analysis of the interaction between the tax system and permit markets.¹⁷

I believe, however, that timing issues require a more nuanced analysis that has not been fully appreciated in the literature. To

¹⁶ See, e.g., Noël B. Cunningham & Deborah H. Schenk, *The Case for a Capital Gains Preference*, 48 TAX L. REV. 319, 344 (1993); David M. Schizer, *Realization as Subsidy*, 73 N.Y.U. L. REV. 1549, 1552 (1998) (“For this and other reasons, discussed within, unrealized appreciation is taxed more favorably than other income—a fact that distorts investment decisions and induces tax-motivated planning.”).

¹⁷ See, e.g., Jonathan Remy Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes for Local and Regional Pollutants*, 28 ECOLOGY. L.Q. 569, 585–86 (2001). Later commentators have taken issue with the idea that there is lock-in within a single period but have maintained the view that multiple period models pose a lock-in problem. See, e.g., Yale, *supra* note 2, at 548.

assist in the exposition we should distinguish at the outset between the role of time within what we can think of as a single period regime, versus the role of time in what we can think of as a multiple period regime. Note that I take the term “period” here to be defined by the relevant *legal* regime. The passage of time can thus occur *within* a legally demarcated period. By a single period regime I mean to capture the case where permits under the cap and trade system have a life that is contained within a single *taxable* period. In the simplest case we can imagine a cap and trade regime with permits that are valid only for a single calendar year and where it is also the case that all regulated firms have the calendar year as their basic taxable period. Clearly, this does not remove time from the picture. A permit could be acquired on January 1 and have wildly fluctuating value over the next 365 days.¹⁸ By contrast, a multiple period model involves the case in which a permit trading regime contemplates actions that have consequences which not only span time but also arise in different *taxable* periods. The required relationship is a function of the relevant accounting period under the regulatory regime, the permissible actions that may arise across the accounting periods contemplated by the regulatory regime, and the relevant tax period. The most likely way in which we will encounter a multiple period problem in the real world is the circumstance in which the taxable period is a year, the regulatory accounting period is a year, and the regulatory system permits banking and/or borrowing of permits across accounting periods.¹⁹

As we will see, the consequences under the single period regime and multiple period regime are importantly different. But before we see exactly how, it is helpful to describe how problems of timing in this context relate to typical understandings of lock-in.

¹⁸ For an extended and enlightening discussion of this issue see Jeff Strnad, *Periodicity and Accretion Taxation: Norms and Implementation*, 99 Yale L.J. 1817 (1989). Any tax system that adopts periodicity rather than continuous taxation will exhibit this feature of time passage between determinations of tax liability. See *id.* at 1825–30.

¹⁹ Obviously, there are an infinite number of ways to create a multiple period problem. Note, however, that banking and/or borrowing need not be present to create the issue. For example, even in the absence of banking and borrowing, we could well imagine the case where the regulatory accounting period is on a calendar year basis and the taxable year tracks the (non-calendar) fiscal year. Actions taken within one regulatory accounting period could thus span taxable years, even without banking and/or borrowing.

The general way of thinking about lock-in is that we sacrifice gains from trade because the *tax* cost of such trade is greater than such economic pre-tax gain.²⁰ Suppose we have some item of property that has value V_o to its current owner and some higher value, V_B , to some potential buyer. We can then quantify the gain from trade with the expression $V_B - V_o$. For simplicity let's assume that the current owner will face the same tax rate t_o , regardless of the amount of gain from selling the property. Also for simplicity, assume that the current owner has a zero tax basis in the property. This latter assumption does not affect the generalization of the discussion to follow. Putting aside the generally rejected concept of negative basis, if there is no lock-in potential in the zero basis case, then there will be no lock-in in any case.²¹ As a general matter, lock-in would occur where the tax cost of the transaction is greater than the pre-tax economic gain from the trade. For a potential purchase price P , where $V_B < P < V_o$, lock-in occurs where $Pt_o > P - V_B$. Importantly, this is an incomplete paradigm to apply in the cap and trade context. It would be wrong, for example, to conclude that where the tax cost of transferring a permit is greater than the differential in pre-tax marginal abatement costs (i.e., the relevant gains from trade), there is lock in. We'll see in a moment the correct way to assess this problem. First, however, I should highlight the basic features of permit markets that are driving the need to elaborate upon the "standard" lock-in story. We should distinguish here between the case where a permit would cover an emission that lies at the business as usual (BAU) level or lower, and the case where a permit would cover an emission that lies above the BAU level.²²

²⁰ See, e.g., Reed Shuldiner, *Index the Code, Not Capital Gains*, 79 TAX NOTES 225, 240–41 (1998); see also Walter J. Blum, *A Handy Summary of the Capital Gains Arguments*, 35 TAXES 247, 256–57 (1957); Cunningham & Schenk, *supra* note 16, at 343; Michael J. Waggoner, *Eliminating the Capital Gains Preference. Part I: The Problems of Inflation, Bunching and Lock-in*, 48 U. COLO. L. REV. 313, 315–16 (1977).

²¹ For discussions on negative basis, see George Cooper, *Negative Basis*, 75 HARV. L. REV. 1352 (1962); Eric A. Lustig, *Negative Basis Reconsidered: Of Hoaxes, Traps for the Unwary, and the Need for Reform*, 32 GONZ. L. REV. 45 (1996–97); Steven Quiring, *Section 357(c) and the Elusive Basis of the Issuer's Note*, 57 TAX LAW. 97 (2003).

²² Note that the latter case covers the possibility of a regulated emitter who holds sufficient permits to cover the BAU level of emissions and then some, as well as an entity (say, an intermediate trader) who does not have emissions subject to regulation.

In the first case—where the permit covers an emission at or below BAU—the crucial point to observe is that the transfer of the permit implicates other actions. That is, by assumption, if the firm is at or below BAU and *sells* a permit then it will have to abate emissions on the margin. Conversely, if a firm is below BAU and *buys* a permit then it will be relieved from abating emissions on the margin. Such abatement or non-abatement on the margin will itself have tax consequences, which we rightly take into account in determining how the tax system as a whole relates to abatement efficiency. One can contrast this state of affairs with the more standard lock-in story. Typically, we might imagine that a potential seller of property would realize some value if it sells. But we would typically be unable to say anything further about the economic (and thus tax) consequences of what the seller does with the sales proceeds. Nor would we generally include the tax treatment of the prospective buyer in the analysis. Examining the buyer's incentives would require one to make an assessment about the buyer's alternate use of funds—an issue about which one would generally have no information. In a permit market, however, regulated actors (below BAU) that increase or decrease their position in permits *must* also change their position with respect to actual abatement. Thus we can in fact make assessments about the alternate use of funds, from the perspective of both the seller and the buyer.²³

In the second case—where the permit-holder is above BAU—then we observe a different type of departure from the standard lock-in analysis. Specifically, a permit held in these circumstances has *no* value absent the prospect of sale. By contrast, the typical type of lock-in case will involve property that either produces income (say, rental income on land) or results in value being delivered to the holder upon some terminal event (say, redemption of a zero coupon bond). Permits are different. If a holder in the above BAU situation never sells, then it holds property that is worth approximately the value of the paper on which the permit is permitted (or nothing if the permit is tracked in a digital registry).

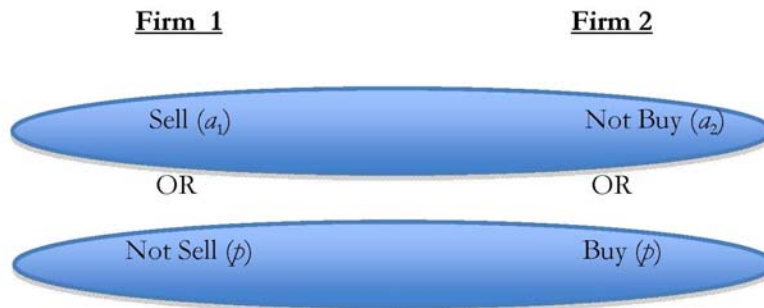
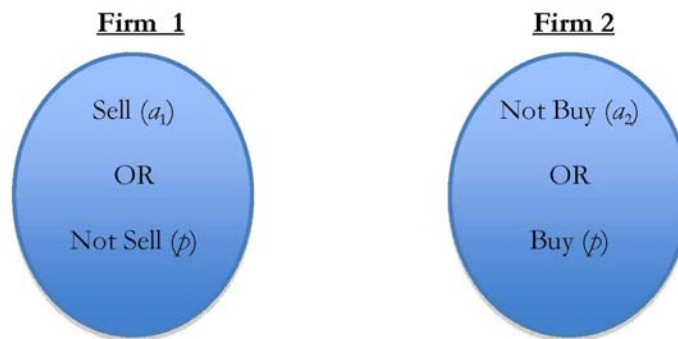
²³ I do not mean to imply that permits are the only type of property where such considerations could arise. The key *general* concept is that the overlay of a regulatory regime provides one with information about regulated actors' opportunity sets. This information allows one to make a more fine-tuned assessment of appropriate after-tax discount rates to be used by the actor in valuing investments.

With these two points about the distinctive character of permit markets in mind we can now turn to a discussion of the requirements for abatement efficiency in a single period regime and in a multi-period regime.

1. *One Regulatory Period With Time*

We are now in a position to analyze the required conditions for abatement efficiency in a single period regime as I use that term. We are interested here in the conditions required to remove tax-induced lock-in (non-trades), as well as tax-induced trades. Recall that what motivates the entire analysis is that from the perspective of the tax system it matters crucially whether the firm already holds a permit on the margin and is considering whether to keep it, or whether the firm does *not* hold a permit on the margin and is considering whether to buy. Again, as noted, from a strictly economic perspective (ignoring taxation), this distinction would be irrelevant because the price of the permit would not vary across the two cases. With taxation and time, however, on an after-tax basis the price may well vary depending on whether the firm is buying or selling on the margin.

Consider first the case where firms are at or below the BAU level. We can begin by elaborating upon the required conditions for inter-firm neutrality and intra-firm neutrality by modifying the diagrams with which we have been working to reflect the alternate ways in which firms can abate or not abate on the margin. Obviously, any given firm might be trying to decide whether to buy or sell on the margin. To cover the range of possibilities, for purposes of exposition I will treat Firm 1 as contemplating a sale of a permit to Firm 2 and I will treat Firm 2 as contemplating a purchase of permits from Firm 1. As above, a_1 , a_2 , and p are pre-tax costs of abatement and permits. The task is to figure out the effect of taxation.

Inter-firm Tax Neutrality*Intra-firm Tax Neutrality*

Observe that each form of abatement, Sell or Not Buy, has a corresponding form of non-abatement—Not Sell or Buy, respectively. This is to state the obvious: (i) if a firm already holds a permit on the margin, its options will be either to sell it or not sell it, and (ii) if a firm does not hold a permit on the margin its two options are obviously either to buy a permit or not. The implications, however, are perhaps not obvious. Examining the above diagrams, we can readily see that the conditions of intra-

firm neutrality require that such corresponding pairs be taxed the same (they are in the same “bubble”). This is just the basic principle that the firm must face the same tax on actual abatement and permits that we have already seen. The conditions of inter-firm neutrality, however, do *not* require that these corresponding pairs be taxed the same. Again, this is just an extension of the basic principle underlying inter-firm neutrality.

We can now introduce after-tax expressions to represent the four potential actions just sketched (Not Sell, Sell, Buy, and Not Buy). I adopt the convention of defining after-tax value of these expressions *relative* to the applicable substitute. That is, the after-tax position of Not Sell is defined relative to the consequences of Sell. The after-tax position of Buy is defined relative to the consequences of Not Buy. The advantage of this approach is that once we have defined the after-tax expressions it will allow us to readily determine whether given assumptions about tax rates produce the result that a certain transaction has positive or negative value relative to its substitute. Throughout, the term t_a refers to the tax rate on abatement and the term t_p refers to the tax rate on permits. Also, I will use the variable b to refer to the taxpayer’s adjusted tax basis in a permit.

The expression for the after-tax value of not selling a permit that a firm currently holds is as follows:

$$(1) \text{ Not Sell: } a(1 - t_a) - p + t_p(p - b) + t_p b$$

On the assumption that we are below BAU, the decision to Not Sell means that the firm is holding a permit for surrender to the regulatory authority (in the single period under this scenario). The four terms in this expression have the following meaning. The first term represents the after-tax value of avoided abatement costs. The second term represents the opportunity cost from not selling the permit. The third term reflects the tax benefit from not being taxed on the transfer of the permit. The fourth term reflects the tax benefit that arises when the permit-holder surrenders the permit to the regulatory authority in the one period and recovers its adjusted basis. The expression simplifies to $a(1 - t_a) - p(1 - t_p)$.

Because I am defining the after-tax expressions relative to the substitute positions, the expression for Sell is of course identical to the expression for Not Sell, but with the signs reversed:

$$(2) \text{ Sell: } p - t_p(p - b) - a(1 - t_a) - t_p b$$

The four terms here have the following meaning. The first term represents the economic flow from selling the permit at price

p . The second term represents the tax cost from transferring the permit. The third term represents the increased after-tax abatement costs. The fourth term represents the foregone tax benefit that the permit-holder would have received by surrendering the permit to the regulatory authority if it had held the permit rather than selling it. The expression simplifies to $p(1 - t_p) - a(1 - t_a)$.

The expression for Buy (relative to Not Buy) is:

$$(3) \text{ Buy: } a(1 - t_a) - p(1 - t_p)$$

In other words, the buyer of a permit saves the after tax actual abatement costs but incurs the after-tax cost of the permit.

The expression for Not Buy just reverses the signs of the expression for Buy:

$$(4) \text{ Not Buy: } p(1 - t_p) - a(1 - t_a).$$

In other words, the firm that chooses not to buy saves the after-tax cost of permits but incurs the after-tax cost of abatement.

We can now apply these expressions to the requirements of inter-firm neutrality and intra-firm neutrality. Consider inter-firm neutrality. Recall that in this case the complication that arises with the introduction of time is that we now require the different forms of not abating at the margin (Not Sell and Buy) to be taxed the same and we require the different forms of abating at the margin (Sell and Not Buy) to be taxed the same. Indeed, we satisfy these conditions here. Not Sell and Buy have the same after-tax value (compare expressions (1) and (3) above). Likewise, Sell and Not Buy have the same after-tax value (compare expressions (2) and (4) above). Crucially, this is the case notwithstanding the introduction of time (and the possibility of permit value fluctuation). This makes sense if we keep in mind the basic distinguishing feature introduced above regarding the BAU or lower case. Specifically, the introduction of time—including the introduction of appreciated or depreciated permits—has no effect in a single regulatory period model. Gain or loss is a function of adjusted basis and amount realized on transfer. In this context adjusted basis is irrelevant to a permit-holder's decisions because it will recover basis in the same tax period regardless of what it does (either upon sale of a permit or surrender). The amount realized is irrelevant because a seller will benefit from an offsetting deduction on actual abatement costs, again in the same tax period. Essentially, we are in the exact same situation as the no-time variant discussed above.

But why don't we have to consider differential tax treatment of Sell-Not Sell and Buy-Not Buy? If we assume $t_p \neq t_a$ (which of course is entirely consistent with inter-firm neutrality), then we have just seen that Not Sell has value of $a(1-t_a) - p(1-t_p)$ relative to Sell. If Not Sell and Sell have non-zero value relative to one another isn't this the paradigm case for tax-induced lock-in (or its converse, tax-induced trades)? The answer is no, for the same reason we have seen above. The key component of inter-firm neutrality is that it neutralizes tax disparities between permits and abatement through price effects. Once we introduce time, the distinction between Not Sell-Sell is just a further specification of the Abatement-Permit margin and tax differentials should be fully priced so long as all firms face the same t_p and all firms face the same t_a . Put in the terms we viewed above, where we satisfy the conditions of inter-firm neutrality, a firm should value p in terms of a , as $a(1-t_a)/(1-t_p)$. Substituting for p in the above expression for the value of Not Sell (relative to Sell), the expression simplifies to zero. That is, with price effects Not Sell and Sell *do* have non-zero value relative to one another. An identical analysis applies with respect to the Buy-Not Buy margin.

Turning to intra-firm neutrality, the end result is the same, though the path to that result is somewhat different. With intra-firm neutrality, we require that each firm face the same tax rate on abatement and permits. The complication that was not present in our initial discussion (without time) is that we must now take account of the differences that arise depending upon whether the firm contemplates a sale or purchase of a permit on the margin. Thus the firm must be indifferent between both the after-tax value of Not Sell versus Sell (expressions (1) and (2) above) and the after-tax value of Buy versus Not Buy (expressions (3) and (4) above). Regarding the Not Sell versus Sell margin, these expressions have value of $a(1-t_a) - p(1-t_p)$ and $p(1-t_p) - a(1-t_a)$, respectively. If we set $t_a = t_p$ (the basic criterion for intra-firm neutrality), then the expressions become $(1-t)(a-p)$ and $(1-t)(p-a)$, respectively. But we have already seen above that under the conditions of intra-firm neutrality, a firm's willingness to pay for a permit is simply equal to its marginal cost of abatement, a . That is, unlike inter-firm neutrality there is no price effect. Thus these expressions have zero value relative to one another. An identical analysis applies to the comparison of Buy and Not Buy, which have value of $p-a$ and $a-p$, respectively.

If this all seems too neat, it may be worth noting that the fact that I have *defined* the expressions for Sell-Not Sell and Buy-Not Buy relative to one another does *not* ensure that they have zero value relative to each other. The relative valuation, rather, depends upon the relative tax treatment of permits and abatement and across firms. If we were to imagine a case that violated both inter-firm and intra-firm neutrality, then this follows readily. For example, in the two firm scenario suppose that $t_p \neq t_a$ and that the firms face different t_p and different t_a . In that case Not-Sell would have non-zero after-tax value relative to Sell and such disparity would not be fully absorbed into pre-tax prices.

So far we have considered the case of permits at or below the BAU level in the one period regime with time. The results were driven by the fact that abating and not abating operate as perfect substitutes and that regulated actors who reduce permit holdings *must* incur actual abatement costs (and vice versa). If we are above the BAU level (either because a regulated firm holds permits in excess of the desired emissions level absent regulation, or because a non-regulated firm holds permits), this is no longer the case. This might suggest that we encounter the typical lock-in problem, but we do not because here permits have zero value absent transfer. Consider the Not Sell/Sell margin. That is, we might be concerned that a firm holding a permit above BAU would not, for tax reasons, sell to a firm below BAU. The potential buyer then might end up abating (inefficiently) on the margin. But this cannot happen in the single period regime. The value to the firm of Not Sell here is simply zero. By definition, if we are above BAU the permit saves no abatement costs. Also, the permit produces no income while it is held and produces no income at the end of the period. In the next period the permit has no value. Whatever the inherent tax cost in transferring the permit, the transfer will have some positive value as compared to none. We get the same result on the Buy/Not Buy margin. There would be no reason for a firm to buy and retain a permit through the end of the period when it is above BAU because this has zero value.

Before moving to an analysis of the multi-period regime, it is instructive to place these conclusions within the context of Paul Samuelson's foundational work on the relationship between tax rate differentials and asset valuation. Samuelson famously demonstrated that if the taxpayer is permitted to reflect the true loss of economic value in an asset through tax depreciation, then

asset valuation will be invariant to tax rate.²⁴ The basic insight is that although a taxpayer with a relatively high tax rate will observe relatively lower after-tax cashflows on a given investment, this effect is exactly offset by a relatively low after-tax discount rate. Although Samuelson analyzed the problem under conditions of constant taxation, Jeff Strnad has extended the analysis to show that the results also apply with both accretion and cash flow taxation so long as all investments are taxed with the same frequency (and rate).²⁵ One can view the results embodied in what I call “intra-firm neutrality” as a specific application of this general point. My setup analyzes the problem as an accretion-based tax, with tax imposed at the end of period 1 for both of the relevant options (permits or abatement). The result is that we achieve invariant valuations even if investments are taxed consistently but firms are not, an outcome that is consistent with the Samuelson result. By comparison, one could view inter-firm neutrality as addressing the inverse situation, in which assets are taxed inconsistently but firms are not (in the sense that firms all face the same set of inconsistencies). Standing alone, inconsistent treatment of assets should lead to variant valuations (because, for example, relatively high rate taxpayers will place higher value on tax preferences).²⁶ However, the assumption that firms face the same treatment with respect to each investment means that the inconsistencies are fully priced and have the same value to all taxpayers. The result of invariant valuations is the same but the mechanism is very different. These distinctions both shed light on the single period results and inform the analysis of the multi-period case, to which I now turn.

2. *Multiple Regulatory Periods With Time*

We can now consider the case of multiple periods with time. Recall that the key distinction from the case just discussed is that we now have the possibility of permits giving rise to consequences in multiple tax periods. Specifically, a firm now has the opportunity to retain a permit from an earlier period for surrender in a future tax period (banking), or to surrender a permit in an

²⁴ Paul Samuelson, *Tax Deductibility of Economic Depreciation*, 72 J. POL. ECON. 604 (1964).

²⁵ See Strnad, *supra* note 18.

²⁶ See *id.* at 158–59.

earlier period in the case where the permit will be issued in a later period (borrowing).²⁷ This raises a number of complications that were not present in the single period regime.

First, in the single period regime the firm that held a permit faced a single decisional margin. It could do one of two things with the permit—sell it or surrender it. (By assumption in the single period model we can eliminate the possibility that the firm just holds onto the permit because it has zero value as of the end of the single period.)²⁸ In the multiple period regime, however, the firm holding a permit now has *three* options. It can sell the permit, surrender the permit, or bank the permit. This means that we must consider two new decisional margins: the margin as between Surrender and Bank and the margin as between Bank and Sell. Accordingly, I offer below two expressions for the after-tax value of Bank, one that fixes its value relative to Surrender and one that fixes its value relative to Sell. This distinction is essential because, as I show below, the firm may place different value on a banked permit depending upon whether it views the alternative use of the permit to be Sale or Surrender.

Second, the multiple period regime requires one to consider how funds are used over time in different resources. For example, if a firm sells a permit in the first period one must account for the tax treatment of the further use of the after-tax sales proceeds. As

²⁷ I consider borrowing here to mean borrowing a permit against a firm's *own* future allocation of permits from the regulator. In typical circumstances outside of the cap and trade context we might take the term "borrow" to connote the borrowing of a permit from another firm. This is not a useful analytical approach here. Borrowing only makes sense if we imagine that in some period t a firm has defined rights to obtain permits in some later period $t+x$. Borrowing means that such a firm can use a permit in the period t , notwithstanding the initial allocation to the later period. Use in the earlier period could mean either surrender to the regulatory authority or sale to another firm. In the former case we have intra-firm borrowing. In the latter case we have intra-firm borrowing followed by inter-firm sale. In either case the borrowing occurs within the firm. By contrast, "inter-firm borrowing" does not produce a category of transaction requiring distinct analysis. If the "borrowing" firm keeps the permit and surrenders it to the regulatory authority this is tantamount to a sale. If the "borrowing" firm returns the permit within a single period, there are no regulatory implications. If the "borrowing" firm returns the permit in a later period, then this is analyzed as a back-to-back inter-firm sale, with purchase price determined by the applicable inter-firm financial flows that accompany the permit transfers.

²⁸ Again, I bracket consideration of permits that might come to be held by non-regulated entities. See *supra* note 7.

we shall see, the analysis is crucially different in the case where the firm is operating at or below BAU, as compared to the case where the firm is above BAU. Because of this distinction I will evaluate the below BAU case and the above BAU case in turn.

With these points in mind it is now possible to fit banking and borrowing into the neutrality paradigms introduced above. We can begin by writing the expression for the after-tax value for Bank. As noted above, this in fact requires two expressions, reflecting the fact that the firm contemplating banking has two alternative possibilities (Surrender or Sale). Moreover, matters are complicated by the fact that the relevant margin differs depending on the precise way in which the firm is below BAU. Specifically, the firm might be below BAU in any given period or it might be below BAU with respect to the whole program but not the particular period in question. For example, if the firm has BAU emissions of 100 units in period 1 and 100 units in period 2 (in a two period regime), then the firm will be below BAU in the first sense if it holds, say, 50 permits in period 1. It will be below BAU in the second sense if it holds, say, 150 permits in period 1. When we consider Bank (relative to Surrender) we should understand the firm to be below BAU in the first sense. This is because if the firm is below BAU in the second sense then a decision to Bank does not implicate the decision to Surrender. Taking the numbers above, the firm that holds 150 permits and decides to Bank a permit on the margin does not affect the Surrender decision because the firm still has adequate permits to cover all emissions in the first period. Note that where we *do* properly consider the Bank-Surrender margin, the firm that chooses to Bank will incur incremental actual abatement costs. That is, the firm that holds 50 permits in the above example will, if it Banks the 50th permit, incur incremental abatement costs compared to the firm that Surrenders all 50 permits. When we come to the Bank-Sell margin below, we should understand the firm to be below BAU in the second sense (that is, the 150 permit case in the example sketched above). Of course, it is conceptually possible for the firm to compare Bank-Sell in the first situation (the 50 permit case), but these options should *generally* have the same value relative to one another. This is because in *either* case the firm will incur incremental abatement costs in the current period. (For example, the firm that drops from 50 to 49 permits for the first period, whether by banking or selling, will have to finance abatement for the 50th unit of emissions.)

Note that where we are below BAU in the second sense the firm that Banks will save incremental abatement cost. In that situation we should imagine the firm that Sells as financing on the margin additional investment in abatement that will reduce emissions that it can no longer cover with the permit it chose not to Bank.²⁹

In these expressions the term r denotes the pre-tax rate of return on holding permits (or an asset of like risk), and the superscript “t” represents the relevant taxable period (with the initial period taking value of zero). For simplicity I assume that assets other than permits are taxed at the same rate as permits, t_p . The expression is given in terms of final period dollars:

(5) Bank (relative to Surrender): $p(1+r)^t(1-t_p) + t_p b - [a(1-t_a) + t_p b](1+r-t_p r)^t$

The first term represents the after-tax value of the permit that the firm will hold in future period t. Note that as a general matter permit price should rise over time in a way reflecting prevailing market interest rates. This reflects the simple fact that in an efficient permit market it is the *present* value of abatements costs (and permits) that will be equalized.³⁰ If permits from different periods have the same present value, then it must be the case that permits assigned to future periods have higher nominal value, reflecting interest.³¹ Thus the pre-tax price of permits in period t is simply $p(1+r)^t$. The second term represents the value of basis recovery that the firm will enjoy in future period t (which could come either from Surrender or Sale). The third term reflects the opportunity cost of not surrendering. Specifically, the surrendering firm will *save* after tax actual abatement costs and enjoy basis recovery in the current period. These savings can then

²⁹ Of course such a firm could Sell and (re)Buy in the later period, but in a well functioning market there should be no arbitrage profits from such activity because of permit price adjustments. Thus we should view a decision to Sell as reflecting a decision that the firm is a cheap abater relative to the market price, in which case the selling firm would invest incremental proceeds in actual abatement.

³⁰ See TIETENBERG, *supra* note 12, at 40. This analysis applies in the case of uniformly mixed accumulative pollutants, such as greenhouse gases.

³¹ *Id.* (“Due to demand and supply patterns, the rate of increase in permit prices would be equal to p , the rate of interest.”) I am ignoring here the possibility that the designer of the market attempts to force permit use into one period or another by placing a discount on banked or borrowed permits. A forcing action may occur where the goal is not merely to minimize abatement costs but to minimize *social* costs in instances where the social cost of emissions varies over time. For a discussion of this issue, see *id.* at 111–25.

be invested at the after-tax rate through period t . Observe that the third term of this expression assumes that abatement costs are fully deducted in the year that they are incurred. I make this somewhat unrealistic assumption here (and in the following after-tax expressions) because it demonstrates the maximal tension between the Bank-Surrender margin and the Bank-Sell margin. I relax the assumption below, where we shall see that the general phenomena described here persist.

Note that if we assume a zero basis and equalization of after tax permit and abatement costs, then expression (5) will always have positive value. Specifically, the terms involving basis drop out of the picture and the choice is between banking, in which case the firm will have some dollar amount that grows at the rate $(1 + r)^t$, or surrendering, in which case the same dollar amount will grow at the lower rate $(1 + r - t_p r)^t$. One might call this positive value the “banking premium.” Such a premium is consistent with prior results in the literature, which have found a tax-induced lock-in effect in multiple period models.³² Yale has aptly described this result as flowing from an application of the Cary Brown theorem.³³ A zero basis in permits can be understood as arising in a system where the firm can expense permit acquisition costs. Under the Cary Brown theorem, expensing of permits is equivalent to a yield exemption, that is the value of the permits grows at the *pre-tax* rate of return $(1 + r)^t$, as in the above expression. By contrast, if a firm surrenders a permit, and thereby frees up funds which are invested in alternate assets which do *not* give rise to expensing, such replacement assets will grow at the after-tax rate of return $(1 + r - t_p r)^t$.

By contrast, the results are very different with a different basis rule. If one assumes basis equals permit price, p , rather than zero, then expression (5) simplifies to zero. That is, Bank has *no* value relative to Surrender. With full capitalization of permit acquisition costs and mark to market accounting until the period of surrender, the value of banked permits in effect grows at the after-tax rate of return, as will the assets that can be purchased with funds made available by permit surrender. This is just to restate a point made

³² See, e.g., Yale, *supra* note 2, at 548.

³³ The Cary Brown theorem expresses the basic idea that under certain assumptions, coupling full expensing of an investment with subsequent taxation of investment returns is equivalent to coupling full capitalization with tax exemption of the yield. See *id.* at 544–45.

by scholars previously: accrual basis taxation treatment removes inefficient incentives to bank.³⁴ But as we shall see presently, such conventional wisdom considers only one of the crucial decisional margins.

The expression for Bank (relative to Sell) is importantly different. It can be written as follows:

$$(6) \text{ Bank (relative to Sell): } p(1+r)^t(1-t_p) + t_p b - p(1-t_p)(1+r)^t - t_p b(1+r-t_a r)^t.$$

The first two terms are identical to those in the expression for Bank (relative to Surrender). The third and fourth terms represent opportunity costs. The third term represents after-tax foregone revenue from not selling the permit in the current period. As noted above, the Bank-Sell margin is relevant where the firm is below BAU for the program (but not for the period). Where this is the case, the firm that sells is considered to use the funds to make investments to reduce further emissions. The multiplier $(1+r)^t$ reflects the fact that the value of this investment grows at the pre-tax rate of return if it is deductible (again, this assumption is relaxed later). This point is absolutely crucial because it drives the central distinction between expression (5) and expression (6). That is, the margins involve different opportunity costs. Recall that in the definition of Bank (relative to Surrender), the opportunity cost involved foregone funds made available from not having to abate in the current period. Those funds were invested in alternate assets. By contrast, when the firm considers the Bank (relative to Sell) margin, the firm makes further investments in actual abatement in either case. (As above, the implicit assumption for illustrative purposes is that such expenses for actual abatement give rise to current deductions.) The fourth term represents the foregone basis recovery that one could have enjoyed by selling the permit, as well as the subsequent after-tax return that can be earned on such amount through period t . (Note that unlike the third term this should be viewed as growing at the *after-tax* rate of return. The proceeds from permit sale should fully fund incremental abatement costs at the margin. The value of basis recovery from selling the permit is an additional amount that the firm would hold

³⁴ See Yoram Margalioth, *Tax Consequences of Carbon Cap-and-Trade Schemes: Free Permits and Auctioned Permits*, in CLIMATE FINANCE: REGULATORY AND FUNDING STRATEGIES FOR CLIMATE CHANGE AND GLOBAL DEVELOPMENT 305, 307-08 (Richard B. Stewart, Benedict Kingsbury & Bryce Rudyk eds., 2009).

and is available for investment in alternate assets.)

These expressions can be simplified and rewritten as $t_p b [1 - (1+r - t_p r)^t]$. Assuming a positive interest rate and a positive adjusted basis, this expression would take on a *negative* value. We might refer to this quantity as the “banking penalty.” With a zero basis, by contrast, the expression reduces to zero and there is *no* advantage to banking or selling. The intuition behind this result—and the way in which the banking premium is converted to a banking penalty—can again be understood in terms of the Cary Brown theorem. The zero basis case can again be interpreted as the circumstance in which permit acquisition costs are fully expensed. If a firm banks the expensed permit, then its value will in effect grow at the *pre-tax* rate of return (i.e., expensing is equivalent to yield exemption). Similarly, if a firm sells a permit (at or below BAU) and finances incremental *deductible* abatement costs on the margin, then it too can be seen as realizing an amount that grows at the pre-tax rate of return. Accordingly, along the Bank-Sell margin in the multiple period regime, the firm should be indifferent between Bank and Sell where it holds a permit with zero basis. Conversely, if we interpret the cost basis case as one in which permit acquisition costs must be fully capitalized and recovered in the period of permit surrender, then the firm which banks a permit will hold an asset that in effect grows in value at the *after-tax* rate of return. However, the firm that sells the permit to finance actual abatement costs, which are by assumption deductible, has (for the same reasons just adduced) realized value that effectively grows at the pre-tax rate of return. Hence, a banking *penalty* occurs where the firm has cost basis.

Note that, as discussed above, I have assumed fully deductible abatement costs to emphasize the maximal extent of banking penalties. More realistically, actual abatement costs may often constitute capital expenditures giving rise to depreciation deductions over time. It is important to observe that this modification may soften the impact of banking penalties, but it does *not* remove them. More generally the prospect of banking penalties can arise along the Bank-Sell margin whenever the tax treatment of actual abatement is more favorable than the tax treatment of holding permits. For example, if the firm that sells and finances actual abatement can recover costs over the life of an investment but the firm which banks permits can only recover an equivalent cost at the end of a banking period of equal duration to

the life of the investment, then a banking penalty will arise under the same line of reasoning as that presented above.

It is helpful at this point to introduce a simple numerical example to demonstrate these results.³⁵ Assume a two period model in which the pre-tax permit price and pre-tax abatement costs are \$100 in the first period. Suppose further that abatement costs, permits, and alternate assets with like risk increase in value at a rate of 10% per year. Finally, assume a single tax rate of 30%.³⁶ For purposes of this example, assume that the taxpayer has acquired a permit at the pre-tax market price of \$100 and the question is what value the taxpayer places on the permit under various assumptions. Note that in this analysis I seek only to identify the impact of tax differentials on valuations across various options. The analysis does *not* yet take into account how such differentials could be expected to affect equilibrium permit price. I return to that question below. The results can be summarized in the following table:

³⁵ I have purposefully adopted the same factual setup as that used in Yale, *supra* note 2, at 545–46. This is the fullest treatment to date in the literature; using the same example demonstrates more readily where our analyses overlap and where they depart. Columns III and VI effectively reproduce the results that Yale derives. Yale, however, does not distinguish the Bank-Sale margin from the Bank-Surrender margin. Thus it is Columns I, II, IV, and V that demonstrate the divergence in our analyses and the manner in which one can expect banking penalties in addition to banking premia.

³⁶ It is a crucial contribution of this Article to demonstrate the implications of *differential* tax rates across firms and within firms on permits and abatement. I return to this issue below, where I evaluate the roles of inter-firm neutrality and intra-firm neutrality in the multiple period model. My numerical example here adopts the simplifying assumption of a single tax rate purely to assist in developing the intuitions underlying the two expressions for Bank.

Table 1: Banking Penalties and Banking Premia

Assumptions: Year 1 $p = \$100$ and $a = \$100$
 $r = 10\%$
 $t_p = t_a = 30\%$

Zero BasisCost Basis

	I	II	III	IV	V	VI
	Sell	Surrender	Bank	Sell	Surrender	Bank
Y1						
After-tax saved abatement costs	0	\$70	0	0	\$70	0
Basis Recovery	\$30	\$30	\$30	\$30	\$30	0
After-tax abatement financed by permit sale	\$70	0	0	\$70	0	0
Y2						
After-tax Y2 Value of Banked Y1 Permits	0	0	\$77	0	0	\$77
After-tax Y2 Value of Y1 Alternate Investments	\$32.10	\$107	\$32.10	\$32.10	\$107	0
After-tax Y2 Value of Y1 Permit Financed Abatement	\$77	0	0	\$77	0	0
Basis Recovery	0	0	0	0	0	\$30
Total Realized Value in After-tax Y2 Dollars	\$109.10	\$107	\$109.10	\$109.10	\$107	\$107
		Banking Premium		Banking Penalty		Banking Penalty

Note that a comparison of columns II and III demonstrates the banking premium.³⁷ This is the value that is commonly considered to induce a lock-in effect. A comparison of columns IV and VI, however, demonstrates the possibility of a banking penalty.³⁸ These results depart from current approaches in the literature,

³⁷ Substituting the assumed values into expression (v) produces a result of \$2.10 in the zero basis case (i.e., the result of column III - column II) and 0 in the cost basis case (i.e., the same as the result of column VI - column V).

³⁸ Substituting the assumed values into expression (vi) produces a result of zero in the zero basis case (i.e., the same as the result of column III - column I) and a result of -\$2.10 in the cost basis case (i.e., the same as the result of column VI - column IV).

which generally find a banking premium in the zero basis case, which is supposed to lead to lock-in as *between* firms. The seeming remedy would be cost basis in permits (which could be achieved by taxing gratis allocation and a mark to market system thereafter).³⁹ As the above analysis shows, however, the banking premium holds only along a single margin—the margin as between Bank and Surrender. In a multiple period regime, however, one must analyze the Bank-Surrender margin and the Bank-Sell margin. Specifically, to satisfy abatement efficiency, one requires efficient allocation of permits *across* firms (as in the one period model), but also *within* the firm across periods. Crucially, along the Bank-Sell margin the impact of basis on the firm's incentives to allocate efficiently are exactly flipped. Zero basis now actually looks *good* as the firm should be indifferent between Bank and Sell. Cost basis looks *bad* as it will lead to the banking penalty, in effect an inefficient incentive for the firm to sell and abate currently rather than bank a permit.⁴⁰ At first blush the suggestion that cost or fair market value basis could lead to distortions seems at odds with common understandings of basic tax principles. The Samuelson result discussed above is supposed to apply to economic appreciation as well as depreciation.⁴¹ This would seem to argue for a fair market value basis in permits. The problem with that conclusion, though, is that it does not take account of the range of investment choices under consideration. For the Samuelson price invariance result to follow among a range of investments, it is necessary for *all* investments to be taxed with the same frequency.⁴² In the example under consideration one can think of the taxpayer as making one of three types of investments:

³⁹ See *infra* Part III for a detailed discussion of this issue.

⁴⁰ Note that in columns I, III, and IV the firm earns a return of \$9.10 and not \$10. In the text I have followed Ethan Yale's application of the Cary Brown theorem to this context. See Yale, *supra* note 2, at 544–45. This would suggest that expensing is equivalent to yield exemption and the firm in this case should earn a \$10 return—that is, the full pre-tax return on the \$100 permit acquisition cost. The reason for the discrepancy is that full equivalency to yield exemption would require further expensing of the tax savings that arise from permit expensing and further expensing of such further expensing (and so on). My assumption in the text is that even if we assume permit expensing (the zero basis case), the firm cannot then also expense the cost of the alternate investment made with those savings. Thus the \$3 pre-tax return on that subsequent investment of \$30 in this example bears 90 cents of tax.

⁴¹ See Samuelson, *supra* note 24, at 605–06.

⁴² See Strnad, *supra* note 18, at 1821–22.

an investment that will reduce actual abatement, an investment in permits (that are banked), or an investment in alternate assets. The general suggestion that permits should take fair market value basis is premised on the idea that this more accurately reflects an income base, thus presumably matching investment in alternate assets. But this does not take account of investments in actual abatement. I have adopted the assumption of tax expensing for abatement costs to make the point in the strongest possible terms. This underlies the above statement that zero basis is good. The point, however, is a general one. If a taxpayer can invest \$ x in period one to acquire a tangible asset that will result in reduced emissions of y units in period 2, or instead bank acquired permits for surrender in period two, then allowing *some* cost recovery in period 1 on the tangible asset but not for the permits should operate as a penalty to banking. Thus once one takes account of the range of investments the analysis is not inconsistent with the basic Samuelson result.

In a world where zero basis causes the problem of inefficient permit allocation, the solution would seem to be simple—ensure that firms hold permits with fair market value basis. But the above analysis shows that the problem is more complex than this. Fair market value basis removes distortions along one dimension (Bank-Surrender), only to open up distortions along another (Bank-Sell). To get a fuller handle on the efficiency consequences of this dynamic we will have to consider the concepts of inter-firm and intra-firm neutrality, as well as potential price effects on permit price.

Before we can turn to that analysis, however, it is necessary to fill out the description for the other side of the market—the firm that does *not* hold a permit on the margin and is contemplating permit acquisition. With the multiple period regime this means one requires after-tax expressions for Borrow. As above, the multiple period model complicates matters in that the firm which does not hold a permit on the margin faces three possible choices: Not Buy, Buy and Surrender, and Borrow and Surrender. This, in turn, introduces two new margins into the analysis: Borrow (relative to Buy) and Borrow (relative to Not Buy). The expression for Borrow (relative to Buy) takes the following form:

$$(7) \text{ Borrow (relative to Buy): } p(1 + r - t_p r)^t - p(1 + r)^t - pa_p(1 + r - t_p r)^t + bt_p(1 + r - t_p r)^t$$

In considering this expression it is helpful to remember the

firm's basic position here. The firm is taken not to hold a permit on the margin but rather has p dollars and is trying to figure out whether (i) to borrow a permit, in which case the firm will have p dollars available for alternate investment in the current period but will face permit acquisition costs in a later period, or (ii) to use the p dollars to buy a permit in the current period for surrender. (Of course, the firm could also use p dollars to incur actual abatement costs, but this involves the Borrow-Not Buy margin, which I will return to below in expression (8)). The first term in the above expression, then, reflects the after-tax return that can be earned on investing p dollars in some alternate asset (which I assume for simplicity grows at the same rate of return as permits and is subject to the same tax rate as permits). The second term reflects future permit acquisition cost in period t . The third term represents an opportunity cost. It reflects the foregone amount of tax benefit that would be available upon deduction of permit acquisition cost in the current period, such amount which is assumed to grow at the after tax rate of return through period t . The fourth term represents the tax benefit of basis recovery with respect to the borrowed permit, such value which grows at the after-tax rate between the time it is accorded and period t . The actual basis recovery rule, of course, will depend on program design and does not follow from first principles. The expression above, however, is a general one that accommodates the various possible basis recovery rules on borrowed permits that might be adopted.

The expression for Borrow relative to Not Buy must reflect the fact that the decision to not buy implicates the incurrence of incremental actual abatement costs in the current period. The expression can be written as follows:

$$(8) \text{ Borrow (relative to Not Buy): } [p + a(1 - t_a)](1 + r - t_p r)^t - p(1 + r)^t - at_a(1 + r - t_p r)^t - a(1 - t_a)(1 + r)^t + bt_p(1 + r - t_p r)^t$$

The first term reflects cash investment. The firm that borrows and surrenders will save after-tax abatement costs and will preserve p dollars, both of which can be invested at the after-tax rate of return through period t . The second term reflects future permit acquisition costs. The third and fourth terms are opportunity costs. The third term reflects the fact that the firm in the Not Buy position will realize the value of the tax deduction on abatement, at_a , which can be invested at the after-tax rate of return. The fourth term reflects the fact that the firm in the Not Buy position finances abatement with cash, the value of which grows at

the pre-tax rate of return (under the logic discussed previously) through period t . The final term reflects basis recovery. As in the case of Bank, the value of Borrow will depend crucially upon the chosen basis recovery rule. And, as in the case of Bank, depending on the contours of that rule, one can end up with a “borrowing penalty” (though likely not a “borrowing premium” under any plausible basis recovery rule). To demonstrate these possibilities it will be helpful to return to the numerical example discussed above in the case of permit banking. To complete the analysis, though, one must make assumptions about the particular basis recovery rule for borrowed permits. I will analyze two possibilities below. One possibility, and the one I suspect would garner most immediate support from policymakers, would allow the firm to recover the full cost of permit acquisition in the period that permit acquisition expenses are actually incurred. Thus if a permit has value of \$100 in period 1 and \$110 in period 2 and a firm surrenders a borrowed permit in period 1, which it then purchases for \$110 in period 2, the result would be a deduction of \$110 in period 2. I’ll refer to that possibility as an “acquisition period” basis recovery rule. One can imagine other rules. An alternate possibility would be that the firm takes a deduction in the period of surrender reflecting the then-current value of the permit (here \$100) and then a further deduction reflecting any additional amounts paid upon permit acquisition (here \$10). I will refer to this possibility as a “split period” basis recovery rule. That rule might strike one as overly generous, but as we shall see in a moment, it is the rule that accords borrowing equivalent tax treatment as buying, a condition that will be helpful in achieving abatement efficiency. In tabular form, the example from above would produce the following results. (Recall that the assumption is that the firm holds p dollars, or \$100 in this example, and contemplates its use.)

Table 2: Borrowing Penalties

Assumptions: Year 1 $p = \$100$ and $a = \$100$
 $r = 10\%$
 $t_p = t_a = 30\%$

	I	II	III		IV	V	VI
	Not Buy	Borrow and Surrender	Buy and Surrender		Not Buy	Borrow and Surrender	Buy and Surrender
	<u>Split Period Rule</u>				<u>Acquisition Period Rule</u>		
Y1							
After-tax saved abatement costs	0	\$70	\$70		0	\$70	\$70
Basis Recovery	0	\$30	\$30		0	0	\$30
After-tax abatement financed by cash	\$70	0	0		\$70	0	0
Extra Cash	\$30	\$100	0		\$30	\$100	0
Y2							
After-tax Value of Y1 Investments	\$32.10	\$214	\$107		\$32.10	\$181.9	\$107
After-tax Y2 Value of Y1 Abatement	\$77	0	0		\$77	0	0
Y2 Permit Acquisition Cost	0	-\$110	0		0	-\$110	0
Basis Recovery	0	\$3	0		0	\$33	0
Total Realized Value in After-tax Y2 Dollars	\$109.1	\$107	\$107		\$109.1	\$104.9	\$107

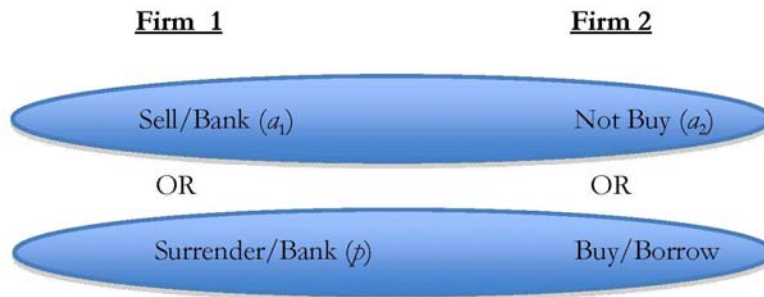
As noted, these results implicate the possibility for various borrowing penalties (compare columns I and II; IV and V; and V and VI).⁴³ On the assumptions that I have made, there is no possibility for a borrowing premium, and thus the situation is somewhat different from the case of banking. One could produce

⁴³ These results are consistent with the evaluation of expressions (7) and (8) with the assumed facts and basis rules. Specifically, with a split period basis recovery rule, evaluation of expression (7) produces a result of zero (compare columns II and III), and the evaluation of expression (8) produces a result of -\$2.10 (compare columns I and II). With an acquisition period basis recovery rule, evaluation of expression (7) produces a result of -\$2.10 (compare columns V and VI) and the evaluation of expression (8) produces a result of -\$4.20 (compare columns IV and VI).

a premium for Borrow (relative to Buy) if one equated the value of Borrow and Not Buy. However, the value of Not Buy derives in part from the ability to benefit from the fact that period 1 abatement grows in value at the *pre-tax* rate of return. The only way to match this result would be to allow the borrowing firm to expense a portion of its investment in alternate proceeds.⁴⁴

With the after-tax expression for Bank and Borrow in place, it is now possible to evaluate the implications for abatement efficiency. This involves application of the inter-firm and intra-firm neutrality norms. Consider first modified diagrams encompassing the Bank and Borrow options for the case of inter-firm neutrality:

Inter-firm Tax Neutrality



For abatement efficiency to hold here, we require that the tax treatment be the same for all of the forms of abatement and we require like tax treatment of all forms of non-abatement. However, we face some additional complications here. First, determining such similarity is no longer a simple matter of reading off the nominal tax rates t_a and t_p , as in the simple scenarios considered above. The lesson of the preceding paragraphs is that the *timing* of the relevant deductions changes the effective tax rates. Second, placing Bank and Borrow into this framework is not symmetrical, as one might have supposed. For Bank, the relevant margin depends on whether we are considering the below BAU in the

⁴⁴ Specifically, in column II, if we allowed the firm the split period basis recovery rule and also allowed the firm to expense \$70 of its investment in alternate assets (that is, the same amount that grows at the pre-tax rate of return in column I), then the column II total realized value in after-tax Y2 dollars would be \$109.10, thus matching the result in column I.

current period case (where Bank should be compared alongside Surrender), or the below BAU for the duration of the program (where Bank should be compared alongside Sell). For Borrow, by contrast, the prospect of Borrow only becomes relevant if the regulated party is below BAU within the current period and thus we can limit analysis to the comparison with Buy.

Consider first the case where the regulated party is below BAU for the program. If permit acquisition costs are fully expensed in the period of acquisition (the zero basis case from Table I), and if borrowed permits are granted the split recovery rule, then reading the results off of Tables I and II, it follows that the forms of actual abatement all produce realized value of \$109.10 and all forms of permits/non-abatement yield a value of \$107.⁴⁵ But doesn't this differential create a distortion as between permits and abatement? The basic point of inter-firm neutrality is that such differentials do not create distortions where faced by all firms, because such tax differential should be capitalized in permit prices. As always, firms should trade until permits and abatement have the same value on an after-tax basis. As we have seen above, in a multiple period regime with the basis rules suggested here, the firm that holds a permit on the margin will consider both Bank and Sell as allowing the firm to realize value equal to the permit price compounded over time at the pre-tax rate of return. Conversely, the firm that does not hold a permit on the margin but is a potential buyer of permits will value Buy (or Borrow) as allowing the firm to realize an amount equal to saved marginal abatement costs compounded over time at the after-tax rate of return. This implies that trade should occur until $p(1+r)^t(1-t_p) = a(1-t_a)(1+r-t_pr)^t$. Solving for p , we can determine equilibrium permit price as a function of marginal abatement cost, pre-tax rate of return, and nominal tax rate on permits and abatement: $p = [a(1-t_a)(1+r-t_pr)^t] / [(1+r)^t(1-t_p)]$. In the above expression, to evaluate p one must make a determination about the value of the superscript t . Evaluating this expression with the assumptions from the numerical example discussed above (including $t = 1$, to reflect the fact of a two period regime), the permit price for Year 1 should settle at approximately \$97.3. The table demonstrates the resulting

⁴⁵ Consistent with the discussion above, in the case that actual abatement costs are not expensed, then the prescription here is that acquisition costs of banked permits should be recovered in the same manner as actual abatement costs.

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after-tax returns where in Year 1 the pre-tax permit price drops to \$97.3 but pre-tax abatement costs for each firm are \$100. For purposes of illustration I assume that Firm 1, which is taken to hold a permit, acquired the permit for \$97.3. Firm 2, which is taken not to hold a permit on the margin, is presumed to hold \$97.3 in cash, the current pre-tax permit price, and must decide what to do with the cash.

Table 3: Banking and Borrowing under Inter-firm Neutrality with Price Effects

Assumptions: Year 1 $p = \$97.3$ and $a = \$100$
 $r = 10\%$
 $t_p = t_a = 30\%$

expensing of permit acquisition costs
split period basis recovery rule for borrowed permits

	I	II	III		IV	V	VI
	Sell	Surrender	Bank		Not Buy	Borrow and Surrender	Buy and Surrender
Y1							
After-tax saved abatement costs	0	\$70	0		0	\$70	\$70
Basis Recovery	\$29.2	\$29.2	\$29.2		0	\$29.2	\$29.2
After-tax abatement financed by permit sale	\$68.1	0	0		0	0	0
After-tax abatement financed by cash from Not Buy	0	0	0		\$68.1	0	0
Extra Cash	0	0	0		\$29.2	\$97.3	0
Y2							
After-tax Value of Y1 Banked Permits	0	0	\$74.9		0	0	0
After-tax Value of Y1 Investments	\$31.2	\$106.1	\$31.2		\$31.2	\$210.2	\$106.1
After-tax Y2 Value of Y1 Permit Sale or Not Buy Cash	\$74.9	0	0		\$74.9	0	0
Y2 Permit Acquisition Cost	0	0	0		0	-\$107	0
Basis Recovery	0		0		0	\$2.9	0
Total	\$106.1	\$106.1	\$106.1		\$106.1	\$106.1	\$106.1

The example demonstrates that with price effects on the permit, at the point where the firms have the same pre-tax marginal abatement costs, Firm 1 should be indifferent on an after-tax basis as between the three options it faces (Sell-Surrender-Bank), and Firm 2 should be indifferent on an after-tax basis as between the

three options it faces (Not Buy-Borrow-Buy). This is the case notwithstanding the differential effective tax rates that the firms face on permits and actual abatement.

Consider now the case in which the regulated actor is below BAU for the period in question. To satisfy the conditions required for inter-firm neutrality, we must now bring Bank into alignment with Surrender. The required tax treatment in this case would involve a cost basis for permits and the split period rule. Reading off the results in Table 1 and Table 2, we see that Sell and Not Buy would each have value of \$109.10. In addition, Surrender, Bank, Buy, and Borrow would all have value of \$107. We should observe the same price effect as above, with permit price dropping to approximately \$97.3 on the assumed values. In addition the results in Table III hold, with appropriate adjustment. Note that the case under discussion involves the firm that is below BAU in the *current* period, which means that a decision to Bank implicates an incremental abatement cost in the current period. This cost must be financed in some fashion. Thus, to test consistent cashflows across the range of options one must also consider such amount. Specifically, in columns I–III, assume that the regulated party purchased a permit for \$97.3, and that permit is currently worth \$97.3. The party also holds \$97.3 in cash. With these facts (and assuming a cost basis rule for permits), the results are as follows. In column I, the taxpayer realizes \$106.1 in end of year 2 dollars, as above. The taxpayer also realizes \$104.1 on the investment of its \$97.3 in cash at the after-tax rate of return.⁴⁶ Total end of year 2 value is thus \$210.2. In column II, the taxpayer likewise realizes \$106.1 as above, in addition to \$104.1 on the investment of the \$97.3 at the after-tax rate of return. In column III, the bottom-line amount reflected above must be adjusted downward to \$104.1. This reflects the loss in value from deferred basis recovery under the cost basis rule.⁴⁷ However, the taxpayer now uses the \$97.3 to finance incremental abatement in the current period. Following the example of column I, this has value of \$106.1 at the end of year 2. Thus the taxpayer realizes \$210.2 across all three columns and is indifferent among its choices.

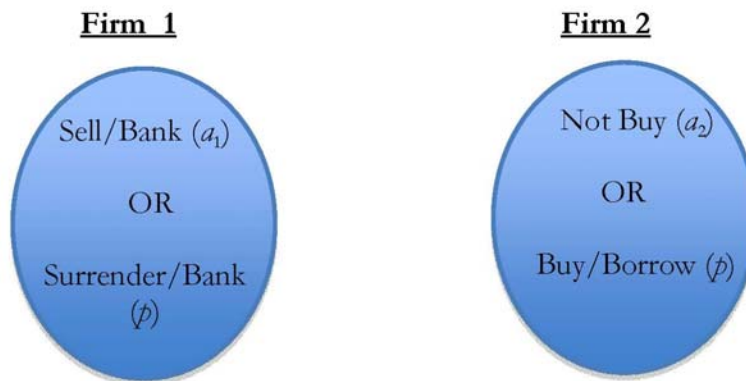
⁴⁶ That is, $(\$97.3)(1.07)$.

⁴⁷ The \$2 downward adjustment can be understood as the result of the inability to invest period 1 basis recovery of \$29.2 at the assumed 7% after-tax rate of return. That is, $(\$29.2)(.07)$ equals \$2 (after rounding).

The above analysis has, of course, considered only a single firm holding a permit. From there I analyzed the case with the firm below BAU for the program and below BAU for the period in turn. This allowed the appropriate basis rule to be chosen. Note, however, that if there are *both* types of firm at issue, then it is not possible to achieve the correct after-tax prices for everybody. For example, consider the firm that is below BAU for the program (but not the period) facing a cost basis rule. In this case Bank would have value of \$104.1 while Sell would have value of \$106.1. Here Bank does not implicate an incremental current abatement cost so an assumption of an additional \$97.3 cash is not appropriate. Thus the firm faces different after-tax prices on its options. A parallel result would arise if the zero basis rule is applied and the firm is below BAU for the current period.

Turning now to a consideration of intra-firm neutrality, consider once more an expanded form of the intra-firm neutrality diagram introduced above. With the addition of Bank and Borrow that diagram takes the following form:

Intra-firm Neutrality



This diagram makes explicit the requirements to satisfy intra-firm neutrality. From the standpoint of Firm 1, what is required is equalization of the effective tax rate on Sell-Bank-Surrender. (Bank is reflected twice to capture the point discussed above that Bank may become relevant along either the margin with Sell or the margin with Surrender, depending on whether the firm is below

BAU for the period or for the whole program.) This is not achieved, however, under either a zero basis approach *or* a cost basis approach. Returning to the numerical example above, under a zero basis approach these three options had the following value: \$109.10, \$109.10, and \$107, respectively. Under a cost basis approach, the three options had the following after-tax value: \$109.10, \$107, and \$107. Moreover, there is no basis rule that would bring the treatment of these three options into alignment. The difficulty is that delaying basis recovery at all (anything short of full expensing) will necessarily drive some tax wedge between Sell and Bank (because delaying basis recovery for Bank is tantamount to taxing at least a portion of the yield on permit value growth, whereas Sell (and abate) allows the firm to realize value that grows at the full *pre-tax* rate of return). Conversely, accelerating basis recovery at all as compared to the baseline of full capitalization and basis recovery in period of permit use will necessarily drive some tax wedge between Bank and Surrender (because acceleration of basis recovery for Bank is tantamount to at least a partial yield exemption, whereas Surrender will free up funds that grow at the full *after-tax* rate of return). One faces an analogous set of problems from the standpoint of Firm 2, where intra-firm tax neutrality would require like tax treatment of Not Buy-Buy-Borrow. Referring again to the numerical example above, these actions have value of 109.1, 107, and 107, respectively under the split period rule. Also, the three actions have value of 109.1, 104.9, and 107, respectively under the acquisition period rule. Price effects cannot bring matters back into alignment. As demonstrated above, it is a hallmark of intra-firm neutrality that there are *no* price effects. That is, pre-tax permit price and pre-tax abatement costs should be identical.

The extremity of the result here (and the literal impossibility of removing distortions through intra-firm neutrality) is a function of the assumption that abatement costs will be expensed and that investments in other assets will not be. It is, of course, conceptually possible that this will not be the case. If actual abatement costs, permit acquisition costs of banked permits, and alternate investments were all taxed under a consistent approach reflecting changes in economic value, then this too would remove distortions under the basic Samuelson result. The more general point should not be lost, however, which is that this approach requires consistency across a broader range of investments than is

the case with inter-firm neutrality. This points, then, to the crucial distinction between the two neutrality approaches. If one assumes differential treatment of actual abatement (or climate capital generally) and alternate investments in the economy, then one cannot bring matters back into alignment through intra-firm neutrality because it is not possible to treat permits the same as each of these.⁴⁸

There is one final point to note before continuing to a more general analysis of the relative merits of inter-firm neutrality and intra-firm neutrality. The above discussion of the multiple period regime has assumed that permits are held at or below the BAU level. Not surprisingly, matters change drastically if that assumption is dropped from the picture. The crucial point here is that a firm that sells permits above BAU does not thereby incur incremental actual abatement responsibility. Nor is there any prospect of surrendering the permit in the current period. Essentially, in a period where the firm is above BAU, it has only two options: Sell or Bank. If it sells the permit, then it will have incremental proceeds that are then invested at the after-tax rate of return. This puts the firm in a worse position than if the permits are expensed and banked, which in effect grow at the pre-tax rate of return. In other words, the case in which the firm is above BAU simply reduces to what one can think of as the standard lock-in story, where a firm holds low or zero basis assets and must consider whether to sell the asset currently or hold the asset for future sale.

D. *Evaluation of Inter-firm Neutrality Versus Intra-firm Neutrality*

How should one assess the relative merits of inter-firm neutrality versus intra-firm neutrality as a means of attaining abatement efficiency? That choice ultimately involves a consideration of the practicalities of implementation. In the real

⁴⁸ Note again that the differential assumed above was designed to be the most extreme case (full expensing of all abatement costs). However, to drive the general results here it is necessary only that one observe *some* differential treatment. This issue relates to a broader point of program design. With a permit market in place it makes no sense to have additional tax incentives for particular investments in abatement. The whole point is for market incentives to lead to the cheapest abatement options. Political pressures, however, can be expected to push towards tax preferences for particular climate investments.

world, of course, setting $t_1 = t_2$ (inter-firm neutrality) or $t_a = t_p$ (intra-firm neutrality) may be no simple matter. We face here two basic considerations. In the closed economy, the lesson of this Part is that inter-firm neutrality is likely preferable, because it requires less consistency across assets. This is not to say that implementation of inter-firm neutrality is simple. Domestic political pressures may well push towards the adoption of sector-specific tax preferences, thus yielding differential taxation of actual abatement across firms, which is a clear violation of inter-firm neutrality. Also, in the multi-period case, the neutrality norm requires one to determine the relationship of firms to BAU, and may require like treatment of actual abatement costs and acquisition costs for banked permits. These are difficult problems. The second consideration is that once the permit market expands across borders, the calculus changes radically. Inter-firm neutrality in this context would require an unprecedented degree of harmonization across tax systems. If one assumes that such harmonization is off the table for the foreseeable future, then intra-firm neutrality will be the only available option.⁴⁹ This move comes, however, with the problems of implementation just mentioned, because one requires consistency across permits, investment in climate capital, and other assets.

III. GRATIS ALLOCATION OF PERMITS

One of the first, and perhaps most important, discrete questions that tax policymakers face is what tax treatment to accord the gratis allocation of permits. It would seem that there has been some degree of confusion regarding the analysis of the taxation of gratis allocation question. The relevant question is

⁴⁹ Carolyn Fischer's work, which to my knowledge is the most complete theoretical treatment of these issues in the multi-jurisdictional setting, adopts an approach that is consistent with what I have labeled intra-firm neutrality. Fischer concludes that with international permit trading (and arm's length transfer pricing), we obtain allocative efficiency. Her model assumes that a firm faces a uniform home country tax rate on actual abatement at home as well as on permit surrenders at home. Conversely, the model assumes that the home country firm faces a uniform foreign country tax rate on actual abatement in the foreign country and on permit surrenders to the foreign country. See Fischer, *supra* note 2, at 148. Thus Fischer assumes tax parity across permits and actual abatement, as required by intra-firm neutrality. Fischer's analysis does not, however, address the substantial complications that arise with the introduction of banking and borrowing.

often taken to be: “Should gratis allocation of permits be included in income?” But that formulation of the question blurs together a number of issues and considerations, particularly as between the public goods and abatement efficiency issues distinguished above.

For example, the leading published guidance on this matter in the United States arises in the context of the sulfur dioxide market, where the IRS concluded that gratis allocation should not be included in income.⁵⁰ That ruling has been criticized on the grounds that permit-holders will have below fair market value basis, thus leading to lock-in.⁵¹ This analyzes the gratis allocation question in terms of abatement efficiency (though, as the above analysis suggests, in an incomplete way).

Conversely, some analysts have suggested that gratis allocation *should* give rise to an income inclusion on the grounds that the regulated firm is made better off by the permit allocation (notwithstanding the incremental regulatory burden), because it is likely to be able to pass the cost of the permit forward to ultimate consumers. This type of argument is concerned with the distributional impact of the benefits and burdens of the system and thus should properly be understood as relating to the broader public finance considerations that arise under the optimal provision of public goods question. Additionally, as with the efficiency argument above, the policy prescription is misguided. The call for inclusion is typically coupled with the result that the permit-holder take a basis in the permit equal to the amount of the inclusion, with such basis to be recovered if and when the regulated party surrenders the permit to the regulatory authority. Thus, in a single period model the result would be an inclusion which is precisely offset by a deduction, or no income on a net basis. That net result would seem to clash with the underlying reason for the initial inclusion upon grant—that the regulated party is made better off by the combined effect of introducing the regulatory regime with gratis allocation of permits. In a multiple period model, one could end up with net income on a present value basis (say, income inclusion in period 1 and basis recovery in period 2), but it is not at all clear that the rationales typically offered for having inclusion in

⁵⁰ See Rev. Rul. 92-16, 1992-1 C.B. 15.

⁵¹ See Gary M. Lucas, Jr., *The Taxation of Emissions Permits Distributed for Free as Part of a Carbon Cap-and-trade Program*, 1 GEO. WASH. J. OF ENERGY & ENVTL. L. 13–17 (2010); Yale, *supra* note 2, at 547.

the first place align with the amount of net inclusion in the multiple period model.

In an attempt to clarify matters, I believe that it is essential for one to take account of the range of activities from grant through surrender when analyzing the question whether gratis allocation of permits should give rise to a *net* inclusion. Additionally, it is essential that one distinguish arguments about abatement efficiency from arguments about optimal public good provision.

Initially, observe that we are unlikely to make much progress on the question of gratis allocation by asking whether the permits form part of an ideal income tax base, say, under a Haig Simons definition of income. Note that most regulatory regimes do not seem, on the surface, to implicate this question. In the typical case, if we imagine that regulations impose incremental costs on the business operations of regulated entities, then such costs will properly be reflected as deductible costs of earning income. With a permit market, the issuance of at least some permits gratis can function as a partial or total absolution of regulatory burden, depending upon the relationship between quantity of permits issued and the taxpayer's level of emissions in the absence of regulation. The question at hand is whether the value of regulatory absolution ought to be included in income. At the highest level of abstraction one can phrase the question, from the standpoint of an income tax, as follows: If one day the government imposes a new regulatory burden on a group of taxpayers, but then says to a taxpayer within that group that it does not have to bear some or all of the cost of the regulation, does that taxpayer have income? It seems that the answer should be "no." The tax system should properly measure the differential regulatory burden across the various taxpayers. The most straightforward way to do this would be to treat the party exempted from the regulatory burden as having no tax consequence arising from the exemption, while treating the party burdened by the regulation as having a deductible compliance expense. One could, of course, achieve the same *relative* treatment by treating the burdened party as having no tax consequence, while treating the exempted party as having income. But such an approach would make life much more complicated than necessary (and with no accompanying benefit). It is the burdened firm that has the out of pocket expenditure, and it is on that party's return where we can most easily reflect the tax consequence. This is essentially the response that we give in

typical regulatory contexts without even thinking about it. We are happy to conclude that a party who has an incremental expense under the regulation takes a deduction. Similarly, if some parties face regulatory costs and others face none, we would think it very odd to ask whether the party who does not face a cost has income by virtue of this. We would never even think to ask the question.

As with many issues in the measurement of ideal income, however, one's analysis of the problem depends upon choice of baseline. If I have accurately captured the intuitive response in the above discussion, it is because we are inclined to measure income in this context by reference to a "pre-regulation baseline"—that is, the taxpayer's position prior to the advent of regulation. But when we embody the abatement from regulatory burden in something like alienable property—a permit—matters may look different. The grant of abatement now looks like windfall property, which perhaps should give rise to a net income inclusion. If so, however, this is because propertizing the regulatory abatement encourages us to adopt a post-regulation baseline. The choice of baseline, however, is ultimately arbitrary and cannot be resolved by debate about the content of the ideal income tax base. The proper way to approach the question, rather, is through analysis of the two types of fundamental concerns distinguished above: abatement efficiency and public good provision.

From the standpoint of abatement efficiency, the preferred course follows from the discussion in Part II. If one is seeking to implement inter-firm neutrality, as would be preferred in the closed economy, then the taxation of permits should track the taxation of investments in climate capital to the extent that firms are below BAU for the program but not for the period. If such costs are expensed, then firms should not have a net inclusion with respect to gratis permits. If such costs are capitalized and depreciated, then permits should be included but permitted matching amortization. To the extent firms are below BAU for the period in question, then permits should be likened to any other market-traded asset. If one is seeking to implement intra-firm neutrality, then matters are more complex. Taxing permits in a way that tracks investments in climate capital invites a distortion as between Bank and Surrender. Taxing permits like any other market-traded asset invites a distortion as between Bank and Sell. Thus one faces an empirical question about the relative cost of distortion across firms within a period and the cost of distortions

within firms over time. It is difficult, if not impossible, to make an a priori assessment of those relative costs.

From the standpoint of public good provision, one can begin with the proposition that whatever one's approach to the broader public finance question, gratis allocation is unlikely to be an optimal approach. In other words, awarding revenue to shareholders of regulated firms is unlikely either to lead to reductions in the otherwise most distortionary taxes in the system or to constitute the optimal cost-benefits offsetting tax. Suppose that the three basic policy options are: (i) auction of permits, (ii) gratis allocation of permits coupled with taxation of regulatory absolute value, and (iii) gratis allocation of permits coupled with no taxation of regulatory absolute value.

For the reasons just adduced, auction of permits is likely better than option (ii) or (iii). *If* that is the case, then it would seem to follow that option (ii) is to be preferred to option (iii), for the simple reason that it is a better approximation of option (i). In other words, if it is optimal for the government to charge the market price for permits, then this suggests that if we depart from this optimal state of affairs by giving permits away, then we should at least attempt to claw back some of this value through the tax system.⁵²

This would provide a reason to implement a set of rules that would cause firms to face a tax on the net value of a permit allocated gratis. Cutting in the opposite direction, however, one should take account of political considerations. Although there may be theoretical merit in the idea of taxation on net of the value of a permit allocated gratis, it is difficult to imagine this type of clawback working as a political matter. If the political bargain required to get a deal involves giving away a certain number of permits for free, then it would be surprising if one could alter the outcome of that deal in a backdoor fashion through the tax system. If the legislature attempted to do so directly through the

⁵² A different type of argument for charging for permits at auction would derive from the literature on transition rules. As a general matter, scholars have advanced strong arguments against transition relief in the introduction of new systems of taxation. The basic idea is that in the absence of transition relief, we offer efficient incentives for regulated actors to anticipate future modification of law. A similar argument applies here. An auction gives firms efficient incentives to anticipate a yet to be introduced carbon price. As above, if this gives a good reason for an auction, so too would it appear to give a good reason to favor taxation of gratis allocation.

articulation of tax rules in cap and trade legislation, then this would likely just alter the nature of the bargain on permits (i.e., if we tax them we just have to give away more for free). If the legislature is silent on the matter, and an administrative agency comes along after the fact and attempts taxation of net value without legislative endorsement, then this will likely be viewed as a transgression of the legislative bargain.

The above analysis suggests that there is no clear answer across all markets regarding the question of whether gratis allocation (plus ultimate surrender) should give rise to a net inclusion reflecting permit value. The answer to that question, rather, depends upon analysis of abatement efficiency and optimal public good provision, which in turn depends upon the chosen neutrality approach to abatement efficiency and the political dynamic surrounding the adoption of a particular cap.

CONCLUSION

The world may be many years from embracing a long-lived, truly global integrated permit market for greenhouse gas emissions. It may never embrace such an approach. But it is not too early to begin formulating a coherent tax policy response to the issues that arise when markets begin to expand over time and space, as they have already begun to do under various national and regional permit markets. The challenge to tax policy is immense, as the ultimate goal is to minimize distortions to a market that eventually will come into contact with many different tax systems. In this Article, I have attempted to provide a framework for undertaking this challenge. Under this framework, one must pay attention to the distinct tax policy issues presented when the issue is about where to set a cap, as opposed to when the issue is about achieving abatement under a given cap at least cost. In addition, where the focus is on cost reduction, the framework calls upon the concepts of inter-firm neutrality and intra-firm neutrality as alternate paths to achieve the goal. Crucially, these alternate paths show us that one can make progress towards the cost effectiveness goal without having like tax treatment of all permits and all abatement across all firms and all times. One need only achieve like tax treatment of permits across firms and abatement across firms (inter-firm neutrality), or like tax treatment of permits and abatement within each firm (intra-firm neutrality). Implementing

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either of these approaches will still present immense challenges. It is my hope, however, that the framework offered here will prove a useful one, particularly as one considers the merits of various approaches to taxation of permit markets in closed versus open markets.