JOURNAL OF ECONOMICS TEACHING

Illustrating the Difference between Emissions Fees and Abatement Subsidies Using Isoquant and Isocost Geometry

Emissions fees (taxes) and abatement subsidies are common policy solutions when negative externalities, such as pollution generated from production, impact market transactions. Textbook treatment of these two policies vary in exposition and detail and are generally more descriptive than analytical. This can leave students with limited insights regarding behavioral differences that arise with these policies. In illustrating unintended policy consequences, this graphical analysis illustrates that a subsidy policy is, paradoxically, more likely to generate more pollution than a fee policy, a result consistent with Metcalf's (2009) empirical work and a result often not well articulated in textbooks.

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1. Introduction

Since its inception, researchers in the field of environmental economics have developed a menu of policies for addressing the negative externality resulting when pollution results from production. Emissions fees (taxes) and abatement subsidies are some of the most common policy solutions discussed in most environmental economics courses. Textbook treatment of these two policies, however, vary in exposition and detail (e.g. Callan and Thomas, 2010; Field and Field, 2009; Kalstad, 2011; Perman, Ma, McGilvray, and Common, 2011; Tietenberg, 2003). However, it is fair to say that this approach, at least at the undergraduate level, is descriptive.[1]

Textbooks tend to offer examples of each policy as well as an overview of those states or countries that have implemented each. They correctly point out that emission fees tend to be more common in Europe than the United States. Finland, France, Germany, Ireland, The Netherlands, Sweden, Norway, and The United Kingdom, all have introduced various forms of carbon taxes that in large measure affect the transportation and manufacturing sectors through fuel prices.[2]

A concrete example of a fee would be Canada's tax on carbon. The province of British Columbia, for example, applies a $35 per ton of carbon emissions that translates into an 8.95 cent per liter tax on diesel fuel and a 6.65 cent per cubic meter of natural gas.[3] Another example is Ireland's carbon tax currently set at €20 per ton of carbon emissions and has subsequently increased the price of a number of fossil-based fuels (Convery, Dunne and Joyce, 2013).

Subsidies, as articulated by many textbook authors, notably Callan and Thomas (2010, pp. 104-6), take the form of either abatement equipment subsidies or per-unit subsidies for pollution reduction. An example of the latter might be the United States federal subsidy (or tax credit) on corn-based ethanol-blended gasoline. Recent research has shown that ethanol blending reduces the average retail price of gasoline by about 17 cents per gallon (National Renewable Energy Laboratory, 2008). Another example would be the Production Tax Credit and Investment Tax Credit for Wind program (Anderson, 2003).

When comparing an emissions fee policy and an abatement subsidy policy, textbooks tend to highlight at least two issues. First, they point out that, while standard welfare analysis might imply an equivalency between the two policies, there are nonetheless significant differences (e.g. Perman, Ma, McGilvray, and Common, 2011). Second, they indicate that subsidies tend to be less desirable a policy for correcting negative externalities. For example, subsidization may promote inefficiencies in resource allocation as less efficient firms have fewer incentives to improve pollution abatement practices. Firms may be able to use subsidy revenue to defray the costs of other inputs to production, including those inputs that cause environmental damage, as it may promote inefficiencies in production, encourage entry into a market leading to more pollution, and discourage the exit of inefficient firms. Callan and Thomas (2010) offer a typical description:

> …a per unit subsidy effectively lowers the polluter's unit costs, which in turn raises profits. If the industry has limited entry barriers, these profits would signal entrepreneurs to enter the industry…the subsidy may cause the market to expand such that aggregate emissions end up higher than they were originally. (p. 106)

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[1]In graduate-level texts, the preferred expositional methodology is mathematical (e.g. Baumol and Oates, 1995).
[2]The United States rarely utilizes charges, preferring emission standards and tradable permit-type policies.
[3]See https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/carbon-tax (accessed on April 22, 2019).

While this is an accurate description of a possible unintended outcome, and echoed in many texts (e.g. Field and Field, 2009, p. 252), it often represents the end of the fee vs. subsidy discussion. Many students may find this analysis lacking in that the behavior is rarely, if ever, illustrated. Moreover, a more illustrative presentation of this discussion reveals that we do not necessarily have to appeal to market entry to demonstrate that subsidization may lead to more pollution. Indeed, as pointed out by Metcalf (2010), subsidies lower the overall cost of energy to firms that may encourage more energy use overall, resulting in more pollution. In fact, his analysis shows that emissions fees and cap-and-trade are generally better policy options.

In what follows, using standard isoquant and isocost geometry, I offer a graphical analysis that highlights essential differences between fees and subsidies on a firm's productive input decisions. Such an exposition will offer students greater insights into the principal behaviors that can lead to unintended policy outcomes such as subsidies on environmentally benign "green" inputs leading to the use of more pollution-generating "brown" inputs.

The remainder of this paper is organized as follows. In Section II, I present a common welfare analysis of fees versus subsidies found in most textbooks. In Section III, I offer a production analysis of a fee. In Section IV, I present the subsidy example. Section V offers a comparative assessment of the two policies and Section VI concludes.

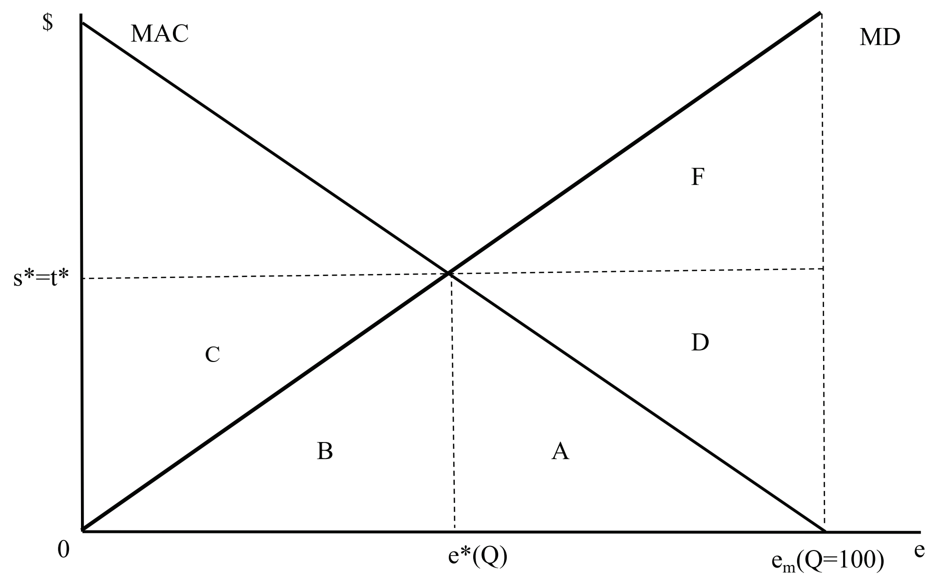
2. Standard Comparison between a Fee and a Subsidy

In a typical environmental economics class, particularly aimed at undergraduate students with often little more than a principles-level background, the first topic studied involves externalities. That is, pollution byproducts of a production process can generate negative externality on members of society, the cost of which is not necessarily captured in the market price for goods. Once covered, students, fairly early on in the course, are exposed to a variety of policy solutions to the externality problem: setting emission standards, emissions fees, subsidies, cap-and-trade systems, etc. The material presented in this paper would fall into the course at this point. I have introduced this material in a lecture/class discussion format, taking roughly an hour or so, as an enhancement to standard textbook material.

A typical textbook comparison between an emissions fee and a subsidy, as found in Perman, Ma, McGilvray, and Common (2011, p. 200), is provided in Figure 1. Marginal cost of abatement (MAC) signifies a representative firm's marginal cost of pollution control (i.e. abatement). MD represents the marginal damage caused to the environment from an increase in emissions. Emissions are typically modeled as depending, at least indirectly, on production, e(Q). However, if the inputs used in production use less emissions-generating bi-products, then ultimately emissions will be influenced more directly by the input choices made by the firm. This will be addressed in more detail later.

If a polluting firm were left unregulated, then total emissions would be maximized at level e_m (i.e. where MAC = 0) because the firm would have no incentive to incur the costs of emissions control. The level of production, then, would be its unregulated level. In the figures that follow, this would be Q=100. Social costs are therefore equal to total damages done to the environment, illustrated as the area under MD: A+B+D+F.

Figure 1. Optimal Level of Emissions



The social cost minimizing level of emissions, e^*, is achieved where the marginal cost of pollution control equals the marginal damages to the environment. For any emissions greater than e^*, the marginal damages are higher than the marginal cost of abatement so it is preferable to reduce emissions. For any emissions level less than e^*, marginal damages are lower than the marginal cost of abatement, so it is preferable to allow for those emissions to occur. The firm incurs abatement costs equal to area A. Damages to the environment is area B. The (minimized) costs to society are therefore A+B.

In principle, e^* can be achieved by taxing an emissions-producing input that would reduce production. In the figures that follow, this would be a Q=80. However, it is argued in standard analysis that one can also reduce emissions to e^* by supporting (i.e. subsidizing) greater use of a non-emissions-producing input that could result in the firm producing more output because input costs for the firm are reduced. In the figures that follow, such a production level would be Q=150. The argument then is that emissions are still reduced because less emissions-producing inputs are used. However, as we will see below, this is not a guarantee with a subsidization policy. Indeed, this is, in fact, why isoquant/isocost analysis can be so valuable here.

Referring to Figure 1, if a fee were set at t^*, then the firm would have an incentive to adjust production so as to reduce $e_m$issions from e_m to e^* because the fee is greater than the MAC. Any further emissions reduction is too costly for the firm to make so it is better off simply emitting and paying the fee. The result is that the firm's total costs of compliance with this policy (abatement cost plus the fee) is A+B+C, and the social welfare maximizing level of emissions, e^*, is achieved. Environmental damages are, again, B. Tax revenues collected, area B+C, are, following convention, treated as a social transfer from the firm to society, and resulting social costs equal to A+B+C+B – (B+C) = A+B, just as before.

With a policy that subsidizes emission reductions, set at s^* per unit of emissions abated, the firm adjusts its production inputs so as to abate emissions to e^*, incurring a cost of A, and collecting the subsidy payments between em and e^* equal to A+D, since between these levels of emission, the marginal cost of abatement is less that the subsidy received. Further reductions in emissions are not profitable since the subsidy payments are too low relative to the marginal cost of abatement. Again, the result is that the efficient level of pollution is achieved at e^*. Again, following convention and treating the subsidy payments as a transfer from society to the firm, social costs are A-(A+D) +B +(A+D) = A+B.

However, note that the firm's costs of compliance with the subsidy policy are now -D < 0. Recall that the firm's costs under the fee policy are A+B+C>0. This clearly implies that the firm would be better off with a subsidy policy than a fee policy.

Once this distributional effect is articulated, most textbooks offer students a largely descriptive argument similar to Callan and Thomas's (2010) language provided earlier, as to why fee and subsidy policies are not necessarily socially equivalent policies as the theory above suggests. While the descriptive approach is valuable, isoquant and isocost analysis, as shown in the figures below, could enhance this intuition by illustrating such effects. Moreover, a graphical analysis that utilizes isoquants and isocosts can offer additional comparative insights that build a deeper understanding of these two policy instruments.

3. Effects of an Emissions Fee on Production

Let us first consider the effect that an emissions fee, such as British Columbia's carbon tax, would have on a representative firm's production input decisions. Suppose a firm has two possible choices for obtaining the energy necessary for production: an energy source that is a non-emissions-generating or "green" input, E_{green}, that has little-to-no impact on the environment (such as wind, solar, or ethanol energy sources) that is not subject to the tax, and an emission-generating energy input, or "brown" energy source, E_{brown} (such as coal or petroleum-based energy).

To further clarify the link between emissions, production, and energy inputs, consider the following general production function:

$$Q=f(L, K, E_{brown}, E_{green}), \qquad (1)$$

where K and L are capital and labor inputs, respectively. To allow for standard presentation of isoquant and isocost analysis, E_{brown} and E_{green} are assumed to be (imperfect) substitutes in production.[4] I chose to focus on the energy inputs in this example because it is from those inputs that emissions tend to arise. It is worth noting that energy input levels vary from industry to industry so not all firms will experience the same impact level from environmental emissions policies, but many firms in certain industries will.

[4]The assumption of imperfect substitutes is helpful here for a couple of reasons. First, it can be argued that there are differences in the productive efficiencies of green and brown energy inputs. For example, it has been claimed that ethanol blended gasoline is less efficient in terms of miles per gallon than conventional gasoline blends. Second, this assumption allows for convex isoquants, which is likely to be more familiar to undergraduate students that may have just been recently introduced to isoquant/isocost analysis than the "perfect substitutes" case. That said, instructors may want to extend discussion of this topic by showing that you get the same conclusions in the perfect substitutes case as you do with the presentation offered in this paper.

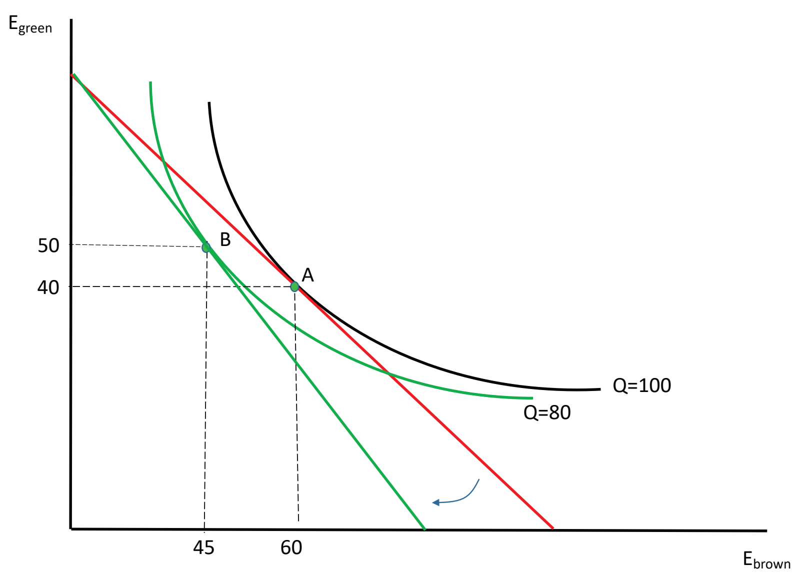
For example, while specific cost data is difficult to come by, McCarthey (2001, p. 224) reports that fuel costs account for 19 percent of total costs for Class 1 railroad companies. Moreover, in the United States firms the trucking industry buys \$30.9 billion from the petroleum and coal industries, or about 10.25 percent of total revenues. These energy sources tend to be where the emissions come from.[5]

As illustrated in the figures below, following standard practice the two energy sources are imperfect substitutes for one another as indicated by the convex, downward-sloping nature of the iso-quants. As is standard, the optimal (profit-maximizing) input mix is achieved when the marginal rate of substitution between the two energy sources equals the market rate of substitution:

$$\left|\frac{MP_{green}}{MP_{brown}}\right| = \left|\frac{P_{green}}{P_{brown}}\right| \tag{2}$$

where P_{green} and P_{brown} are the prices the firm pays for green and brown energy, respectively.

Figure 2. Case 1: Fee Levied on E_{brown}



There are several possible outcomes, each with varying outcome probabilities that result from levying a fee on E_{brown}. Figure 2 shows one possible outcome. Prior to the imposition of the fee, the firm produces 100 units and uses 60 units of E_{brown} and 40 units of E_{green}. Once a fee is levied on E_{brown}, in this case, the firm is incentivized to reduce output (from 100 to 80), move from point A to point B, and use more E_{green} (50 units) and less E_{brown} (45 units). Arguably, most economists would point out the socially desirable effects of a fee on pollution

[5]The trucking data were derived from input/output use tables for the United States found at https://apps.bea.gov/iTable/index_industry_io.cfm (accessed April 4, 2019). Absent direct total cost data, please note that since the percentage above is based on revenues, petroleum and coal's contribution to trucking costs are likely to be higher.

to this possible outcome. We see a reduction in output (desirable if production is generating a negative externality on society) and a shift away from the pollution-generating input to the more environmentally friendly input.

At this point, it can be very helpful to show algebraically the reason for the inward rotation of the firm's isocost curve since many students are not necessarily experienced with this analysis. Consider the total cost of production prior to the imposition of the fee:

$$TC = E_{green}P_{green} + E_{brown}P_{brown} \tag{3}$$

Solving for E_{green} we obtain the standard isocost curve:

$$E_{green} = \frac{TC}{P_{green}} - \frac{P_{brown}}{P_{green}}E_{brown} \tag{4}$$

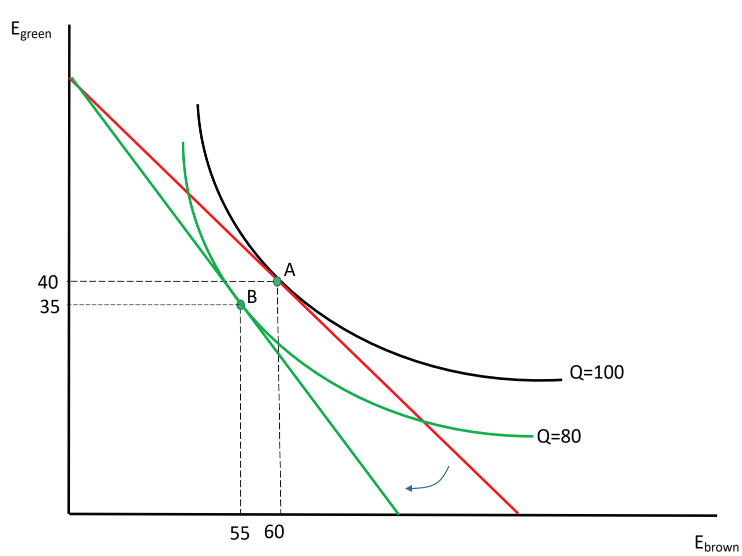
Now, if we impose a fee, t, on the purchase of the brown energy input, students can see that the isocost curve steepens and rotates inward as total energy costs are held constant:

$$E_{green} = \frac{TC}{P_{green}} - \frac{(P_{brown} + t)}{P_{green}}E_{brown} \tag{5}$$

The intuition behind this result can be reinforced by instructors by pointing out to students that if the firm were to only buy E_{brown}, it would have to buy less of it for a given total energy cost.

However, what is illustrated in Figure 2 is not the only possible outcome. Figure 3 shows a second possible outcome. If the substitution properties of the two energy inputs are more limited in nature, then it is quite possible that as the firm moves from point A to point B, both E_{brown} and E_{green} inputs are reduced (to 55 and 35, respectively) and thus, output is reduced.

Figure 3. Case 2: Fee Levied on E_{brown}



Overall, with respect to emission fees, in both cases the policy is having the desired effect. That is, less of the pollution-generating input, E_{brown}, is being used and therefore pollution emissions are being produced.[6]

4. Effects of a Subsidy on Production

Now, let's consider the effect that an abatement subsidy, similar to the United States' federal subsidy on corn-based ethanol-blended gasoline alluded to above, would have on a representative firm's production input decisions. We illustrate the impact of such a subsidy by effectively lowering the price of E_{green}. To illustrate this for students, we return to the isocost equation (4) but instead of adding a fee to the price of E_{brown}, we reduce the price of E_{green} with a subsidy, s:

$$E_{green} = \frac{TC}{P_{green}} - \frac{(P_{brown})}{(P_{green} - s)} E_{brown} \quad (6)$$

Students can then see that this policy results in a steepening and a rotating upward of the isocost curve, holding overall energy costs constant, as shown in Figures 4 and 5. Again, the intuition behind this result can be reinforced by instructors by pointing out to students that if the firm were to only buy E_{green}, it would be able to buy more of it for a given level of total energy expenditures.

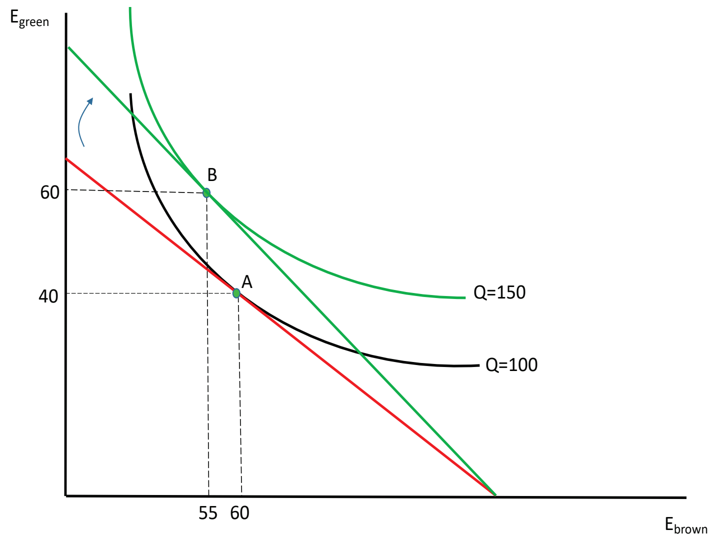
As in the case with the fee, there are several cases worth considering here. Figure 4 illustrates what might be the preferred outcome from a policy perspective. The firm substitutes towards E_{green} (from 40 to 60 units) and away from E_{brown} (from 60 to 55 units) and is able to produce more. The subsidy relaxes the firm's budget constraint, allowing it to produce more (from 100 to 150 units), as it moves from point A to point B.

If the ultimate goal of a policy is to discourage the use of inputs that degrade the environment, then the subsidy is working with the added benefit of encouraging a cleaner input. The result, then, is that we should see declines in welfare losses resulting from production. However, Figure 5 offers another possible outcome. As the firm assesses its input mix given the impact that the subsidy has on relaxing its budget constraint, it may find it profitable to move from A to B, and thereby use more of both E_{green} (from 40 to 50) and E_{brown} (from 60 to 65), as it increases production levels.

If the green input is not as productive an input, it may use slightly more of that input to secure the subsidy. This might free up other funds to support the purchase of more E_{brown}. This might present a challenge for policy makers. Again, if the desire is to reduce E_{brown} usage in favor of E_{green}, the policy as it stands does not seem to be working as expected. More E_{brown} may be used to support increased production. The result might then be an increased harm to the environment.

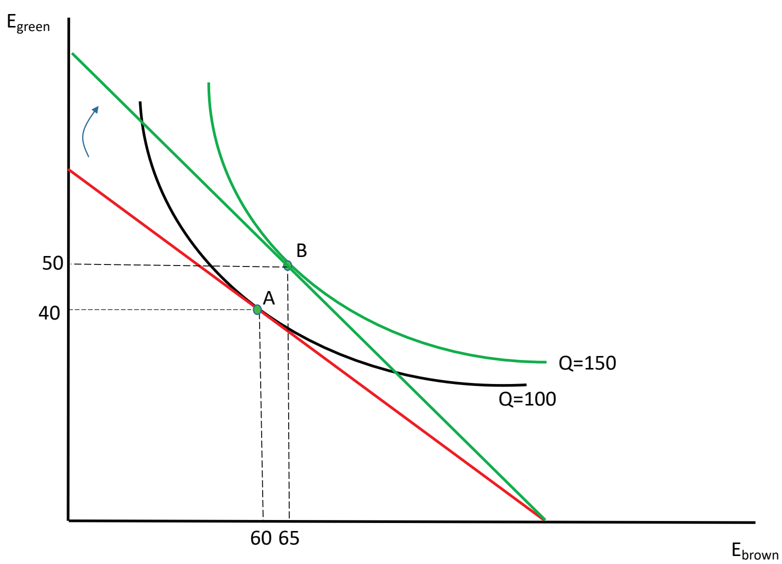
[6]There is a third case where E_{brown} has "Giffen good" characteristics. As this outcome is quite rare, this analysis is presented in the Appendix.

Figure 4. Case 1: Subsidy Provided for E_{green}



Overall, with respect to emission subsidies, in one case the policy is having the desired effect, less of the pollution-generating input, E_{brown}, is being used and therefore pollution emissions are being produced. In the other cases, it's having the opposite effect. If the intent is to reduce the externality being caused by E_{brown}, the subsidy policy is a riskier option than the fee.[7]

Figure 5. Case 2: Subsidy Provided for E_{green}



[7]Again, there is a Giffen good case here as well, addressed in the Appendix.

5. Overall Assessment of the Two Policies and Class Discussion Points

If the overarching goal of any environmental policy is to discourage the use of pollution-generating inputs in favor of cleaner ones, then the analysis above suggests to students that a fee would be preferable to a subsidy. Hence, we would expect a policy such as a carbon tax to be more successful at curbing emissions than a subsidy such as the tax credit policy for ethanol blends in the US. Once this case is made, there are several possible discussion points that can lead to valuable class discussion of the other relative merits of the two policies. This is a valuable exercise for students as it encourages broader considerations that can have real-world implications. For instance, once the instructor has presented and discussed the figures above, (s)he may pose, as I have, the following questions:

- What is/should be the ultimate goal of the policy? For example, might subsidies be preferred if job growth is desired more so than environmental protection? When I posed this question in class, it led to a spirited discussion of the relative value of jobs (that are more likely to be created with a subsidy), versus the environment (that is more likely to benefit from a fee). The overall value of this I believe is the discussion itself. It reinforces the idea of what externalities are and gets students thinking about distributional effects of policy (i.e. jobs versus the environment, etc.).
- Should we expect more E_{green} usage in countries that apply fees on E_{brown} or subsidies on E_{green}? This question encourages students to think empirically. The efficacy of a theoretical model is whether or not it can stand up to empirical scrutiny, which I believe is a valuable discussion to have in class.
- Does the degree of substitutability between E_{brown} and E_{green} impact the analysis? What if they were perfect complements? Perfect substitutes? This is a more technical question that would be best posed if the class appears to have a very good grasp of isoquant/isocost analysis. Its value is that students can assess if ease or difficulty of factor substation impacts the conclusion that fees are generally better than the subsidies and ensuring that the externality problem is corrected.
- Can other parameters or restrictions be placed on, say, subsidies to ensure more E_{green} and less E_{brown} is used? I posed this question to the class largely in response to the discussion resulting from the first question above. Can the subsidy policy that would likely promote job growth be modified in an efficient way to prevent firms from buying more E_{brown}? This gets students thinking about composite polices that involve combinations of standard policies that are common in environmental economics (although not necessarily related to this specific issue, a deposit/refund system is a common type of composite policy).

The overall result of offering this type of analysis to students could really enhance learning and debate.

6. Conclusion

Environmental economics courses typically will cover emissions fees and abatement subsidies as policy solutions to the negative externality pollution generated in market transactions. Textbook treatment of these two policies vary in exposition and detail and are generally descriptive and not analytical. This can leave students with limited insights regarding behavioral differences that arise with these policies.

The graphical analysis shown in this paper can offer instructors a means of illustrating many important distinctions between fees and subsidies. In particular, in illustrating unintended policy consequences, my graphical analysis illustrates that a subsidy policy is, paradoxically, more likely to generate more pollution than a fee policy. This is a result consistent with Metcalf's

(2009) empirical work and a result often not well articulated in textbooks.

While there are clear benefits to applying isoquant/isocost analysis to this issue, there are likely curricular drawbacks. For instance, many undergraduate environmental economics courses will only have principles of economics courses as a prerequisite. However, intermediate microeconomics is where these models tend to be introduced for the first time in an economics major's coursework. Since it is rare that a principles class will expose students to isoquants, presenting the fee/subsidy issue in the manner suggested in this paper may require the instructor to offer some additional background.

Indeed, the environmental economics class that I teach at my institution does not require intermediate microeconomics. However, I have found that it is possible to offer a relatively short and concise 45-60 minutes overview of isoquant and isocost analysis that provides enough background to make the fee/subsidy analysis shown in this paper understandable. My strategy bases my review on isoquant and isocost material found in principles textbooks such as Hubbard and O'Brian (2010, pp. 355-361) and Baumol and Blinder (2009, pp. 149-152). Informing the students that this material comes from principles-level textbooks can make it seem less intimidating. While it can be helpful for students to have such texts as references, these books can be quite expensive. Thus, I recommend some more cost-effective alternatives such as Depken's (2006) reasonably priced Microeconomics Demystified that not only offers a concise overview of isoquant/isocost analysis but also provides students with a quick reference for other microeconomics material they may have forgotten from their own principles class. Finally, there are a few internet-based resources that can support student learning. I have found useful material for students at policonomics.com for example. In addition, several students have suggested these YouTube videos: https://www.youtube.com/watch?v=lT8eSU9pxcw and https://www.youtube.com/watch?v=_MQ4pYKP7H4 as helpful resources.

Moreover, it may be the case that exposure to isoquant and isocost geometry is increasing at the principles level. Indeed, two recent contributions by Holmgren (2017), and Erfle (2019) have developed Excel-based techniques for illustrating indifference curve and budget constraint analysis found in consumption theory that is very accessible at the principles level. This could then be easily extended to production theory. Either way, the application of isoquant and isocost geometry to the basic elements of environmental policy offers students a much richer understanding of this complex topic.

At the end of the day, the question instructors need to ask is whether or not the time to review the basics of isoquant/isocost analysis is worth the effort to address the fee/subsidy issue presented in this paper. In my judgement it is. With ever increasing attention being paid to sustainability issues both in the US and internationally, the insights gained here provide students with valuable knowledge around this very active and important policy debate.

The proposition that the type of analysis presented here would be a valuable addition to any environmental economics class does suggest additional research. My experience has been that students who have seen this analysis in class seem to have a better understanding of the subtle differences between a fee policy and a subsidy policy. Class discussions seem to have been more on-point and test performance seems clearer. However, such anecdotal observations are not necessarily proof of superior learning outcomes. Hence, future research needs to be done to verify whether this is indeed the case. Perhaps this might involve specific test question comparisons between several class sections where some are treated to this analysis and others are not. Perhaps by employing classroom experimentation following, for instance, Grant, Bruehler, and Chiritescu (2016) or other procedures, would be helpful as well.

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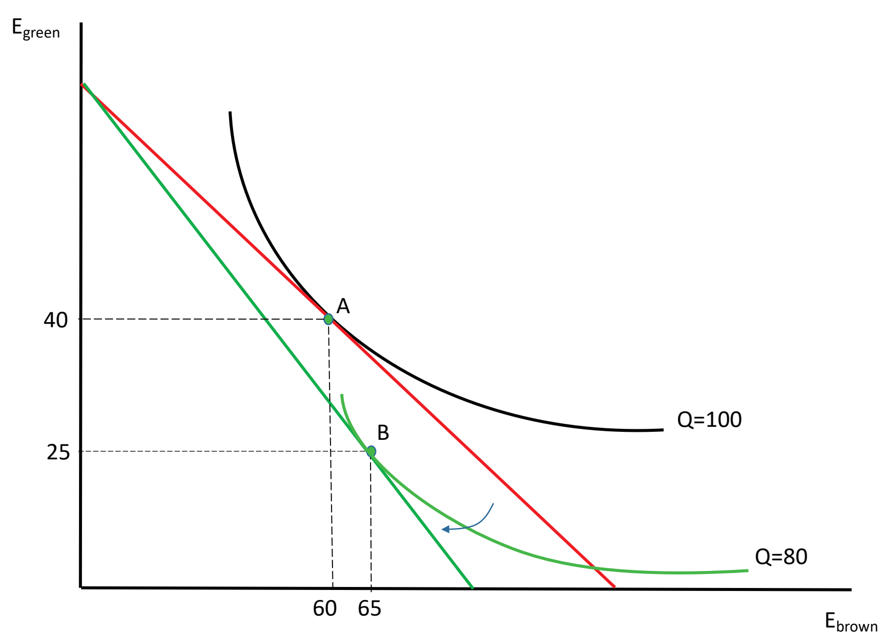
Appendix: The Giffen Good Case

There is a third possibility for both the fee and subsidy policy; the Giffen good case. Giffen goods are typically addressed in consumer choice theory as unusual cases where a price increase for a good, for example, could result in more of that good being purchased. This would be the case if the good were a substantially inferior good that nonetheless accounts for a substantial share of a consumer's budget. The classic example found in many textbooks is the increased demand for potatoes after the blight that destroyed the potato crops in nineteenth century Ireland that caused the price of potatoes to increase substantially.

It is theoretically possible that such a phenomenon could occur when firms are purchasing inputs. However, these possibilities are likely to be quite rare and quite unusual, so I would not include them in the standard lecture. However, they are nevertheless worth keeping in mind should a student ask about these possibilities.

Consider first the fee policy. One cannot rule out that the fee may place such pressure on the firm's energy budget that the firm would, rather perversely, actually choose to use more E_{brown}. In effect, E_{brown} could be a type of Giffen good in production. This condition is illustrated in Figure A1 below. While specific examples are very difficult to come by, it is nevertheless possible, however unlikely, that E_{green} may be much more expensive an energy source that the firm would be spending most of its energy budget on E_{brown} despite its inferior characteristics. The result is that E_{brown} usage increases by 5 as the firm moves from A to B. So, while this case can weaken the conclusion that a fee is highly likely to correct the negative externality, it is nonetheless a low-probability outcome.

Figure A1. Fee Levied on E_{brown} where E_{brown} is Giffen



Finally, consider first the subsidy policy illustrated in Figure A2. Although again this might be an unusual outcome and specific examples are very difficult to come by, it cannot be ruled out. The firm may find that E_{green} is so inferior to E_{brown} that it will take the subsidy on less E_{green} usage (moving from point A to B and using only 35 units of E_{green} instead of 40). Then it could use any resulting budget savings to purchase even larger quantities of E_{brown} (moving from 60 to 75 units) to meet production needs. This case, however unlikely, further strengthens the argument against subsidization as a means of correcting a negative externality.

Figure A2. Subsidy Provided for E_{green} where E_{green} is Giffen