

*It is difficult to calculate the right tax in a world of imperfect Coasian bargains.*

# The Pigou Problem

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In recent years, there has been a revival of interest in Pigovian taxation, especially for dealing with the problems of global warming and pollution. A number of prominent articles have variously argued for additional Pigovian taxes on gasoline. For instance, Ian Parry and Kenneth Small offered indirect estimates of the relative size of the externality per unit of gasoline consumed in a 2005 *American Economics Review* paper examining gas taxes in Great Britain and the United States. The following year, Aaron Edlin and Pinar Karaca-Mandic published a paper in the *Journal of Political Economy* that calculated the accident externality from driving. More recently, a number of prominent economists from across the political spectrum have issued calls for Pigovian taxes on gasoline as a potential means of dealing with unpriced externalities. Harvard's Gregory Mankiw has informally aggregated those concerns in his calls for a Pigou Club of economists who identify themselves by their support for a gasoline tax. On his website, Mankiw argues for an additional \$1-a-gallon tax on gasoline in the United States, implemented over a 10-year period.

This article questions the economic justification for these Pigovian taxes and argues that existing empirical work is inadequate to justify such a tax in the standard neoclassical framework. In particular, it calls into question claims that the identification and measurement of a Pigovian externality is a sufficient condition for determining the optimal level of the tax. A claim about the optimal tax is a joint claim about the size of the externality and about the optimality of observed outcomes, not just the externality. Measuring the size of the observed Pigovian externality — even if done perfectly — is not a reliable guide to the proper level of the Pigovian tax because, in a world of efficient transfers, we will still observe some exter-

nalities. Hence the debate about externalities should be about whether those compensating factors exist and not about measuring the externality itself.

Even in a world with compensating transfers and regulations, the observed amount of the externality (e.g., pollution) is unlikely to be zero. Any tax calculation that is determined using the size of the measured externality but that does not consider all regulations and transfers affecting equilibrium will not tell us what the optimal tax should be. Any tax recommendation requires empirical work that is not undertaken in any of the cited papers. A tax imposed without such calculations may well be superfluous and inefficient.

## COASE

In his classic 1960 *Journal of Law and Economics* article "The Problem of Social Cost," Ronald Coase questioned the reliability of using Pigovian estimates to craft real-world regulation. His core argument is usually stated thus:

■ In a world of costless bargaining, well-defined property rights, and very low transactions costs, the various parties will negotiate until a jointly maximizing outcome is reached. No taxation is necessary or desirable in this world.

However, it is not often understood that his argument is relevant even when transactions costs are positive. We can extend his reasoning to see how it bears on the problem of taxing externalities:

■ Even in a world of positive transactions costs, some Coasian transfers may take place that partly mitigate the harm of an externality. Unless the Pigovian tax collector can fully account for all those transfers, any estimate of an appropriate tax based solely on the size of the externality will clearly overstate the optimally efficient tax level.

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■ In the presence of regulations (at any level of government) that have bearing on the supply of the externality-causing activity (even if not directly tied to the externality itself), we will need to estimate the difference between the real-world level of the activity and the hypothetically efficient level of the activity. Absent such an estimate, simply knowing the size of the externality itself gives us no clue about the appropriate tax or its optimal level.

■ Even in a strictly Pigovian world in which both the possibility of Coasian bargains and the indirect effects of regulation on the equilibrium supply of the externality-producing good are assumed away, the optimal Pigovian taxes are likely to be lower than the standard Pigovian rate if there are other taxes in the economy. That is, the Pigovian tax rate estimated in a partial equilibrium setting is likely to be supra-optimal in a general equilibrium setting in which a variety of distortionary excises already exist, even if those taxes were not explicitly designed to cope with externalities. Furthermore, taking into account regulations that are substitutes for Pigovian taxes further moves the optimal tax level away from the standard Pigou solution and makes it likely that applying a straightforward Pigovian tax in addition to existing taxes and regulations is inefficient and even counterproductive.

**THEORY**

The single major problem is that the applied Pigou tax literature — particularly the policy literature — concentrates on the presumption that the tax should equal the marginal externality, also known as the Pigou Externality (PEX). What we really need to know is the optimal quantity of the good or activity that produces the externality. Absent detailed information about both regulatory distortions and private Coasian transfers, knowing the size of the PEX gives us no clue as to the size of the optimal Pigou tax.

Using Figure 1, consider the following thought experiment: The island of Sodor is run like an autarkic, laissez-faire kingdom. There are no public constraints or taxes on anyone or anything beyond that of the minimal state. In this world, drivers produce a dollar’s worth of externalities ( $PEX = \$1$ ) for every mile driven in a private vehicle, and they drive a total amount  $Q$  per year, which is 20 percent higher than the optimum amount  $Q^*$  they would drive if the externality they produced were fully factored in.

This is a standard Pigou story. A tax of \$1 per mile driven that is imposed uniformly on all drivers would equate marginal social costs to private costs and drivers would then drive a total of  $Q^*$  per year.

But what if we first assume the existence of costless Coasian bargaining? Then sufferers from the externalities — such as those who object to the air pollution or excessive congestion — could bribe drivers so that they drive less. How much less? So that the total driving amounted to  $Q^*$  per year. In this case there would be no uninternalized externality and there would be no basis for imposing an optimal Pigou tax. And yet, if we were unable to observe the Coasian bargain, we might mistakenly try to measure the harm per unit of driving. We would then still observe that each mile driven causes \$1 of harm. That is, the observed PEX would still be \$1. However, imposing a Pigou tax of \$1 per mile driven would definitely be sub-optimal in this example. Indeed, any positive Pigou tax would now lower welfare from the first-best policy.

What if we modified the assumptions so that bargaining is costly and transactions costs are positive? It would not necessarily follow that Coasian bargains will not or cannot take place. Depending on the level of transactions costs, there could still be incentives to make a variety of limited transfers even if the first-best solution were not attainable. Municipalities might act on behalf of critical coalitions and also seek to regulate bad behavior or subsidize good. These might include rules such as emissions inspections, environmental regulations on the refining of gasoline, restrictions on the siting of gas stations,

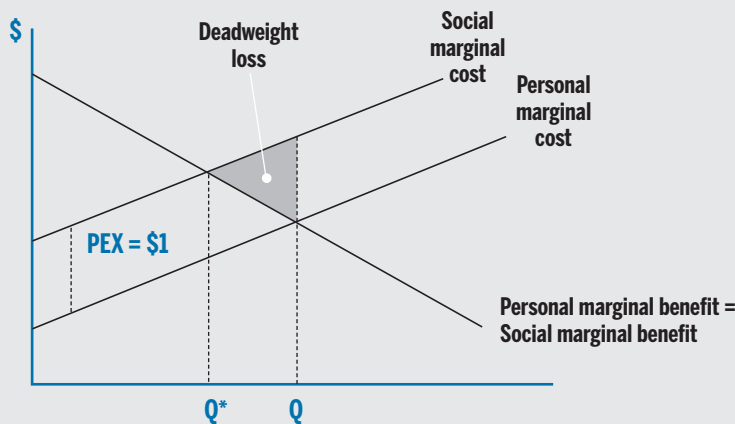
or publicly funded programs that provide incentives to drive less or to use public transportation. Limitations on parking or roadways, or subsidies to live near the downtown area, can be seen as aspects of a political set of Coasian bargains that shift the relevant supply and demand curves (e.g. parking can be sufficiently restricted to have the same effect as a tax on driving). As a result, total driving is reduced to some  $Q'$  that is between the optimal  $Q^*$  and the no-tax  $Q$ . Here, a Pigou tax would be justified but the size of the tax cannot by definition be established by examining the externality per mile driven (or as is more commonly done, by estimating the average externality per unit of gasoline consumed). Without having any estimates of  $Q$ ,  $Q'$ , or  $Q^*$ , it will be impossible to establish any basis for a Pigou tax. Yet many recent papers use sophisticated calculations of a Pigou externality as the sole basis for recommending a Pigou tax.

Moreover, in a general equilibrium setting in

Figure 1

**Understanding the Pigou Tax**

The microeconomics of a negative externality and a Pigovian tax.





which other taxes are present, it is likely that the optimal Pigou tax is far below the tax suggested by the observed Pigovian externality. The existence of other distortionary taxes in the economy — even if not explicitly designed to mitigate the externality — will still have an effect on the observed  $Q$ . Hence those taxes are likely to narrow the gap between ideal and actual quantities. As A. Lans Bovenberg and Lawrence Goulder argue in a 1996 *American Economic Review* paper, in a world with general taxation, the optimal Pigou tax is almost certainly lower than the partial equilibrium Pigou tax (and might even be negative). This is an issue that goes beyond the need to enforce revenue neutrality, but it is rarely addressed.

**IMPLEMENTATION** This does not take into account the problem of setting an optimal Pigou tax in the presence of regulations and market imperfections that affect the actual  $Q$

monopoly control of parking spaces would lower the observed amount of driving from the laissez-faire benchmark without affecting the PEX per unit of driving. Private zoning restrictions that limit the right of way or that make it desirable to live in a particular community would shift the observed  $Q$  without necessarily changing the marginal observed Pigovian externality.

Similarly, any government-sponsored goods or services that make driving less desirable will have a bearing on how far  $Q$  is from the theoretical optimum. If, for example, the city chooses to build a new stadium that is difficult to access by car and has limited parking, that decision encourages people to minimize driving to the venue.  $Q$  will approach  $Q^*$  even though each mile driven produces the same \$1 externality. The extra congestion from people driving to the new stadium does not necessarily imply a need for greater taxation if — at

## It only makes sense to set the Pigovian tax equal to the per-unit externality if there are no regulations or other imperfections.

observed and that may shift the optimal  $Q^*$  and cause  $Q$  to be moved closer to or farther from the optimum. For example, in his 1969 *American Economics Review* paper commenting on Coase, James Buchanan notes that if there is monopoly power in the provision of the good with the external byproduct, then price will be above the competitive equilibrium and observed quantity lower than in perfect competition. Thus, any estimate of Pigou taxes that did not take the monopoly into account would overestimate how much tax to impose and would not even be able to establish the desirability of the Pigou tax in the first place.

More concretely, consider how the inefficiencies in the oil delivery market surely act as a tax on the supply of oil and should be factored into optimal tax calculations. For example, OPEC has enjoyed at least partial success in limiting oil production and therefore has to bear some responsibility for raising the average price of gasoline. Though no one knows the exact size of the OPEC “tax,” it is likely to be comparable to estimates of the optimal gas tax. Or consider that restrictions on oil drilling in Alaska or on the construction of nuclear power plants in the United States almost surely push back the supply curve of energy relative to the hypothetical “free market” position. On the other hand, countervailing subsidies and distortions work in the opposite direction, which further increases the difficulty of establishing an optimal tax and calls into question the results of scholars who claim to have done so.

Any imperfection or regulation in the provision of complements or substitutes to the good under examination will also have a bearing on whether the observed  $Q$  is above or below  $Q^*$  regardless of the measured PEX. For instance,

the margin — there is a corresponding incentive for people to relocate closer to the town center. The same goes for the provision of subsidized public transportation or for subsidies to minimize commuting or city travel during rush hour. Conversely, any subsidy to drivers will push  $Q$  farther away from  $Q^*$  and increase the Pigou tax that should be charged above the observed \$1 per mile, which would now be an underestimate of the optimal tax.

It is important to remember that the standard measure of externality makes sense only if there are no adjustments that take place other than adjustments to the externality itself.

### **CALLS FOR PIGOU TAXES**

As noted above, there have recently been more and more calls on the part of economists for the use of higher gasoline taxes to deal with the externalities of driving, congestion, and environmental damage. Mankiw, citing the work of Parry and Small, has openly come out in favor of a \$1-a-gallon tax in the United States, to be phased in over several years.

Edlin and Karaca-Mandic go directly from estimating the accident externality of driving to advocating a Pigou tax equal to their “estimated external marginal cost.” However, they give no consideration of existing regulations or taxes. Their main finding is that higher density contributes to increased accident risk. The greatest part of the externalities that are not properly internalized in the insurance system are those imposed by uninsured drivers on the insured. Their non-tax alternative is to promote road-building to decrease traffic density. Their second-best solution is to tax gasoline. But it is not clear in their analysis how one would go about

inferring that there are “too many” accidents without essentially arguing that they could measure the optimal level of driving,  $Q^*$ . This is especially problematic when Edlin and Karaca-Mandic already observe that gas taxes would “take inadequate account of heterogeneity” by taxing drivers in rural, sparsely populated areas as heavily as those in denser urban areas where accident externalities are likely to be greatest. But in fact, this is a secondary issue. The real point is that a rigorous analysis would have to take into account all taxes and regulations that have any effects on driving and congestion. It would then have to demonstrate that a tax would be welfare-improving at the margin, especially given the distortions that a uniform tax on both congested and non-congested drivers would necessarily create.

Furthermore, when one factors in the confounding effects of other distortions — such as political uncertainty or regu-

in a remote area might result in more driving. As Parry and Small themselves note, a uniform gasoline tax would be only a second-best policy because it would ignore the distributional consequences vis-à-vis taxing highly congested areas at the same level as uncongested regions. But the problem is more serious than that; any approximately “correct” gas tax would by definition be overtaxing the low-density, low-traffic regions vs. the high-density areas. Given that the congestion effects in the Parry and Small calculations are by far the largest measured externality, that would mean differentially taxing people in the areas generating the fewest congestion externalities.

Prominent figures in both the Republican and Democratic camps have called for higher gasoline taxes on similar grounds. Yet almost none of the calls for higher Pigovian gas taxes have been based on research that is more sophisticated than the standard externality analysis. None fully take into

## A consistent economic position would mean replacing all relevant taxes and environmental regulations on driving and automobiles with a Pigou tax.

latory shift — it is hard to believe that the proposed Pigou taxes would be sufficient to cause the measurable changes that proponents desire. Consider that in Parry and Small, the authors estimated that a \$1-a-gallon tax in the United States would have been optimal in the early 2000s. This was presented as the total estimate of the optimal tax, including pre-existing taxes that averaged about 40 cents a gallon, and not taking into account other, non-tax distortions such as the effects of regulation (e.g., CAFE requirements) or secondary taxes. Hence, the marginal proposed increase would have brought the total price of gasoline to approximately \$2 at the pump. Since the early versions of the Parry and Small paper were circulated in 2002, retail gasoline prices in the United States have risen by much more than the marginal figure of 60 cents that they considered optimal. Since a substantial part of that rise includes the effects of war and political uncertainty in the Middle East and not simply underlying changes in expectations about production technology and demand, it is likely that people are paying close to the “optimal tax” first estimated in Parry and Small’s paper — even if revenues from that tax do not benefit the U.S. government. Yet most gas tax proponents still feel usage is “too high.”

Moreover, Parry and Small treat the congestion and pollution externalities as being additive. But in some cases, the effects of one mitigate the other. In particular, a high degree of congestion in an area may serve as a disincentive to drive in the first place and encourage substitution to public transportation or riding a bike. In that case, treating the externalities additively would bias upwards estimates of the optimal tax. Conversely, attempts to evade congestion through living

account the quantitative effects on the optimum tax of the existing variety of regulations, including support for ethanol, fuel economy standards, restrictions on highway construction, and subsidies for public transportation. In general, most of the Pigou tax proposals do not seriously propose eliminating all of the existing substitute regulations in exchange for a higher gasoline tax. Certainly a consistent economic position would mean replacing all relevant taxes and environmental regulations on driving and automobiles with a flat Pigou tax in the range of \$1.01 to \$1.34 per gallon (or a marginal increase of about 60 to 90 cents per gallon based on the original Parry and Small work). And even if such a policy would be an efficiency-enhancing move, it is highly unlikely that such a small shift (especially after netting out existing taxes and regulation) would result in more than a minor change in the total consumption of gasoline, choice of vehicles, or in standard driving patterns beyond what we have already observed in the last few years as a result of the recent increases in price.

While there are grounds for believing that serious environmental and other problems are best dealt with through the imposition of minimally distortionary taxes, it would be good to have better grounds for believing that the existing levels of taxation and regulation are currently suboptimal. Simply observing that cars continue to pollute or that rush hour traffic is becoming more congested are not sufficient grounds for an economist to argue for higher taxes, even if we obtained a precise measure of the pollution or congestion externalities. In all cases, advocating a Pigou tax requires that we know the relationship of existing  $Q$  to optimal  $Q^*$ , and not the size of the externality.

There may also be a conflict between the desire to attain the optimal efficiency level and the desire to attenuate pollution, congestion, or carbon emissions directly. From a pure economic perspective, the goal is to push us to the efficient  $Q^*$ , but a great deal of policy seems concerned with reducing the size of the social externality itself. The two goals may be in conflict. As carmakers develop less polluting automobiles or gas suppliers discover better refining techniques, the principle of Pigou taxation would require that the gas tax be lowered, yet there is no mechanism for monitoring when taxes are too high. Parry and Small indicate that the tax in Britain was above and the United States below the optimum. A call for a U.S. Pigou tax would require symmetric calls for reducing European tax levels if we are concerned about global welfare. Indeed, an efficient Pigou proposal would also have built-in rules to determine when the tax should be lowered.

Furthermore, there is clear evidence that many of the proponents of Pigou taxation would not be satisfied by changes in behavior that result from a Pigou tax. As noted, the run-up in gasoline prices in recent years has eclipsed Parry and Small's estimate, yet almost none of the advocates of either carbon credits or Pigou taxes seem close to satisfied with current levels of gasoline usage or carbon emissions. This suggests that people either do not accept the logic of the Pigou literature, or else concern with emissions and pollution is independent of attempts to reach an efficient solution. If that is the case and numerical targets are the politically desirable ends (regardless of efficiency), then tradable credits may be the most reasonable second-best way of reaching those goals. But then advocates should be upfront about their belief that they "know" what the right level of pollution should be and are willing to reach those levels, even at prohibitive cost. Of course, this cuts against the grain of the cost-benefit tradeoff that underlies the desire to estimate the optimal Pigou tax.

Where there is a desire to reduce overall levels of pollution or congestion as "bads" in and of themselves, a higher gas tax could be justified as an easy-to-enforce, relatively less distortionary method that should displace more complicated regulatory systems now in place that probably achieve less at higher opportunity cost. However, it is important to observe that the calls for such higher taxes cannot be derived from any of the existing literature on Pigovian externalities. We should not confuse the desire for direct regulatory measures with calls for taxation as a response to Pigovian externalities. And the statistical "rigor" of published empirical work is an illusory basis for those claims.

## CONCLUSION

This article calls into question the Pigovian justifications for higher taxes on goods and services that generate standard Pigovian externalities. Though there has been a great deal of literature on measuring externalities such as auto pollution or congestion, none of it is a sufficient basis for determining an optimal Pigou tax.

Even if we insisted on a Pigovian tax as a precautionary measure, it would make sense only if it replaced all preexisting subsidies, taxes, and regulations rather than being added on top of existing arrangements. Moreover, a truly scientific proposal would also make clear under what circumstances the Pigou tax should be lowered as well as raised.

The above bears with greatest force on the literature on gasoline taxes. Contrary to the conventional wisdom and our usual economic intuition, there is almost no empirical work to give us strong grounds for belief that the current taxes and restrictions on gasoline and other fuels in the United States and throughout the world are necessarily below the optimum level. The best work has been devoted to measuring the size of the Pigovian externality on certain narrow margins. But because that is not the critical measure for the purpose of optimal tax policy, it stands to reason that we, as a profession, have no economically rigorous grounds for advocating higher gasoline taxes.

Concerns about the desirability of Pigou taxation for reasons other than pure efficiency may remain, but these are debates about the appropriate source of government revenues and the particular distortions and distributional consequences of taxing some goods and not others. Often, the calls for taxes really reflect the proponents' distaste for a particular set of externality effects rather than the inefficiency itself. To the extent that the case for Pigovian taxes on gasoline and fossil fuels are driven by the size of measured externalities, not much can really be inferred about policy. At the end of the day, any proper accounting of the optimal tax will require information about the desirable level of the externality-causing activity itself and not just its externalities. In particular, the net effect of all the other regulations, subsidies, taxes, and private and public transfers relating to this activity must be estimated to justify efficiency-promoting taxation. The relevant issue is not how much pollution/externality remains, but whether the activities causing the externality are at their socially optimal level. In the end, most calls for Pigou taxes are misguided attempts to condemn a particular activity as undesirable without consideration of the true workings of the market. R

## Readings

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