

EXTERNALITIES: PIGOVIAN TAXES AND SUBSIDIES

LET x AND y DENOTE AMOUNTS OF TWO ("PRIVATE") GOODS. THE x -GOOD IS PRODUCED BY USING THE y -GOOD AS INPUT; CONSUMERS CARE ABOUT CONSUMING BOTH GOODS; AND AN EXTERNALITY IS GENERATED BY THE PRODUCTION/ACTIVITY: s DENOTES THE LEVEL OF THE EXTERNALITY.

EACH CONSUMER:

UTILITY FUNCTION $u^i(s, x_i, y_i)$.

ENDOWMENT y_i^0 : ($x_i^0 = 0$).

NOTE THAT THE EXTERNALITY IS "GOOD"
FOR i IF $MRS_s^i > 0$;
... THE EXTERNALITY IS "BAD"
FOR i IF $MRS_s^i < 0$.

PRODUCTION:

$$x = f(z); \quad z = \sum_{i=1}^n (y_i^0 - y_i); \quad s = x.$$

\uparrow $x := \sum_{i=1}^n x_i$ \uparrow

MORE GENERALLY,

$$s = g(x) \text{ OR } s = g(z).$$

CHARACTERIZING THE EFFICIENT ALLOCATIONS:

$$\max_{s, x, y} \sum_{i=1}^n \lambda_i u^i(s, x_i, y_i) \quad \text{s.t.}$$

$$(1) \quad \sum x_i \leq f(z) = f(\sum y_i - \sum y_i) \quad : \quad \sigma$$

$$(2) \quad \sum x_i \leq s \quad : \quad \mu$$

MARGINAL CONDITIONS:

$$x_i: \quad \lambda_i u_x^i = \sigma + \mu$$

$$y_i: \quad \lambda_i u_y^i = \sigma f'(z) = \frac{\sigma}{MC}$$

$$s: \quad \sum \lambda_i u_s^i = -\mu$$

Economic Form:

$$MRS_x^i = \frac{u_x^i}{u_y^i} = \frac{\sigma + \mu}{\sigma f'(z)} = \frac{1}{f'(z)} + \left(\frac{\mu}{\sigma}\right) \frac{1}{f'(z)}$$

$$= MC + \frac{\mu}{\sigma} MC$$

$$\sum MRS_s^i = \sum \frac{u_s^i}{u_y^i} = \sum \frac{\lambda_i u_s^i}{\sigma f'(z)} = \frac{1}{\sigma f'(z)} \sum \lambda_i u_s^i$$

$$= -\left(\frac{\mu}{\sigma}\right) \frac{1}{f'(z)} = -\frac{\mu}{\sigma} MC.$$

$$\therefore \boxed{MRS_x^i = MC - \sum_{j=1}^n MRS_s^j} \quad (i = 1, \dots, n)$$

DECENTRALIZING AN EFFICIENT ALLOCATION VIA PIGOVIAN TAXES AND SUBSIDIES

THE CONSUMER PAYS THE PRICE $P = P_x + P_s$ FOR EACH UNIT HE PURCHASES. HIS FOC IS THEREFORE $MRS_x^i = P_x + P_s$. $P_s = -\sum MRS_s^i$.

THE FIRM RECEIVES THE PRICE $P = P_x + P_s$ FOR EACH UNIT IT SELLS, BUT PAYS THE TAX P_s TO THE GOV'T FOR EACH UNIT; THUS, ITS NET RECEIPT IS P_x PER UNIT. ITS FOC IS THEREFORE $MC_x = P_x$.

THE CONSUMER RECEIVES THE LUMP-SUM TRANSFER OF $(-MRS_s^i)(\sum x_j)$. TOTAL LUMP-SUM PAYMENTS BY GOV'T ARE THEREFORE $(-\sum MRS_s^i)(\sum x_j) = P_s \sum x_j$, WHICH IS ALSO THE TOTAL TAXES COLLECTED.

WE HAVE

$$MRS_x^i = P_x + P_s = MC_x - \sum_{j=1}^n MRS_s^j \quad (i=1, \dots, n).$$

\therefore THE EQUILIBRIUM IS EFFICIENT.

NOTE THAT IF $\sum MRS_s^i > 0$ (i.e., THE EXTERNALITY IS ON BALANCE A POSITIVE ONE), THEN CONSUMERS PAY LESS THAN P_x ; THEY PAY A LUMP-SUM TAX; AND THE TAXES ARE USED TO PROVIDE THE FIRM(S) A PER-UNIT SUBSIDY.

THE "CONTINGENT VALUATION" PROCEDURE ATTEMPTS TO IMPLEMENT THIS PIGOVIAN OUTCOME BY SAMPLING THE POPULATION. INDIVIDUALS IN THE SAMPLE ARE ASKED TO REPORT THEIR MRS_s^i (BUT ARE NOT GENERALLY PAID OR CHARGED BASED ON THE REPORT). THEN THE SAMPLE IS USED TO CALCULATE AN ESTIMATE OF $\sum MRS_s^i$, BASED ON THE DEMOGRAPHICS OF THE SAMPLE.

THERE IS CLEARLY A PROBLEM HERE: IF INDIVIDUALS ARE PAID BASED ON THEIR REPORTED MRS_s^i , THEY HAVE AN INCENTIVE TO ^{REPORT} VERY LARGE NEGATIVE VALUES FOR MRS_s^i . IF THEY ARE NOT PAID, THEIR INCENTIVE IS TO REPORT AN MRS_s^i THAT WILL PULL THE LEVEL OF S (i.e., OF $\sum x_j$) IN THE DIRECTION THEY PREFER, GIVEN WHAT THEY BELIEVE OTHERS ARE REPORTING.

Petrol taxes

Pigou or NoPigou?

An old debate gets a makeover in cyberspace

Nov 9th 2006 | from the print edition

ARTHUR PIGOU, an early-20th-century British economist, might well have shuddered at the thought of [Facebook.com](http://www.facebook.com) (<http://www.facebook.com>), a student networking site. A hermetic academic, awkward in the company of women, he surely would have balked at the dating and the picture uploads. But what would he have made of the "Pigou Club", which has surfaced on Facebook and is giving him unprecedented—even cultish—exposure?

His appearance on the internet is down to a contemporary economist clearly at home in cyberspace: Greg Mankiw of Harvard University. For months, Mr Mankiw, a former adviser to George Bush, has been blogging away in support of "Pigovian taxes" on petrol, believing that a levy of \$1 a gallon would not only bring America \$100 billion of extra revenue but might also reduce global warming.

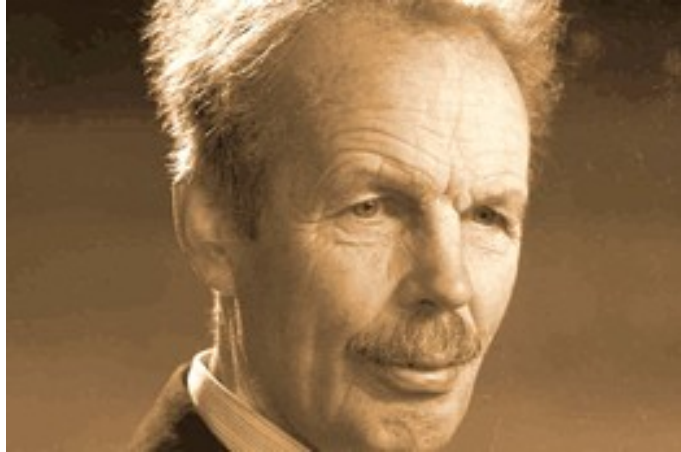
With his Pigou Club Mr Mankiw has whipped up a following behind an economist whose theories on unemployment came under attack from his colleague, John Maynard Keynes. On Facebook, 600 people have signed up to the Pigou Club. Mostly students, they join other Pigovians such as Larry Summers, Gary Becker, and Kenneth Rogoff.

Pigou advocated taxation as a way to combat the negative externalities, or side-effects, associated with certain activities. These have been used to justify levies on cigarettes, alcohol and even traffic congestion. Their advocates argue that they could be used to wean Americans off their dependence on petrol, which degrades the environment, props up unsavoury regimes and clogs traffic.

But governments are not perfect arbiters, say opponents of the Pigou Club. In the spirit of Ronald Coase, an intellectual nemesis of Pigou, a NoPigou club has taken shape on the internet, with its own Facebook following (though with only 59 supporters so far). Coase claimed that a Pigovian tax would penalise producers and consumers and might have other undesirable side-effects. People should be able to negotiate among themselves when there are side-effects, he said. Terence Corcoran, editor of Canada's *Financial Post*, writes a [NoPigou blog](http://nopigouclub.blogspot.com/) (<http://nopigouclub.blogspot.com/>), arguing that such taxes are blunt instruments and governments have insufficient information about them to wield them properly.

Pigou did indeed accept that point, albeit rather late in life, so it is unclear how he would have felt about petrol and global warming. One thing, however, is certain: the reclusive outdoorsman would have found the effects of internet fame decidedly taxing.

from the print edition | Finance and economics



A.C. Pigou in 1943 *Ramsey and Muspratt Collection*