The Social Costs and Benefits of Biofuel Policies

Harry de Gorter
Cornell University

Policy Objectives

1. Energy
   - Reduce dependence on fossil fuels, esp. imports from Middle East
   - Improve environment (air pollution, global warming and traffic congestion)
2. Agriculture and Food
   - Improve farm incomes
   - Reduce tax costs of farm subsidy programs
   - Stimulate rural development

Policy categories

1. Tax credits
2. Mandates

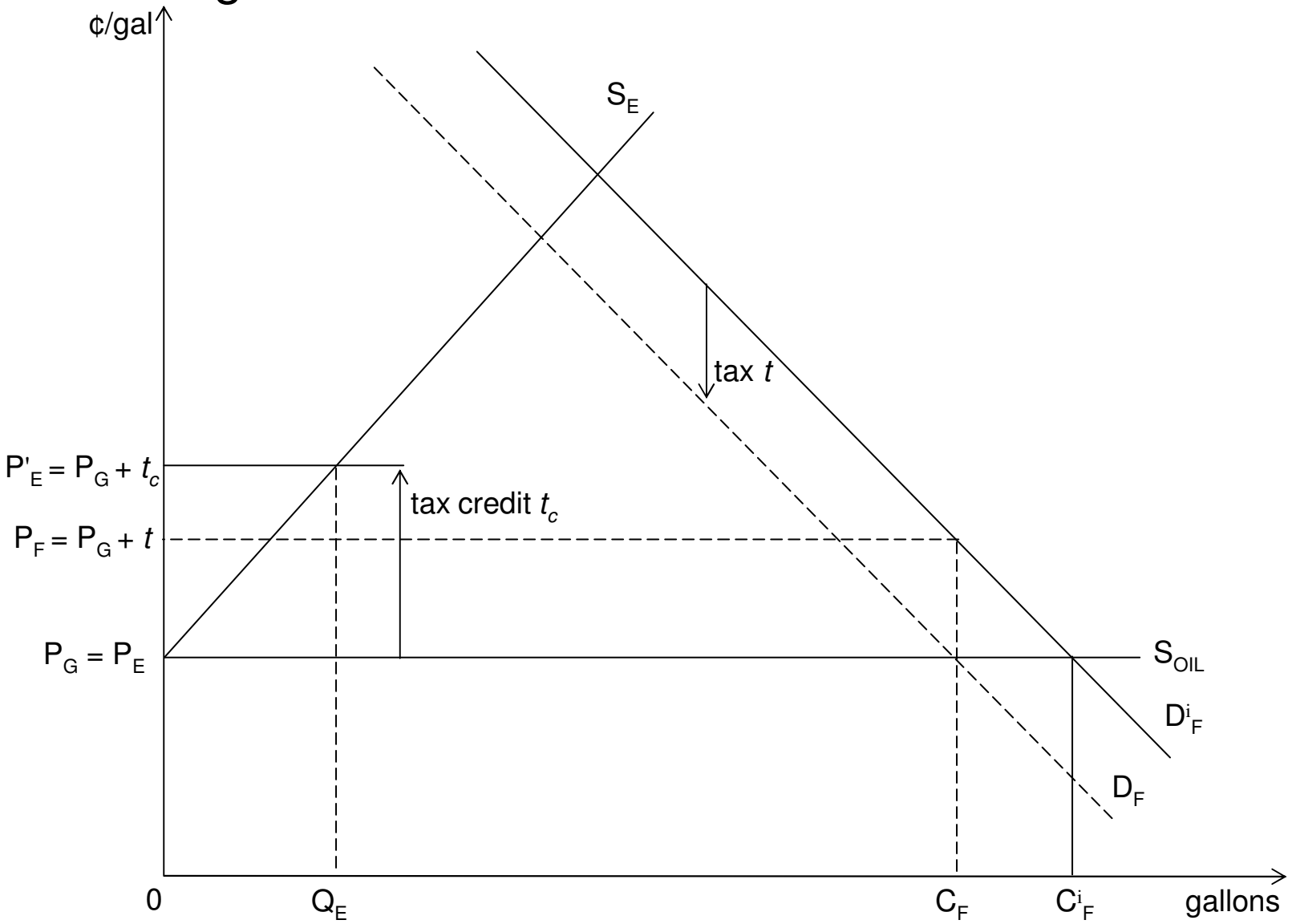
- Farm subsidies
- Import tariffs

The economics of a tax credit

- “Among various support measures, fuel tax exemptions are most widely used”

  (Kojima, Mitchell and Ward, 2007, p. 54)
- Exempted or reduced biofuel excise taxes cover 65 percent of total world fuel consumption (de Gorter and Just 2007a)

Figure 1: The economics of a biofuel tax credit



Price Relationships in "Flex" Model

- Price consumers are willing to pay:

$P_E^* = \lambda(P_G + t)$ where λ = % reduction in mileage (0.70)

$P_E^* >$ or $< P_G$ depending on relative values of P_G, t and λ

- Market price in flex model:

$P_E\hat{} = \lambda P_G - (1- \lambda)t + t_c$

$P_E\hat{} > or < P_E^*$, depending on relative values of t_c, λ and t

$P_E\hat{}$ varies with t

if eliminate t_c, then $P_E\hat{} = \lambda P_G - (1-\lambda)t$

Price of corn (= price of ethanol in $/bu):

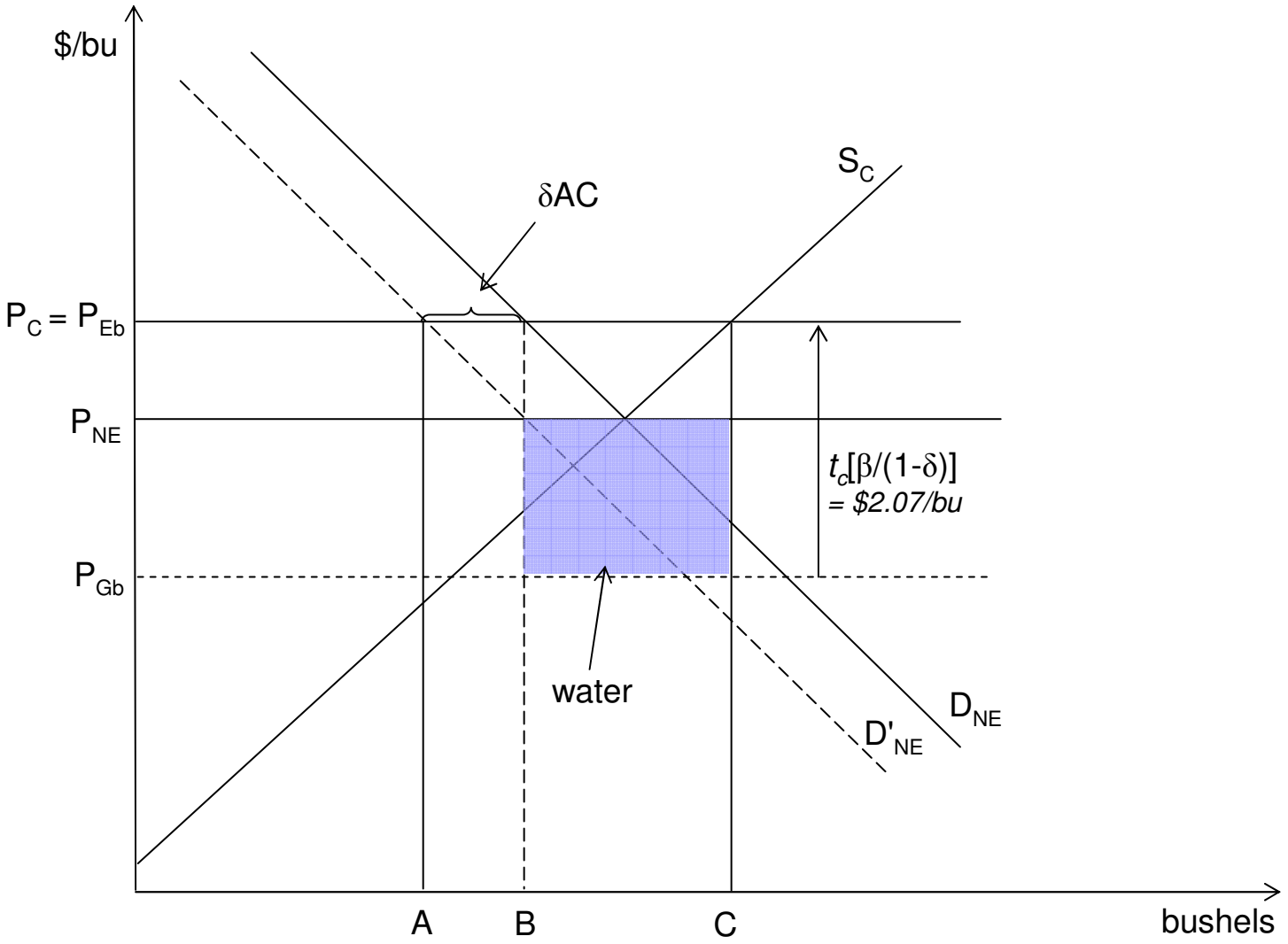
β = gals ethanol from 1 bu of corn (= 2.8)

δ = proportion of the value of corn returned to market in form of by-products (= 0.31)

$$P_{Eb} = \left(\frac{\beta}{1-\delta}\right)\left(P_G + t_C\right) - c_0 \qquad \left(\frac{\beta}{1-\delta}\right) = 4.06$$

t_c = 0.51¢/gal. = $2.07/bu ($2.31/bu if incl. states)

Figure 2: Corn market equilibrium with an ethanol tax credit



The Case of Binding Mandates

- "Virtually all existing laws to promote…biofuels set blending requirements, meaning the percentages of biofuels that should be mixed with conventional fuels" (FAO report by Jull et al. 2007, p. 21).
- In the United States:

1. Consumption Mandates (local, state and federal)
2. Blend "Mandates"
   - *de facto* mandates with environmental regulations (CAA in 1990s and MTBE in this decade)
   - Additive value for ethanol - a complementary good (oxygenator/octane enhancer)

Figure 5: The Economics of a Biofuel *Blend Mandate*

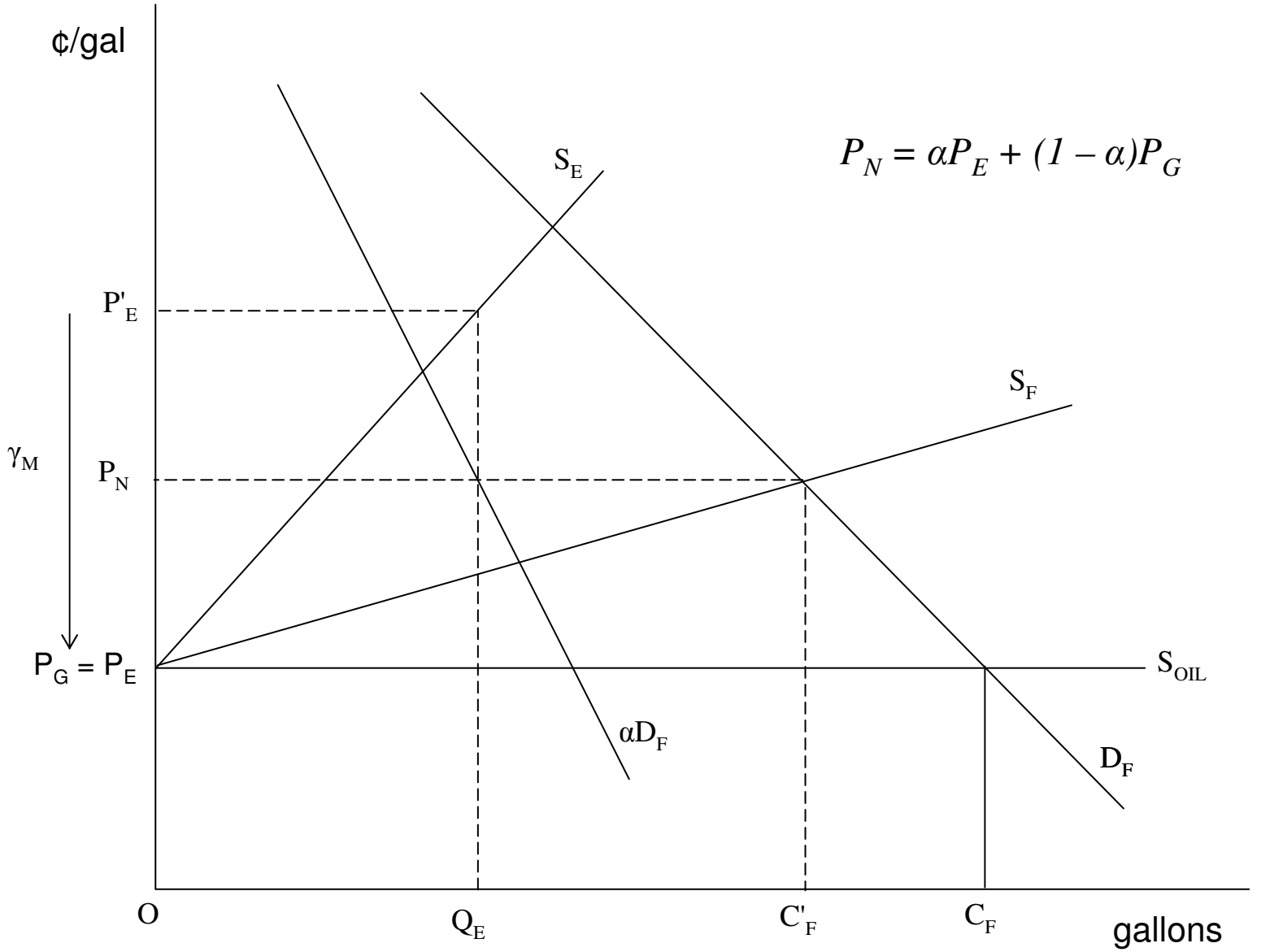


Figure 6: The Economics of a Biofuel *Consumption Mandate*

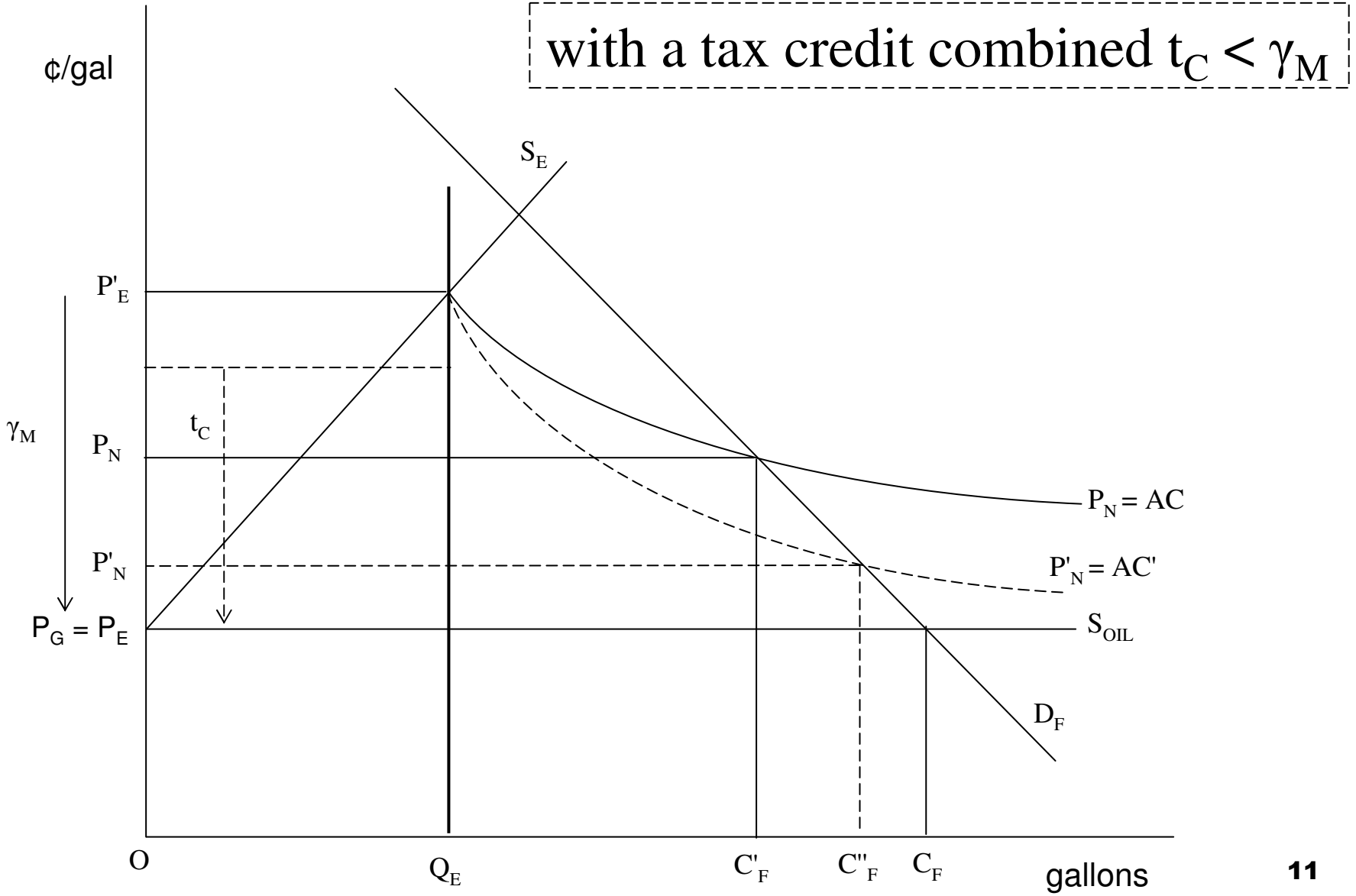


Figure 6: The Economics of a Biofuel *Consumption Mandate*

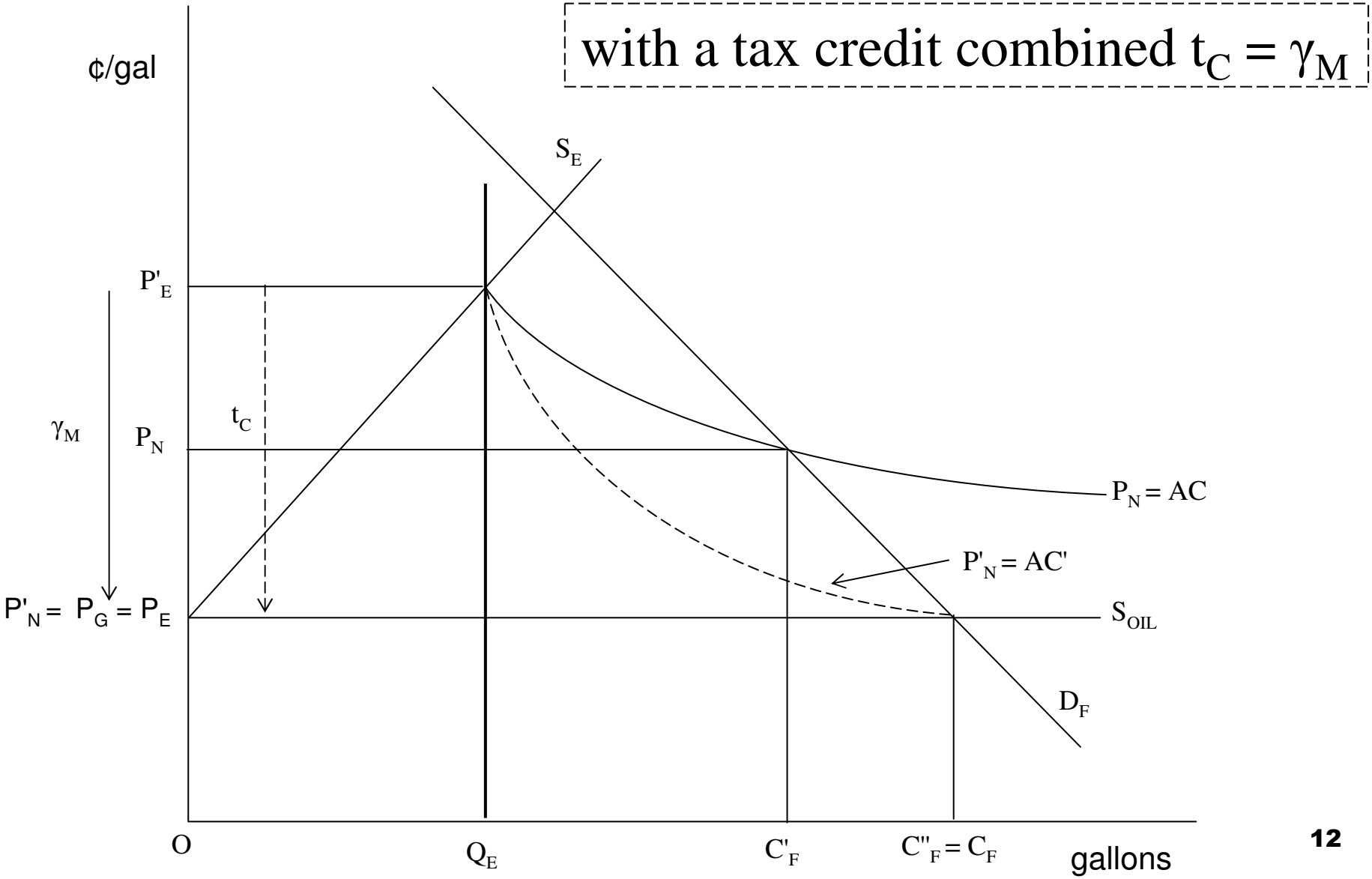
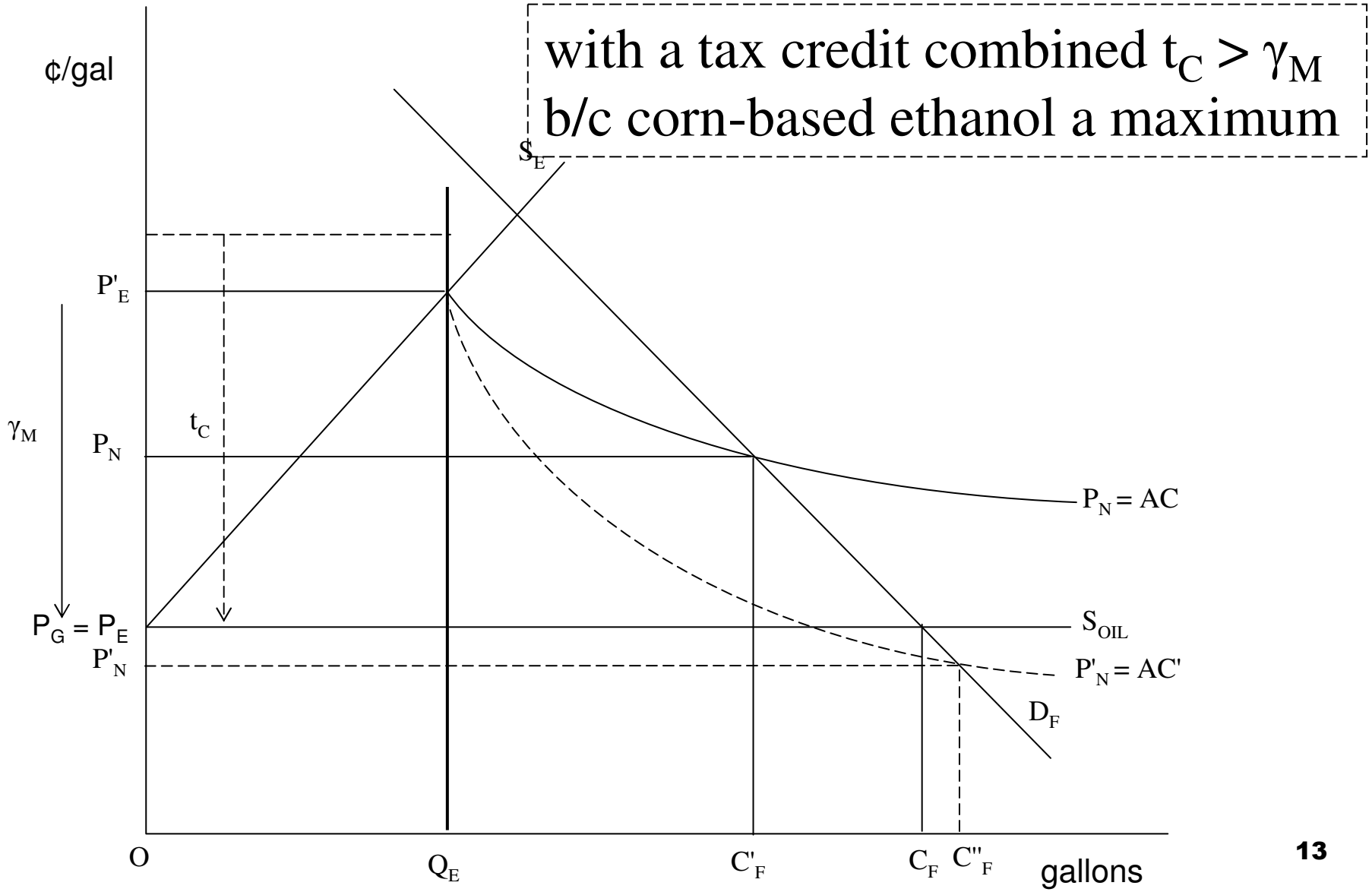


Figure 6: The Economics of a Biofuel *Consumption Mandate*



Import tariffs

- "*Perhaps the most outrageous example is America's $0.54 per gallon import tariff on ethanol… This contrasts with the $0.51 per gallon subsidy that US companies…receive on ethanol. Thus, foreign producers can't compete unless their costs are $1.05 per gallon lower than those of American producers…*"
  Joseph E. Stiglitz (2006).

Import Tariffs

- If only tax credit, tariff reduces world price by tariff (no change in domestic ethanol prices unless world oil prices decline)
- If only mandate, tariff requires more domestic supply so ethanol price increases
- If both a tax credit and a mandate, 3 parts:
  - Net gain for Brazil with tariff (*versus* no policy)
  - But Brazil could gain more if remove tariff
  - U.S. producers get a benefit from tariff

Conclusions

- Need to calculate P_{NE} and rectangular deadweight costs
- Cannot justify biofuel policy for reducing tax costs of farm subsidy programs
- Mandate better than tax credit because:
  - Reduces gasoline consumption more (implicit tax on gasoline)
  - Save tax costs (reduce deadweight costs in labor market due to income-wage tax)
- As P_{OIL} increases, mandate 'unbinds' at some point but a tax credit continues to distort

Conclusions (cont'd)

- With a mandate, tax credit acts as a gasoline consumption subsidy:
  - Increase in gasoline consumption offsets decrease in gasoline consumption due to mandate (partially or all)
  - Or offsets even more if tax credit > ethanol price premium due to mandate
- All countries have both tax credits and mandates
- U.S. cellulosic mandates will probably bind and have higher tax credits than previously
- Price premiums are 'subtractive'

Conclusions (cont'd)

- Even if mandate not binding, tax credit implicitly subsidizing gasoline consumption b/c:
  - Prevents mandate from binding (with higher P_G)
  - Can increase mandate to get same ethanol price as existing tax credit
- *Variable* tax credit even worse b/c subsidizes gasoline consumption as P_{OIL} declines (latter already increasing gasoline consumption)
- Farmers better off with mandate over tax credit b/c latter always results in higher P_{OIL} (input costs always higher)

Conclusions (cont'd)

- 1st best, 2nd best and *bad*: need to go to *least bad* (going from bottom up; not down from top)
- Eliminate tax credit
- Eliminate import tariffs
  - Meant to offset tax credits
  - Minimal impacts on world oil price
  - Lowest costs for biofuels
  - Encourage switch in biofuel use from food crops to non-staple and non-food crops in developing countries
- Maintain a mandate
  - *Blend* mandate better than a *consumption* mandate
    - Smoothes prices
    - Easier to achieve
    - If tax credit, @ least P_E increases

Conclusions (cont'd)

- International coordination
  - Ideally want average fuel price paid by consumers equal across countries (adjusted for any differentials in local externalities)
- Thumb rule: have mandates inversely proportional to gasoline taxes
- Practical b/c countries with lower gasoline taxes have relatively lower biofuel production costs (e.g., USA, Canada and Australia)

References

(1) de Gorter, Harry, and David R. Just. (2008). "'Water' in the U.S. Ethanol Tax Credit and Mandate: Implications for Rectangular Deadweight Costs and the Corn-Oil Price Relationship", Paper presented at the ASSA annual meetings in New Orleans, 4-6 January 2008. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1071067

2) de Gorter, Harry, and David R. Just. (2007a). "The Welfare Economics of an Excise-Tax Exemption for Biofuels and the Interaction Effects with Farm Subsidies", Department of Applied Economics and Management Working Paper # 2007-13, Cornell University, 17 September. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1015542

(3) de Gorter, Harry, and David R. Just. (2007b). "The Law of Unintended Consequences: How the U.S. Biofuel Tax Credit with a Mandate Subsidizes Oil Consumption and Has No Impact on Ethanol Consumption", Department of Applied Economics and Management Working Paper # 2007-20, Cornell University, 23 October. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1024525

(4) de Gorter, Harry, and David R. Just. (2007c). "The Economics of U.S. Ethanol Import Tariffs with a Consumption Mandate and Tax Credit", Department of Applied Economics and Management Working Paper # 2007-21, Cornell University, 23 October. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1024532

References (cont'd)

Goulder, Lawrence H. and Roberton C. Williams III. (2003). "The Substantial Bias from Ignoring General Equilibrium Effects in Estimating Excess Burden, and a Practical Solution", *Journal of Political Economy*, 2003, vol. 111, no. 4:898-927.

Parry, Ian and Kenneth Small (2005). "Does Britain or the United States Have the Right Gasoline Tax?," *American Economic Review* Vol. 95, No.4 (September): 1276-1289.

Parry, Ian W. H., Margaret Walls and Winston Harrington. (2007). "Automobile Externalities and Policies". *Journal of Economic Literature*, June Vol. 45, Issue 2:373-399.