

IMPACTS OF ENERGY TAXES AND SUBSIDIES

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Keywords: energy taxes, energy subsidies, price gap approach

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Summary

There are numerous taxes and subsidies affecting the production and consumption of energy throughout the world. Taxes and subsidies affecting the production and consumption of fossil fuels are probably of most interest to readers of the *Encyclopaedia of Life Support Systems* since a number of adverse environmental impacts result from the combustion of fossil fuels.

Most taxes on the production and consumption of fossil fuels do not have a dominant environmental goal although their removal would have environmental impacts. Gasoline is by far the most heavily taxed fossil fuel. Removal of gasoline taxes in Europe would result in marked increases in consumption while increasing taxes in North America to levels applying in Europe would reduce world carbon dioxide emissions by about 5 per cent.

Consumption of fossil fuels is heavily subsidized in many non-OECD economies while production of coal is subsidized in several OECD economies. There was a general reduction in subsidy levels throughout the 1990s.

Analysis of the direct impacts of removing subsidies suggests that removal could significantly reduce world consumption of fossil fuels and associated adverse environmental impacts. Such a conclusion is less certain when the indirect impacts of subsidy removal are considered. Removal of subsidies in non-OECD economies would increase supplies to the export market, reducing world prices and stimulating consumption in OECD economies. Removal of European coal subsidies would relocate

production to lower cost producers without necessarily greatly reducing world consumption. There is a need for further study of these indirect impacts with the only two studies undertaken so far producing conflicting results about their relative significance. It is also necessary to consider policies that might replace subsidies, such as income transfers to the poor in developing countries, since they may affect demand for fossil fuels.

Although the environmental benefits of removing subsidies are uncertain, their removal is readily justified by the resulting gains in world economic welfare.

1. Introduction

An energy tax or subsidy literally means that production or consumption of energy is taxed or subsidized where energy is expressed in physical units such as petajoules. There appear to be few actual taxes or subsidies that take this form. However, there are numerous taxes and subsidies that do influence the production and consumption of energy.

A proposal for a directive adopted by the European Commission in March 1997 set minimum rates of tax for members to apply to a range of fossil fuels and electricity. Exemptions could be granted for energy intensive industries and electricity generated from renewable sources. Tax rates across the different fuels do not necessarily reflect energy content but there were some adjustments within some groups related to energy content.

From the perspective of the Encyclopaedia of Life Support Systems, the major interest in energy taxes and subsidies would appear to be in taxes and subsidies influencing the production and consumption of fossil fuels. Combustion of fossil fuels has a number of adverse environmental impacts. Emissions of sulfur dioxide, nitrogen oxides and particulates have been shown to have an adverse effect on human health (especially respiratory problems) while the acid rain problem from sulfur dioxide emissions damages crops, forests and man-made structures (through corrosion). More recently there has been much concern about emissions of carbon dioxide from the combustion of fossil fuels contributing to the risk of global climate change. There has also been concern about adverse environmental impacts from the production and distribution of fossil fuels such as the release of the greenhouse gas methane from coal mining.

The above adverse environmental impacts of the production and consumption of fossil fuels are not reflected in market prices. There would be a case for taxing the production and consumption of fossil fuels so that market prices do reflect any established environmental damage.

While production or consumption of some fossil fuels is taxed in many countries, the primary aim of most of these taxes is not to reflect environmental damage. For example, gasoline is taxed in most developed and developing economies but the dominant aim of the tax is usually to raise government revenue. Nevertheless, the removal of taxes on gasoline or other fossil fuels could have environmental implications to the extent that this resulted in increased production and consumption of fossil fuels.

The existing structure of taxes on fossil fuels has not attracted a great deal of research interest. There has been much more research interest in the possible impacts of introducing carbon taxes, which are taxes on the carbon content of fossil fuels. Such taxes are specifically aimed at reducing carbon dioxide emissions and could be considered a form of energy tax. Carbon taxes are discussed in a separate article.

While there has been little research interest into the existing structure of taxes on fossil fuels, there has been much more research interest in subsidies on fossil fuels. It has been shown that the production and consumption of fossil fuels is heavily subsidized in many developing and, to a lesser degree, developed economies. Subsidies are more frequently directed at consumption in developing economies and production in developed economies. The major aims of subsidising consumption of fossil fuels in developing economies appears to be to make energy cheaper for poorer households and to encourage economic growth with low cost energy. The major aim of subsidising production in some OECD countries appears to be (especially in the case of coal) to maintain local production and employment in the face of import competition.

The concept of subsidies used in the literature is broader than direct government payments to producers or consumers. Economic and environmental implications will follow from any government policies that lower the cost of energy production, raise the price received by energy producers or lower the price paid by energy consumers. All policies with such an effect can be regarded as forms of subsidies and so include restriction on exports, protecting markets for domestic production (through tariffs, quantitative restrictions on imports or requiring that some domestic buyers purchase from domestic producers at above import prices), interest subsidies, preferential tax treatment and so on.

There are some subsidies that may reduce the demand for fossil fuels and these have not been included in the studies of subsidies. In some countries household insulation is subsidized to reduce the demand for energy and ultimately fossil fuels. Furthermore, in some countries production of some types of non-fossil fuel forms of electricity generation is also subsidized.

To the extent that subsidies increase consumption of fossil fuels, removal of these subsidies would reduce adverse environmental impacts. These subsidies may also have adverse effects on the efficiency of global resource allocation and their removal could also yield economic benefits.

Most research has been directed at attempting to quantify the size of existing subsidies. Efforts to analyse the impact of their removal has mainly involved partial models where many variables are held constant. There is a clear need for a much more general analysis of the removal of subsidies where all the global ramifications are examined. Such an analysis may show that the reduction in adverse environmental impacts may be less dramatic than may appear from a partial analysis. It is also necessary in such an analysis to consider the types of alternative policies that might be introduced to replace subsidies. Subsidies have various policy aims and when the impact of replacement policies with similar aims is considered, the reduction in adverse environmental impacts

may be less pronounced than would appear from a simple analysis of the direct removal of subsidies.

In this article, the existing structure of taxes on fossil fuels is briefly reviewed. Efforts to quantify subsidies on fossil fuels are then discussed. Studies of the impacts of removing these subsidies using both partial and general models are next considered.

2. Taxes on Fossil Fuels

2.1. Theory

Imposing taxes on the consumption of fossil fuels is a market based approach to limit the environmental damage arising from the consumption of fossil fuels. It would be possible to determine the socially appropriate tax rate if it were possible to quantify in monetary terms the damage that would be avoided by reducing the consumption of fossil fuels and the costs that would be incurred. The appropriate tax rate would be determined at a level where the incremental costs of reducing consumption by an additional unit (marginal costs) was just equal to the incremental damage that would be avoided (marginal benefits). Net benefits from reducing consumption of fossil fuels are maximized at the point where marginal benefits are equal to marginal costs.

Marginal benefits of reducing consumption of fossil fuels may vary regionally within a country. For example, the acid rain problem arises in regions where there is a high concentration of sites emitting sulfur dioxide and high rainfall. It is likely to be a less serious problem in drier regions with limited numbers of sulfur dioxide emitters. Similarly, environmental problems arising from petroleum consumption are greatest in densely populated urban areas. Such regional differences in environmental impacts implies that the optimal tax should vary regionally.

A major appeal of taxes as a policy instrument is that incentives are created for market forces to find the least cost pattern of adjustment. Under a regulatory approach, the authorities would simply impose limits on different emission sources with little knowledge of the costs that would be incurred in meeting these limits.

2.2. Existing Taxes on Fossil Fuels

There are a number of taxes on the production and consumption of fossil fuels throughout the world. However, the dominant aim of these taxes is seldom to reduce environmental damage. Some exceptions are the carbon taxes imposed by Scandinavian countries and an air pollution tax that applies to imports of steaming coal into Taiwan. Although an environmental goal may not be the dominant aim of most taxes on fossil fuels, removal of these taxes would have environmental implications. Consumption of fossil fuels apart from gasoline are lightly taxed or not taxed at all in most countries. Gasoline is by far the most important case where the existing tax structure may limit consumption.

In the absence of taxes, gasoline would represent a relatively small proportion of the total costs incurred in owning and operating a motor vehicle. As a result, demand for

gasoline is relatively unresponsive to changes in the price of gasoline over a reasonably wide range. Within this range a one per cent increase in the tax on gasoline would result in less than a one per cent decline in consumption of gasoline so that total tax revenue would be increased by raising the tax. Given these properties, gasoline has been a favored commodity for revenue raising taxes.

Country	Tax (%)
France	76
Germany	72
Italy	70
Spain	64
UK	79
Japan	57
Canada	56
USA	30

Source: International Energy Agency

Table 1. Tax on Unleaded Gasoline as a Percentage of End Use Price at November 1999

From table 1 it is apparent that gasoline is relatively highly taxed in the OECD economies shown. Assuming an elasticity of demand (the percentage change in the quantity consumed in response to a one per cent change in price) of 0.35 removal of the tax could result in an increase of consumption of more than 25 per cent in several countries. It is also apparent that gasoline is comparatively lightly taxed in the United States. It has been estimated (assuming an elasticity of demand of 0.5 per cent) that if the tax on petroleum fuels in North America was increased to the levels applying in Europe, world carbon dioxide emissions could be reduced by about 5 per cent.

Environmental goals have influenced the tax relativities between different types of gasoline in some countries. For example, leaded gasoline is taxed at a marginally higher rate than unleaded gasoline under the proposed European Union 1997 directive and in Australia, mainly due to the assumed difference in environmental impacts from consumption. However, the reverse situation applies in many other countries where redistributive goals appear to be stronger than environmental goals. Consumers of leaded gasoline typically own older motor vehicles and are likely to be poorer than consumers of unleaded gasoline.

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Biographical Sketches

Brian Fisher was first appointed ABARE's Executive Director in November 1988. During 1984–85, Dr Fisher was Chief Research Economist, then Deputy Director, of the former Bureau of Agricultural Economics. He was appointed to the chair in Agricultural Economics at the University of Sydney in 1985, becoming Dean of the Faculty of Agriculture at the University in 1987.

Dr Fisher has been the government board member on a number of statutory corporations, including the Australian Wool Realisation Commission, Wool International and the Australian Animal Health Council. In 1995 and 1996, he was the Chairman of the Board of the Australian Animal Health Laboratory.

In 1993 Dr Fisher was appointed one of the experts completing the socioeconomic assessment of climate change for the United Nation's Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report. Dr Fisher played an integral role in the international climate change negotiations as economic adviser to Australia's negotiating team in the lead up to, and at, the third Conference of the Parties in Kyoto. He fulfilled that role at the fourth Conference of the Parties in Buenos Aires in November 1998 and did so again at the fifth Conference of the Parties held in Bonn in November 1999. He is currently engaged as one of the experts completing the IPCC's Third Assessment Report.

Dr Fisher has published over 190 papers and monographs. He received the Farrer Memorial Medal in August 1994 and became a fellow of the Academy of Social Sciences in Australia in November 1995. Dr Fisher holds a PhD in agricultural economics from the University of Sydney.

Mike Hinchy is a Senior Economist at the Australian Bureau of Agricultural and Resource Economics. During the past ten years he has specialized in the economics of climate change writing numerous papers on emission trading schemes and general equilibrium modeling of the impacts of policies to combat climate change. He has been a contributing author to the Second and Third Assessment Reports of the Intergovernmental Panel on Climate Change. He has published over 60 papers and research monographs. He holds the degrees of BEc. (Hon) from the University of Sydney and MSc. from the University of Cambridge.