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Toward an optimal U.S. ethanol fuel subsidy

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Abstract

Enhanced environmental quality, fuel security, and economic development along with reduced prices of ethanol–gasoline blends are often used as justifications for the U.S. federal excise tax exemption on ethanol fuels. However, the possible effect of increased overall consumption of fuel in response to lower total price, mitigating the environmental and fuel security benefits, are generally not considered. Taking this price response into account, the optimal U.S. ethanol subsidy is derived. Estimated values of the optimal subsidy reveal that the subsidy's environmental and security benefits are questionable. However, positive environmental and security benefits from the ethanol tax-exemption subsidy may be obtained if the subsidy is combined with an increase in the excise tax on gasoline.

Keywords: Economic development; Energy security; Environmental quality; Ethanol; Excise tax; Renewable fuels; Tax exemption

The U.S. ethanol federal excise tax exemption on vehicle fuels has existed in controversy since its inception in 1978. Designed to provide incentives for the establishment and development of a U.S. renewable fuels industry, proponents have praised its lasting and expanding benefits while critics have condemned it as deadweight loss corporate welfare. Supporters – including the American Coalition for Ethanol and American Corn Growers Association – argue that the ethanol fuel tax exemption (subsidy) helps to improve air quality, leads to energy security, spurs economic development, reduces greenhouse gases, and lowers the overall price of vehicle fuels. For example, a study by Cooper (2003) states that consumers could save $0.08 per gallon if more ethanol were introduced into U.S. fuel markets. In contrast, Taxpayers for Common Sense argue there is only an artificial demand for ethanol solely based on governmental subsidies and the subsidies are a corporate bailout for agribusiness conglomerates. For a more detailed discussion on the merits of

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and concerns with the ethanol subsidy, the reader may refer to the National Center for Policy Analysis (2005).

Analyses behind both of these popular counter positions tend to miss the (somewhat unintended) effect of an indirect demand response to the ethanol subsidy. Although vehicles that can use both conventional gasoline and the E85 fuel (blend of 85% ethanol and 15% petroleum gasoline) are commercially available, only five million of these so-called flex cars were on U.S. roads in 2005 (Lundegaard, 2006). By far, the bulk of the ethanol fuel has been used in E10 fuels, which contain only 10% ethanol and 90% conventional gasoline. Reduction in ethanol price due to subsidy then translates into lower price of blended fuels, causing higher demand for the blended fuels in general and their primary component – fossil fuels – in particular. This possible increase in petroleum fuel use, due to an ethanol subsidy, may then mitigate the other beneficial effects of the subsidy. In particular, the environmental benefits of improved air quality and reduced greenhouse gases along with fuel security benefits may be reduced or completely offset by the increased use of fossil fuels. Surprisingly there is little or no acknowledgment of this indirect price response effect, much less an investigation of it. One reason for the lack of interest may be an assumption that the consequences are second-order small and thus of limited concern. However, the impact the elasticity of total fuel use with respect to the ethanol subsidy has on the environmental and security benefits of the ethanol subsidy should be investigated prior to reaching such a conclusion. If the total effect of an ethanol subsidy is to be determined, such price responses should be taken into account.

Our objective is to derive the socially optimal U.S. ethanol subsidy incorporating a comprehensive evaluation of the environmental, security, and economic development benefits. This optimal subsidy is based on utility maximization which explicitly incorporates the effect that an ethanol subsidy not only stimulates the use of renewable fuel, but, as a side effect, also provides a price incentive for agents to increase their use of fossil fuels. Specifically, we analyze the hypothesis that this increased consumption of fossil fuels can mitigate and possibly completely offset the environmental and security benefits of the subsidy. The optimal subsidy is then estimated given published parameter values. The sensitivity of the optimal ethanol subsidy to elasticities and the marginal welfare gains from improvements in the environment and security are also analyzed.

The remainder of the paper is organized as follows. The next section presents a brief overview of the U.S. ethanol market. A theoretical model for the optimal ethanol subsidy is developed next, followed by a discussion of parameter values used to evaluate the subsidy. The results of estimation and sensitivity analysis are presented in the following two sections. The last section discusses implications of our results and presents concluding comments.

1. Current ethanol tax exemption provisions and benefits

The force behind the recent rapid expansion of the ethanol–fuel market is the current phasing-out of MTBE (methyl–tertiary–butyl ether) as a fuel oxygenate and its replacement with ethanol. The ethanol–fuel market received a further boost from the 2005 Energy Bill which, while eliminating the oxygenate requirement, sets a new goal for expanding domestic fuel supplies with renewable fuels, mainly ethanol and biodiesel. In particular, the renewable fuels standard sets a national minimum usage requirement of four billion gallons in 2006 with a mandated increase to 7.5 billion gallons in 2012. More importantly the ethanol tax incentive at $0.51 per gallon is extended through December 31, 2010. Thus, the 2005 Energy Bill will boost the total market for ethanol by mandating minimum usage and provide a price subsidy for achieving this level of usage. This represents a fundamental shift in the pattern of ethanol fuel use. Until recently, ethanol