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The Marginal Cost of Public Funds for Excise Taxes in Thailand†

Abstract

We extend the Ahmad and Stern (1984) framework for calculating the marginal cost of public funds (MCF) for excise taxes in Thailand by incorporating non-tax distortions caused by (a) environmental externalities, (b) public expenditure externalities, (c) market power in setting prices, (d) addiction, and (e) smuggling or tax evasion. Our calculations, based on our benchmark parameter values, indicates that the MCFs are 0.532 for fuel excise taxes, 2.187 for tobacco excise taxes, 2.132 for alcohol excise taxes and 1.080 for the VAT. Using pro-poor distributional weights does not change the relative

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the MCFs the non-tax distortions created by (a) environmental externalities, (b) public expenditure externalities, (c) addiction, (d) market power, and (e) smuggling. Our analysis, based on our benchmark parameter values, indicates that the MCFs are 0.532 for fuel excise taxes, 2.187 for tobacco excise taxes, 2.312 for alcohol excise taxes, and 1.080 for a VAT increase. We also use pro-poor distributional weights and data on the spending patterns of 90 household groups in Thailand to calculate distributionally-weighted MCFs, but this procedure does not change the ranking of the social marginal cost of the excise taxes. Finally, we show that a revenue-neutral marginal tax reform—reducing the excise tax rates on alcohol and tobacco by one percentage point and increasing the fuel excise tax—would result in a net efficiency gain equal to 1.72 Baht for every additional Baht of fuel tax revenue.

vector of consumer prices and I is lump-sum income. Later we show how to incorporate distributional concerns in the measurement of the social marginal cost of public funds (SMCF).

Total tax revenues $R = \sum_{i=1}^{n} t_i x_i$ depend on the tax rates, t_i, imposed on the n commodities, denoted by the x_is, that are consumed by the individual. A money measure of the harm imposed on the individual in raising an extra dollar of tax revenue by increasing tax rate t_i is defined by the expression:

$$MCF_{t_i} \quad \frac{\frac{1}{(q, I)} \frac{dV}{dt_i}}{\frac{dR}{dt_t}} \qquad (1)$$

where (q, I) is the individual's marginal utility of income. In defining the MCF_{t_i}, it is assumed that dR/dt_i is positive, i.e. that the government is operating on the upward-sloping section of its Laffer curve with respect to t_i.

Rule for optimal commodity taxation states

problem. The individual make consumption decisions according to the following utility function:

$$U^{*} \quad V(x_1) \quad C(x_1) \quad x_2 \tag{5}$$

where is a positive parameter. If < 1, the individual is said to have a self-control problem because he does not take into account the full personal cost consuming x_1. The individual's budget constraint is q_1

$$MCF_{t_1} \quad \frac{1 \qquad {}_{A_1} \quad {}_{11}}{1 \qquad {}_{1} \quad {}_{11}} \tag{10}$$

assuming that there are no other distortions in the economy. If the government could raise revenue by imposing a lump-sum tax, such that its MCF was 1.00, then the optimal tax rate on the commodity would be ${}_{i} \qquad {}_{A_i} \quad 1 \qquad (C_{x_i} / q_i)$. The optimal sin tax rate would reflect the *neglected* proportion of the additional cost incurred in spending an additional dollar on x_1. See O'Donoghue, T. and M. Rabin (2006) for further discussion of optimal sin taxes.

Obviously, incorporating these self-control distortions into the calculation of the MCF is controversial, but we think that lack of self-control problems, especially with regard to tobacco products, reflects public opinion and policy-makers' views concerning the use of excise taxes. For this reason, we think that it is important to incorporate defective decision-making explicitly in the model so that it can be compared with the other distortions that affect the MCF. In this way, a better judgment can be made concerning the relative importance of self-control problems in the overall assessment of the appropriate level of excise taxation.

monopoly on the sale and distribution of domestically produced cigarettes in Thailand. In this situation, the MCF is equal to:

$$MCF_t(\qquad 1) \qquad \frac{1}{1 \quad (\qquad _M)} \tag{16}$$

which is independent of the degree of tax shifting. In this case, the total tax rate on the product is effectively $\qquad _M$.

Norton (1988) has developed an economic model of smuggling and Usher (1986) and Ray (1997, 380-384) have incorporated tax evasion into the calculation of the MCF. Below, we outline a simple model that incorporates smuggling into the MCF for an excise tax. Suppose the elasticity of the supply of the smuggled commodity is $\quad ^s \quad 0$. The price of the smuggled commodity will reflect its production cost plus the smuggling costs that are incurred by the smugglers, $q^s = p + c^s$. It will be assumed that these smuggling costs are less than the per unit excise tax imposed on the legitimate goods. Consumers are willing to buy smuggled goods as long as the price of a smuggled good plus the search costs, f, are less than the price of a legitimate good cigarette, $q^s = q - f$. Assuming the excise tax increases are fully reflected in the price of the legitimate good, this implies that $dq/dt = dq^s/dt = 1$ if search costs are relatively constant. The demand for the legitimate goods that are fully taxed is the difference between the total demand and the demand for smuggled goods or x^l

where $s_i^h \quad x_i^h / x_i$ is household h's share of the total consumption of commodity i. The $_i$ parameter is known as the distributional characteristic commodity i, and it measures the social harm caused by increasing total household expenditure on x_i by a dollar. Note that $_i$ will tend to be larger when ^{h} and s_i^h are positively correlated. This means that $_i$ will be high for commodities that are consumed mainly by the poor.

The social marginal cost of public funds from taxing commodity i can be defined as:

$$SMCF_{t_i} \quad \frac{\frac{dS}{dt_i}}{\frac{dR}{dt_i}} \quad {}_i \, MCF_{t_i} \tag{20}$$

To compute the $_i$s, we need the ^{h}s which reflect a society's, or perhaps more accurately its policy-makers', willingness to trade-off gains and losses sustained by different segments of society. The distributional weights are based on value judgments, and economists have no spec

Note that the components of the MCF that reflect the distortions are multiplied by the

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The estimated demand elasticities are shown in the matrix below. (The own-price elasticities are along the diagonal.)

-0.1033	-0.0959	0.0818	0.1940	-0.0262	-0.0730	0.0545	-0.6860	-0.0486	0.0649
0.7103	-0.8429	-0.0125	-0.2744	0.4372	0.5244	-0.9369	0.1127	0.8354	-0.8950
-0.0348	-0.5159	-0.7992	-0.0835	0.1114	-0.0185	-0.1424	0.2369	0.1969	-0.3799
-0.5169	-0.3983	0.0281	-0.8380	0.1388	-1.1741	0.5797	0.2243	-0.6041	0.4520
0.0206	1.0223	-0.6111	1.8406	-1.5239	1.2575	-1.1766	1.8135	1.4716	-1.6749
-0.2923	-0.3043	0.2181	0.6647	-0.0927	-0.1833	0.2832	-0.5222	-0.1347	-0.0513
-0.2673	0.2926	0.1845	-1.4932	0.9452	1.2515	-0.2462	-0.2629	0.6606	-2.5485
0.1650	0.1295	-0.0802	0.7296	-0.5065	-0.0600	-0.2327	-0.0228	0.3480	-0.3652
0.0851	-0.1283	0.1458	0.0926	-0.4631	-0.3089	0.1216	-0.1335	-0.5734	0.1231
-0.9002	0.0565	0.0221	-1.1178	0.3235	0.2813	0.1250	-0.2827	-0.3962	-0.4540

The price elasticities of demand for the ten commodities were estimated, using the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980), based on data on consumption expenditures from 1983 to 2002 in the Thailand National Income Account. The observations for 1998-99 were omitted because of the non-normal consumption shares in that year due to the economic crisis that began in the fall of 1997. (An appendix describing the demand estimation is available from the authors upon request.)

Our estimated own-price elasticity for alcoholic beverages is quite high, - 0.8429, compared to the -0.54 estimate obtained by Sarntisart (2003). However, it is less elastic than the values in the TDRI (2005) study where the price elasticities for color tax rate increase will be offset by declines in tobacco and fuel excise tax revenues. (The net effect on other commodity tax revenues is indeterminate, but likely to be relatively small.) This negative effect on tobacco and fuel excise tax revenues will tend to raise the MCF for alcohol excise taxes. However, the reductions in the consumption of tobacco and fuel would also reduce the MCF for alcohol excise taxes if the net distortion for these commodities, captured by the $E_j \quad A_j \quad 1 \quad {}_j \quad M_j$ terms in the MCF formula, are negative i.e. marginal social cost exceeds marginal social benefit.

The price elasticity for tobacco products is -0.7992, which is close to the -0.83 value obtained in a study by Pattamasiriwat (1989), but substantially higher than the -0.39 price elasticity found by Sarntisart (2003) based on household tobacco consumption data.[8] The differences may be due to smuggled or non-taxed cigarettes which the study by Sarntisart indicated are fairly prevalent in Thailand. (He found that about 46 percent of imported cigarette package littering in five provinces across Thailand were untaxed cigarette.) In other words, the price elasticity using data from the National Income Account is higher than for total household cigarette consumption, where taxed and untaxed cigarettes are included. Galbraith and Kaiserman (1997) found the same relationship in Canada where the price elasticity for taxed cigarettes was higher (-1.01) than that for total (taxed and untaxed) cigarette consumption (-0.4). Another study from Canada by Gruber, Sen and Stabile (2002) also found that the demand for taxed cigarettes was higher than the total demand (-0.70 versus -0.45). Our cross-price elasticities of demand imply that an increase in tobacco taxes will increase tax rate is a uniform tax rate because all good are equally "substitutable" with leisure, the non-taxed good.

Given the importance that the theoretical literature on optimal taxation has attached to the cross-price elasticities between leisure and commodities, it is important to briefly review the few papers have examined the empirical significance of the separability assumption for computing MCFs for commodity taxes. Madden (1995, p. 497), noting that several econometric studies of consumer demands and labour supplies reject the separability assumption, estimated models with and without the separability assumption, based on data for Ireland 1958-1988, and concluded that the MCF "rankings do not appear to be very sensitive to assumptions regarding separability between goods and leisure". In particular, he found that the MCFs for alcohol, tobacco, and fuels were 1.664, 1.397, and 1.193, respectively, without imposing separability and 2.304, 1.504, and 1.418 when separability was imposed.[10] Although Madden's estimates of the MCFs were higher when separability between leisure and commodities was imposed in estimating the demand elasticities, the rankings of the MCFs for the three commodities subject to high levels of excise taxation did not change. In his computations of the efficiency effects of excise taxes in the U.K., Parry (2003) assumed that petrol and alcoholic beverages were substitutes for leisure and that cigarettes were a complement. However, the implied cross-price elasticities between leisure and the price of these commodities were very low and did not have a material effect on Parry's measures of the marginal excess burdens imposed by the excise taxes.[11]

In marked contrast with the above studies, West and Williams (2006) found that including the cross-price effect between labour supply and the price of gasoline had a significant effect on the magnitude of the MCF for the excise tax on gasoline in the United States. They estimated a model based on individual household's expenditures gasoline and all other goods and their labour income, and found that higher gasoline prices increased labour income (reduced the demand for leisure). This reduced the MCF from taxing gasoline and increased the optimal gasoline tax rate. However, only one of the three cross-price elasticity between labour income and the price of gasoline that they estimated was significantly different from zero (males in households with two adults) and that point elasticity was very low 0.013.

The West and Williams results are somewhat surprising, and the importance of the cross-price effects between excise taxes and labour supplies need to be investigated more completely. Given our current and very limited knowledge about the importance of these effects, we have proceeded by adopting the conventional assumption that these effects do not have a material effect on the rankings of the MCFs for excise taxes.

In spite of a significant body of research, there is a great deal of uncertainty regarding the appropriate values to use for the $_E$ parameters for developed countries, such as the United States or the United Kingdom. There is even greater uncertainty for a developing country, such as Thailand, where much less empirical research has been

[10] Madden calculated the marginal revenue cost of increasing welfare, which is the inverse of the MCF.

[11] See Dahlby (forthcoming, Chapter 3).

Our estimates for the "environmental" externalities from alcohol are based on Smith (2005)'s recent survey of alcohol excise taxes because he decomposed these externalities in a way that is consistent with our framework.[13] Smith estimated that the total externality cost of alcohol in the U.K. is 17 percent of the pre-tax price. Based on his breakdown of the social costs of alcohol, we have decomposed his total externality into an 8.2 percent private sector "environmental" externality (losses sustained by employers etc.), a 1.31 percent public expenditure externality (health

[13] For further discussion of the externalities caused by alcohol consumption and tax policies to deal with these issues, see Pogue and Sgontz (1989), Grossman et al. (1993), Irvine and Sims (1993), Kenkel (1996), Cook and Moore (2002), and Chaloupka, Grossman, and Saffer (2002) and Grossman (2004).

costs, crime, and social responses) and 7.3 percent "internality" from unemployment and pre-mature death. (The latter is included in the $_{A}$ parameter for alcohol to be discussed in Section 3.6.) The $_{E}$ parameter for the benchmark case was calculated as -0.082*(1–0.393)*0.27 = -0.014. The 0.393 is the tax rate on alcohol in Thailand. We multiply by (1 – 0.393) to express the externality as a percentage of the tax inclusive price. We then multiply by the 0.27 which is the ratio of the purchasing power parity Thai GDP per capita to the U.K GDP per capita.[14] The High Case is the benchmark case without the adjustment for the relative GDPs in Thailand and the U.K. The Low Case is 50 percent of the benchmark case.

The environmental externality from tobacco is mainly second-hand smoke, and we do not know of any estimates for this type of externality. As noted in the literature, much of the second-hand smoke problem occurs within the family, and therefore it is debatable whether this is an "externality". The incidence of second-hand smoke in Thailand has also been reduced with non-smoking in public transit, schools and public offices, but smoking is still permitted in bars and non air-conditioned restaurants in Thailand. Overall, we think that the second-hand smoke externality is likely to be small (not many people offer to pay smokers to butt out their cigarettes), but obviously this is controversial and based on a value judgment that we admit is difficult to defend.

Newbery's (2005) estimate of the environmental cost is 14 pence per litre for gasoline in UK, excluding road costs which we treat as a public expenditure externality, and including 3.2 pence per litre for accidents. Our benchmark value for fuel environmental externality is -(0.14£/litre)(67.8B/£)(0.27)(25B/litre) = -0.10 using the relative Thai to UK GDP per capita to is 27 percent of the U.K GDP per capita. For the High Case, we do not adjust for differences in Thai to UK real GDP per capita - (0.14£/litre)(67.8B/a(per litrubti)(ali)-0.8(cper lit5.7(ddti)(ait)-0.8(ureT9(--5.2lity i)5.7()6)11.9 f-17-5.2al)

The benchmark value for the impact of smoking on health care costs uses the estimates from Manning et al. (1989) of $US 0.25 per package (figures updated to 2003) See Cnossen (2005, p.37). This value was multiplied by 0.20 to reflect the relative GDP in Thailand and divided by 1.08, the price of a package of cigarettes in Thailand. The resulting estimate of the $_G$ parameter is (0.25)(0.20)/(1.08)= 0.046, rounded to 0.05. The High Case was obtained using the position expressed by the Director-General for WHO, Dr. Lee Jong-wook, that 15 percent of all health care costs in high income countries are due to smoking. Public health care costs are two-thirds of total health care costs in Thailand. Total health care costs in 2002 were 333,798 million Baht and total value of cigarette consumption was 55,832 million Baht. Therefore the High Case parameter value was calculated as (0.32)(0.15)(333,3798)/(45,219) = 0.29, rounded to 0.30. The Low Case parameter value was based on the Sarntisart (2003, p. 43) estimate that the direct health care costs of tobacco were 249 million Baht in 2003. This would imply that the $_G$ parameter would be (249)/(55,832)= 0.004.

Newbery's (2005) estimate of road costs are 25.2 pence/litre in the U.K. The benchmark value for fuel public expenditure externality is (0.252£/litre)(67.8Baht/£)(0.27)(25Baht/litre) = 0.18. The High Case is 50 percent higher and the Low Case is 50 percent lower that the Benchmark Case.

As noted in the introduction, excise taxes are often viewed as "sin taxes", levied in order to discourage the consumption of products that are "bad for people". In Section 2.3, we used the O'Donoghue and Rabin (2006) model to formalize the view that some individuals engage in excessive consumptiopO'D[so)nssoas "side0 T5(o-mak7.3489 0 TDg1(ex..4(o)l population who reportedly drink every day plus 50 percent of the 3.79 percent who drink 3 to 4 times per week.[15] Thus the Benchmark figure for is 3.34+(0.5)3.79 = 5.2 percent. The High Case figure is 3.34 + 3.79 = 7.1 percent. The Low Case figure is half the percentage that drinks every day.

The Benchmark value for the addiction distortion for cigarettes was obtained using Gruber and K szegi's (2004, p.1979) estimate that the cost in terms of life years lost per pack of cigarettes in the United States is $35.64. The purchasing power equivalent assumed that marginal changes in pure profits are taxed at the statutory Thai corporate income tax rate of 30 percent. Our analysis is based on the assumption that excise taxes are fully shifted to consumers. However, a study by Young and Bieli ska-Kwapisz (2002) indicates that taxes on beer and spirits are over-shifted in the United States. In their study, taxes on beer and spirits increased consumer prices by approximately 1.7 times the tax rate. We also briefly consider the impact of the over-shifting of alcohol excise taxes on the MCF for alcohol.

The Thai Tobacco Monopoly (TTM) has a monopoly in production of domestic brands. The market power distortion in the Benchmark Case, $_{M}$ 0.20, is based on an estimate of the market power of European tobacco companies from a study by Delipalla and O'Donnell (2001).[20] We have assumed that all of the profits of the TTM go to the Thai government, or 1. Therefore, the total effective tax rate on cigarettes in the benchmark case is 0.587 + 0.20 = 0.79, which is very close to the effective tax rate that Sarntisart (2003, p.43) used in his study of tobacco control in Thailand. The High Case is twice the benchmark case and the Low Case is half the benchmark case.

The mobile phone market in Th5 TDf10D1r17.02T

To capture the effect of alcohol smuggling, we use a total demand elasticity of $_{22}^{T} \quad 0.54$ based on the estimate of the demand for alcohol in Sarntisart (2003). A study of alcohol smuggling in Thailand by TDRI (2006) indicates that illegally produced and smuggled alcohol is about 16 percent of alcohol consumption.[22] For the Low Case, we use 8 percent and for the High Case we use 24 percent.

To capture the effect of tobacco smuggling, we use a total demand elasticity of $_{33}^{T} \quad 0.40$ based on this widely used value of the elasticity of demand for cigarettes. The Benchmark value for the proportion of smuggled cigarettes is from a survey by Sarntisart (2003. p.26) who found that "15.5% of their cigarettes packages had warning labels in English or other non-Thai languages or no warning labels, and were probably illegally imported". The Low Case estimate was based on the results of a different survey, also described in Sarntisart (2003), where it was found that 46 percent of discarded imported cigarette packages had warning label in wrong language or no warning labels. Given that imports represent 4.89 percent of total consumption of cigarettes, the proportion of smuggled cigarettes in the Low Case was calculated as 0.46(4.89) = 2.22 percent. (The share of imported cigarettes was based on figures in Sarntisart (2003 Table 3.4 p. 9).) The High Case figure is twice the Benchmark figure.

The calculations of the MCFs for the Benchmark parameter values are shown in Table 3. Alcohol taxes have the highest MCF at 2.312, followed by tobacco at 2.187, and fuels at 0.532. The large gaps between the MCFs for alcohol and tobacco and the MCF for fuels indicates that there would be a substantial welfare gain from a revenue neutral tax reform which reduced tax rates on alcohol and tobacco and increased the tax rate on fuel. However, this conclusion has to be tempered by the fact that the low

To summarize, our analysis indicates that smuggling, market power, and addiction have potentially large impacts on the MCFs, especially for tobacco taxes, and that interactions with other tax bases is especially important for calculating the MCFs for excise taxes.

These conclusions are based on a particular set of parameter values. To determine the sensitivity of our results to the choice of the parameter values, we recalculated the MCFs using the High Case and Low Case values for the parameters. Table 4 indicates that the MCFs are lower in the High Case. This means that the higher parameter values for the environmental and public expenditure externalities and addiction more than offset the use of the higher parameter values for market power and smuggling. The contributions of the various distortions to the MCFs are also generally larger (in absolute value) than in the Benchmark case. The only major anomaly is that the public expenditure externality now reduces the MCF for tobacco.

	Excise Tax on Alcohol	*Excise Tax on Cigarettes*	*Excise Tax on Fuel*	*VAT*
MCFs	1.95	2.10	0.32	1.05
Contributions of Non-Tax Distortions to the MCFs:[a]				
Environmental Externalities, E	-0.243	0.257	-0.016	-0.012
Public Expenditure Externalities, G	-0.725	-0.220	-0.010	-0.021
Market Power, M	0.388	0.442	-0.424	-0.004
Addiction, A	-0.304	-0.6290.3x/TT4	1	E-0.009 0.168

	Excise Tax on Alcohol	*Excise Tax on Cigarettes*	*Excise Tax on Fuel*	*VAT*
MCFs	2.220	1.794	0.645	1.083
Contributions of Distortions to MCF:[a]				
Environmental Externalities, $_E$				

regions in each decile) from the Socio-Economic Survey (SES) 2002. Table 6 shows the computed distributional characteristics for all of the commodities for values of between 0.25 and 1.00, normalized so that the distributional characteristic for food is equal to one. Note that when = 0.25, alcohol, tobacco and fuel have almost identical distributional characteristic values, around 0.88. Therefore, with a moderate set of distributional weights, the real

	ξ = 0.00	***ξ = 0.25***	***ξ = 0.50***	***ξ = 1.00***
	1.000	1.00	1.000	1.000
	1.000	0.882	0.835	0.762
	1.000	0.885	0.821	0.707
	1.000	0.942	0.893	0.828
	1.000	0.940	0.849	0.721
	1.000	0.957	0.874	0.754
	1.000	0.888	0.799	0.660
	1.000	0.987	0.922	0.824
	1.000	0.904	0.801	0.659
	1.000	0.910	0.827	0.700
		[a]		
	2.311	2.038	1.930	1.761
	2.183	1.932	1.792	1.543
	0.533	0.510	0.465	0.402

[a]

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