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Fuel taxation in EC counties: A political economy approach

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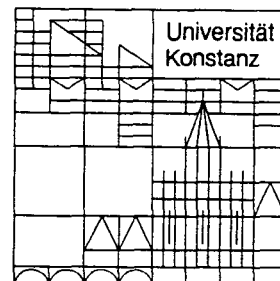
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Sonderforschungsbereich 178
„Internationalisierung der Wirtschaft“

Diskussionsbeiträge



Juristische
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Fakultät für Wirtschafts-
wissenschaften und Statistik

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Hannelore Weck-Hannemann

**Fuel Taxation in EC Countries:
A Political-Economy Approach**

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A POLITICAL-ECONOMY APPROACH

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Zusammenfassung

Die steuerpolitischen Harmonisierungsziele der EG-Kommission stoßen in vielen Mitgliedsländern auf Skepsis und Widerstand, da aus ökonomischer Sicht mit einer Verlagerung von steuerpolitischen Kompetenzen auf die EG-Ebene einerseits Effizienzgewinne ebenso wie Effizienzverluste und andererseits Verschiebungen im nationalen Steuerertrag verbunden sind. Eine wirtschaftspolitische Handlungsempfehlung kann daher nur entwickelt werden, wenn die Ziele und Konsequenzen einer autonomen Steuerpolitik theoretisch fundiert und empirisch abgesichert sind. Die vorliegende Arbeit stellt einen Versuch dar, eine politisch-ökonomische Basis für eine positive Theorie der Mineralölsteuerpolitik zu entwickeln und die aus einem Medianwähler- und einem Leviathan-Ansatz gewonnenen konkurrierenden Hypothesen einer empirischen Überprüfung zu unterziehen. Der ökonometrische Test in dieser Arbeit hat noch einen vorläufigen Charakter und läßt eine gesicherte Diskriminierung von einzelnen Erklärungsansätzen nicht zu. Er gibt aber doch deutliche Hinweise darauf, daß die von der Kommission betonten Verzerrungseffekte durch nationale Steuersatzunterschiede gegenüber der Einbuße an nationaler Besteuerungssouveränität in der Vergangenheit nicht dominiert haben und weitere empirische Untersuchungen erforderlich sind, um das langfristige Kommissionsziel einer supranationalen Verbrauchsteuerpolitik ökonomisch zu rechtfertigen.

FUEL TAXATION IN EC COUNTRIES: A POLITICAL-ECONOMY APPROACH

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and

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1. Introduction¹

Commodity taxation in EC member countries has been an issue for the EC Commission from the very beginning of European integration. The still lasting conflict to be settled is between supporters of supranational regulations who want to prevent distortions in the Common Market on the one hand, and supporters of national tax autonomy who oppose outside interference in traditional tax structures on the other. Art. 99 of the EEC-Treaty empowers the Commission to submit proposals for directives which force member states to harmonize the system of commodity taxes, if uncoordinated taxation of goods endangers the establishment and the functioning of the Common Market. The Commission evidently has favoured commodity tax harmonization in the Community, but only a few proposals and draft directives were approved by the European Council since the unanimity requirement offers a block veto to any single member country.

The drafting of excise tax directives requires a tradeoff between tax neutrality ensuring undistorted competition in the Common Market and the acknowledgement of national sovereignty in tax policy. In accordance with GATT, the solution to this tradeoff was the community-wide adherence to the destination principle, which allowed for tax rate autonomy in any member country as long as tax differentials between member countries were neutralized by compulsory border adjustments and border controls. Since the destination principle has been applied to the general turnover tax and the major excises, a harmonization of national tax rates was not required.

Deviations from the general destination principle, above all source taxation of export services (e.g. tourism) were tolerated by the Commission. In addition, limited tax

¹ We owe thanks to Andreas Haufler (Univ. of Konstanz) and to the participants of the Workshop on the International Political Economics of Taxation for critical remarks and helpful comments. Technical assistance of Vera Müller and Thomas Kathmeyer in the collection of data and in econometric estimation is acknowledged.

arbitrage opportunities were legally offered to tourists and strategic transborder shoppers. Border controls were not extended to detect illegal tax evasion by small scale smuggling. An even higher incentive to evade taxes was offered by the possibility of legal VAT rebates on commodities in the exporting country, but illegal VAT evasion in the country of residence. Tax arbitrage in various forms has thus been well known to consumers as tourists, crossborder commuters, business men or mail order customers.

From January 1st, 1993 commodity taxation will take place in the Internal Market without internal borders, i.e. tax adjustment of traded goods will no longer be administered and controlled at the national boundaries. As a matter of fact, the Commission expects an enormous extension of arbitrage activities by final consumers, even if trade between registered firms can be effectively monitored.

In its White Paper on the Completion of the Internal Market (Commission of the EC, 1985) the Commission announced a harmonization of VAT and excise tax rates which it regarded unavoidable to prevent major distortions in trade patterns and the distribution of national tax revenues among EC countries as a consequence of ruinous tax rate competition. In 1987 the Commission released a series of draft directives stipulating rate bands for a two-tier VAT and equal excise tax rates on fuel, tobacco and alcohol. From an economic point of view in particular the proposals for uniform excise tax levels were criticized as unduly restrictive (cf. Lee et al. 1988, p.55ff.), although the Commission's view that excise tax harmonization is more important than VAT rate harmonization is shared by economists as well (cf. Parsche et al. 1990, p. 165; Peffekoven, 1991, p. 110). The proposal of uniform tax rates on different forms of fuel was rejected by political representatives of various member states, especially by those whose tax rates deviated most from the Community average. Since a realistic chance for an approval of the 1987 draft directives on excises never existed, the Commission suggested a more flexible harmonization programme in 1989, based on minimum rates and rate bands for different excises, but political criticism of the Eurosceptics especially in Great Britain, Denmark, and the Mediterranean member states remained.

The opposition against the Commission's harmonization plans is a consequence of its rather centralist view on the major tax policy problems the member countries will face in the Internal Market. The Commission emphasizes administrative difficulties after the abolition of border controls, stemming from tax arbitrage activities of purchasers and strategic tax competition among revenue seeking governments. This view is supported by Euro-harmonizers, who basically subscribe to the subsidiarity principle but are afraid that the behaviour of economic and political agents will lead to national welfare losses in the Community due to allocative distortions of trade and due to revenue shortfalls in countries which are not willing to join the strategic tax cut run. On the other hand Euro-

sceptics stress the Commission's revealed ignorance of subsidiarity, since the harmonization plans would have forced countries to give up their traditional excise tax patterns and to change their politically accepted governmental revenue structures. Furthermore, harmonized excises can no longer be used as an efficient Pigouvian internalization measure in accordance with country specific marginal social costs of negative externalities. Finally, the use of excises as benefit taxes to cover the marginal costs of public goods supply or as tax deterrents to correct distorted preferences of citizens will be severely constrained by supranational harmonization requirements. The antagonistic views of Euro-harmonizers and Euro-sceptics with respect to commodity taxation can only be solved in a comprehensive cost/benefit analysis that allows to trade off the Community-wide harmonization gains against the harmonization costs and to establish equalization schemes to compensate revenue losing countries. To our knowledge, economic models which would allow to evaluate the economic effects of tax policy restrictions in line with national preferences of the member states do not exist, since the positive theory of tax policy has not been an important issue on the research agenda of public economics. Our paper can thus be seen as an attempt to fill this gap in the economic theory of tax policy, at least for fuel taxation.

The paper is organized as follows. Chap. 2 presents an overview on the taxation of fuel in EC countries. In chap. 3 we use the political economy approach to identify economic and political factors to rationalize fuel tax policy in different European countries. We derive a set of hypotheses which we test econometrically in chap. 4 for a sample of 12 countries including 10 EC countries, Austria and Switzerland. We finish with some tentative conclusions about the necessity and scope for a harmonization of EC fuel taxation in chap. 5.

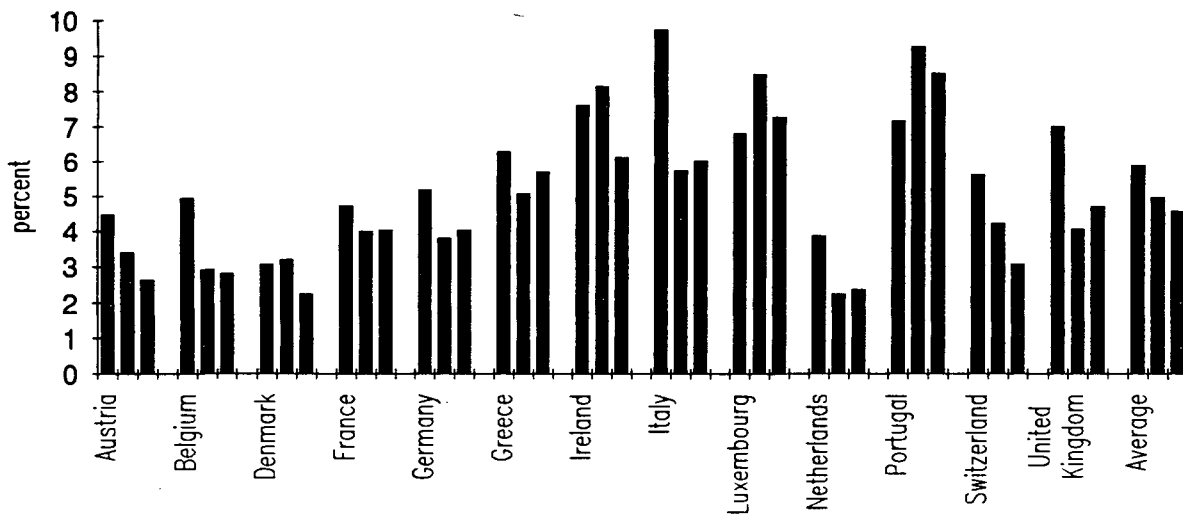
2. Fuel Taxation in EC Countries, Switzerland and Austria

All OECD countries levy excises on fuel. Half of them, 10 EC countries as well as Austria und Switzerland are included in our quantitative investigation.

Revenue from fuel taxes in the 12 countries considered account for 2.3% of total taxes in Denmark and in the Netherlands up to 8.5% in Portugal (fig.1). The revenue share of excises on fuel is lowest in the high tax countries Belgium, Denmark and the Netherlands. But also in Switzerland, a low tax country, the fuel tax share is below average. Between 1960 and 1990 the fiscal importance of fuel taxes declined, the sample average of the fuel tax share fell from 6% in the sixties to 4% in the eighties. Since 1985 the fiscal importance of fuel taxes is rising again. The coefficient of variation of

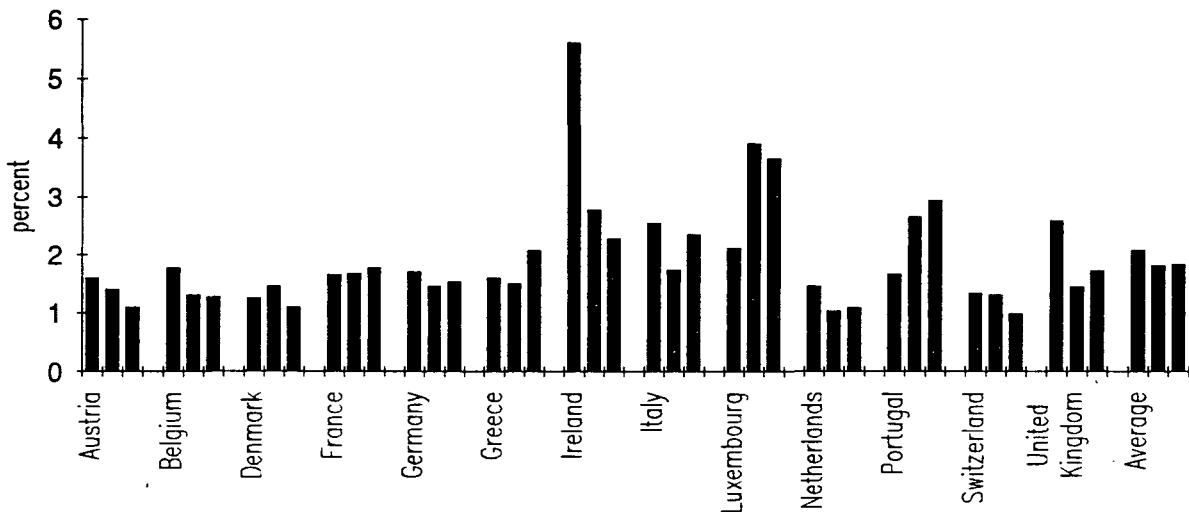
fuel tax shares exhibits a fluctuating pattern over time, with low values in the sixties and returning to low values in the late eighties again.

Fig. 1: FUEL TAX REVENUE IN EUROPE
(percentage of total taxation 1970, 1980 and 1990)



Source: OECD (1992), own calculation

Fig. 2: FUEL TAX REVENUE IN EUROPE
(percentage of GDP 1970, 1980 and 1990)

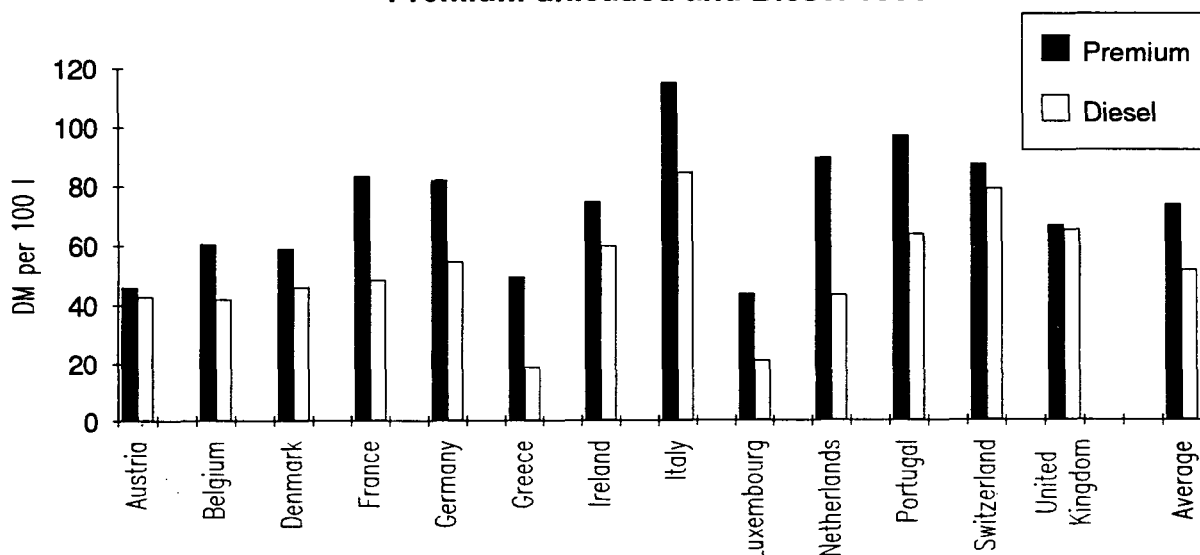


Source: OECD (1992), own calculation

This pattern changes slightly when the normalizing effect of national tax levels (ranging from 32% in Switzerland to 50% in Luxembourg in 1990) is disregarded by relating fuel tax revenue to the GDP. The fuel tax quotas lie between 1.0% in Switzerland and 3.6% in Luxembourg (fig. 2). The time path of the average tax quota again fluctuates and shows a falling tendency, although the pattern is less clearcut here. The coefficient of variation of tax/GDP quotas across the 12 countries exhibits similar levels as the fuel tax share in total taxes but higher fluctuation over time.

In all countries the fuel tax is implemented as a specific excise levied as a unit tax on the production or the import of hydrocarbon products. Tax bases, tax rates and tax administration vary from country to country. The tax base is either the volume or the weight of mineral oils. Hydrocarbons for heating or lubricants are exempted in some countries (heating oil in Belgium, Luxembourg and Portugal, lubricants in France and the Netherlands). Tax rates differ between fuel products. In general, petrol is taxed higher than diesel (fig. 3), premium higher than regular, and leaded petrol higher than unleaded. But there are countries where some of the petrol products distinguished above are subject to the same unit tax. Variation of tax rates on the most important fuels is similar to the variation of fuel tax quotas, but the span of diesel rates is broader than the span of petrol rates.

Fig. 3: FUEL TAX RATES IN EUROPE
Premium unleaded and Diesel 1991



Source: Bundesministerium der Finanzen, Bonn (1991)

A first empirical inspection of tax differentials in the 12 countries does not support the hypothesis of converging tax rates in EC fuel taxation over time, which was stated recently by R. Smith (1987, 153 ff.). On the contrary, significant differences between national tax rates and fuel tax shares remain over time and exhibit considerable variation in the fiscal importance and in the instrumental character of fuel taxes in Europe, in spite of the slight convergence of fuel tax quotas by the end of the last decade.

3. Hypotheses for the Explanation of Fuel Tax Policy in EC Countries

International differences in the utilization of fuel taxes as a country specific policy instrument are the major source of opposition against harmonization plans of the Commission. High tax countries will face a shortfall of tax revenue when upper tax limits force them to reduce their fuel tax rates or prevent them from using fuel taxes as a source of additional budget revenue in the future. Low tax countries are afraid of major political opposition against higher EC fuel taxes since harmonization increases the tax burden of their citizens in a regressive way. In addition, there has been distrust of the Commission who might claim excises as a new direct source of revenue to feed the Community budget.

Although the Commission basically acknowledges the principle of subsidiarity and national autonomy in excise tax policy, it argues that EC wide unified fuel taxes (proposed in the draft directive of 1987, COM(87) 327/2 fin.) are necessary to avoid distortions of competition caused by differing fuel tax rates. The Commission thereby supposes that national governments act in a myopic way and will not be able to adjust national tax rates to the changing conditions of tax arbitrage after the fall of the tax borders.

In 1989 the Commission revised the draft directive (COM(89) 526 fin.) which laid down either an EC wide minimum threshold or an EC wide span for national excise rates on specific fuel products. The submission of this directive implies that the Commission expects member countries to follow a "beggar thy neighbour" policy of undercutting fuel taxes in a ruinous competition for tax export. Nevertheless opposition against this more flexible approach remained, since the Commission chose lower thresholds (e.g. 0,337 ECU/lit. for petrol) significantly above the existing minimum rate (0,207 ECU/lit. in Luxembourg), the benchmark level which would not have required accommodating tax changes in any EC member country. The long term objective of unified fuel taxes is stressed further by the introduction of EC wide target rates for petrol and kerosene (draft directive COM(91)43 fin.). This measure restricts the national policy maker to changes

in these fuel tax rates, which reduce the gap between the national tax rate and the target rate. Although this rigid regulation leaves little if any room² for an autonomous national fuel tax policy in the internal market, a further revision and unification of the two draft directives of 1989 and 1991 (COM(92) 3 fin.) was finally approved by the ECOFIN Council in July 1992.

Although the Commission's hypotheses of governmental behaviour are economically plausible and its consequences can be studied in suitable theoretical models, they have not been subjected to thorough empirical investigations. A positive theory of national fuel tax policy has to elaborate the various targets of fuel tax policy and to quantify the amount of social costs a country has to bear if it decides to uphold a tax differential vis à vis its neighbour. Empirical tests must help then to filter out the decisive determinants of national tax policy and they will provide an economic justification for strict supranational regulations if tax export turns out to be the dominating guideline for eager national fiscs in the internal market.

A rational policy maker chooses a political strategy which maximizes benefits according to his preferences subject to the constraints given by the economic reaction of the citizens and by the institutional setting. A politician who is in charge of fuel taxation must follow a fuel tax policy which does not jeopardize his reelection. If perfect competition prevails in the political market, fuel tax policy must follow the preferences of the median voter in order to avoid the loss of political support. If the reelection constraint is not binding, the politicians in government may use the discretionary leeway to follow a tax policy in accordance with their own preferences or ideology. In the following subsections we offer a series of hypotheses to explain fuel taxation endogenously, starting out from rational voters and politicians in a median voter and in a Leviathan framework (related aspects are discussed, e.g., in Bowman/Mikesell 1983 and in Case/Hines/Rosen 1989).

3.1 Fuel Taxation in a Median Voter Model

In the following models we assume that fuel taxes are used by the government to provide a public good "traffic infrastructure" (in the following "roads" for short), which generates welfare gains for the consumers. Rational voters will evaluate situations with different levels of fuel tax revenue and road supply according to their preferences. They will always decide in favour of that tax/road programme which guarantees the higher

² In particular, a country which wants to reduce its excise rate on petrol to avoid revenue losses to a low tax neighbour country can only bring down its petrol tax rate to the target rate, but is trapped and cannot react at all, if its actual petrol tax rate is already below this target rate.

utility level. We denote by $u^i(C^i, B^i, G)$ the utility function of consumer/voter i , defined over the commodity space R^3 , where C^i is an aggregate private consumer good, B^i is fuel consumption and G is individual consumption of the public good "roads". A rational consumer i will allocate his fixed budget Y^i between the two private goods C^i and B^i in order to maximize his utility u^i

$$(1) \max u^i(C^i, B^i, G) \quad \text{s.t.} \quad Y^i \geq C^i + (p+t)B^i$$

C^i is chosen as the numeraire, p is the producer price of fuel, t is the unit tax on fuel. Solving the optimality problem (1) explicitly yields the Marshallian demand functions $C^i(p, Y^i, t, G)$ and $B^i(p, Y^i, t, G)$ which depend parametrically on the policy variables t and G . With his fuel tax payment tB^i , voter i contributes to the costs associated with the supply of the public good G .

Moreover, we have to take into account a characteristic complementarity relationship between commodities B^i and G , since both fuel and road utilization are indispensable to reap utility gains from individual transport services. The utility function thus shows a separable structure

$$(2) \quad u^i(C^i, B^i, G) = w^i[C^i, F^i(B^i, G)]$$

The Lagrangian associated with the consumer choice problem is

$$(3) \quad L(C^i, B^i, \alpha) = w^i[C^i, F^i(B^i, G)] + \alpha[Y^i - C^i - (p+t)B^i]$$

with α being the marginal utility of income. Differentiation with respect to C and B leads to the first order conditions

$$(4) \quad w_C' - \alpha = 0$$

$$w_F' F_B' - \alpha(p+t) = 0$$

and after elimination of the Lagrange parameter α

$$(5) \quad w_F' / w_C' = (p+t) / F_B'$$

Partial derivatives are marked by a prime and a subscript, e.g. w_F' is the partial derivative of w with respect to F . The efficient consumer decision is characterised by marginal condition (5), indicating that the shadow price of the aggregate commodity F is equal to the consumer price of fuel $(p+t)$ marked up by the reciprocal of the marginal "productivity" of petrol in generating transport services.

Resubstitution of the Marshallian demand functions for C^i and B^i in (3) yields the

indirect utility function

$$(6) \quad w^i[C^i(p, Y^i, t, G), F^i(B^i(p, Y^i, t, G), G)] = v^i(p, Y^i, t, G) ,$$

which includes the consistent individual evaluation of various policy programmes (t,G) by consumer/voter i.

3.1.1 Benefit Taxation of Fuel

A politician who has to compete for reelection has to consider the voters' evaluation of his transport programme (t,G). In a system of perfect political competition majority requires support by the median voter. The scope of feasible transport programmes is restricted by the budget constraint, which allows for fuel tax revenues as the only source of financing "roads" G. To avoid a loss of political support the incumbent policy maker has to provide the feasible programme (t,G) which maximizes the median voter's utility.

$$(7) \quad \max v^m(t, G) \quad \text{s.t.} \quad t \Sigma B^i(t, G)/G \geq 1 .$$

Partial differentiation of the Lagrange function

$$(8) \quad L(t, G, \mu) = v^m(t, G) + \mu[t \Sigma B^i(t, G)/G - 1]$$

with respect to the policy variables t and G leads to the first order conditions

$$(9) \quad \begin{aligned} \delta v^m / \delta t + \mu(\Sigma B^i + t \Sigma \delta B^i / \delta t) / G &= 0 \\ \delta v^m / \delta G + \mu(-t \Sigma B^i / G + t \Sigma \delta B^i / \delta G) / G &= 0 \end{aligned}$$

Elimination of the Lagrange multiplier μ , which measures the marginal welfare gain following a marginal relaxation of the governmental budget constraint, allows for interpreting efficient policy by one marginal condition

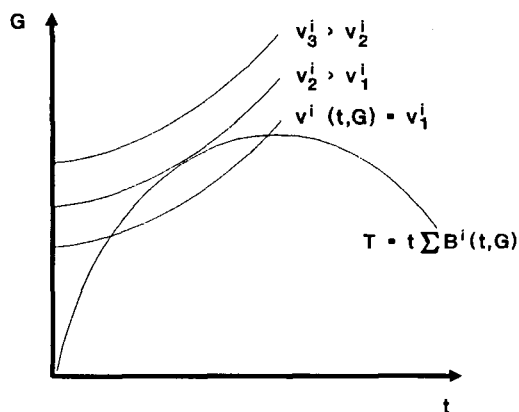
$$(10) \quad E(v^m, t) / E(v^m, G) = -[1 + E(B, t)] / [1 - E(B, G)]$$

where E indicates an elasticity, e.g. $E(B, t) = (\delta B / B) / (\delta t / t)$. The left hand side of (10) defines the functional relation between t and G along an indifference curve of the median voter. Due to the standard assumptions for the utility function u, the iso-utility locus of $v^m(t, G)$ is positively sloped in the (t,G) space.

The right hand side of (10) describes the functional relation between the policy variables according to the governmental budget constraint. Fiscally feasible levels of public good supply G are related to the tax rate t according to a modified Laffer curve. The modification occurs since first round effects on fuel demand are superposed by second

round effects through the complementarity relation between fuel and road consumption, which result in shifts of the fiscal constraint. Due to the standard assumption of non-satiation, the governmental budget constraint must be binding for the utility maximum and the optimal policy programme can only be located on the rising branch of the Laffer curve (fig.4). The optimal (t^*, G^*) -choice is dependent on the exogenous income level of the median voter. A marginal rise of y^m will not only increase the median voter's utility level $(\delta v^m(t^*, G^*, Y^m, p)/\delta Y^m > 0)$ but requires an adjustment of the policy variables as well. As long as individual transport $F(B, G)$ is not an inferior good, demand for the composite commodity F will rise with income and induce a rise in the demand for roads as well $(\delta G^*/\delta Y^m > 0)$. The government is able to meet this demand increment by higher fuel taxes $(\delta t^*/\delta Y^m > 0)$. A similar effect is induced by a fall in the producer price of fuel p , since both the substitution effect of lower shadow prices for transport services and the income effect stimulate the demand for fuel and roads.

Fig. 4: EVALUATION OF ALTERNATIVE POLICY PROGRAMMES BY VOTER i



If the tax on fuel is a benefit tax for public transport infrastructure, then the economic model gives rise to the following hypothesis H1 for a median voter oriented fuel tax policy.

H1 (benefit tax): If the fuel tax is levied as a benefit tax, then a median voter oriented politician will only increase fuel taxes in line with a higher supply of the public good G.

H1 postulates a positive relation between the fuel tax rate and government expenditures for road construction and road maintenance.

3.1.2 Fuel Tax as a Pigouvian Tax

A further allocative justification of fuel taxation is the internalization of social costs of individual transport which occur in immediate connection with fuel consumption. If we include a public bad Z in the utility function of the median voter

$$(11) w^m[C^m, F^m(B^m, G), Z(B)] \quad \text{with} \quad \delta w^m / \delta Z < 0, \delta Z / \delta B > 0 ,$$

then he will not take account of externalities created by his consumption of transport services. Internalization may be forced by a Pigou tax on fuel, in our model in addition to the benefit tax considered above. If the Pigou tax is levied at a unit tax rate, equal to the marginal social costs of fuel consumption at a Pareto efficient allocation, then consumers adjust their demand to the consumer prices gross of the Pigou tax. The market equilibrium for the new price vector will turn out Pareto efficient.

Revenue from the Pigou tax component must not flow back to consumers as higher "roads" supply, since complementarity would induce higher fuel consumption and social costs. Therefore the government's budget constraint should include an additional expenditure component, e.g. a neutral lump sum transfer. The indirect utility function for consumer/voter i depends on four policy variables (besides prices and income)

$$(12) v^i = v^i(p, Y^i, t_1, t_2, G, S) ,$$

where t_1 is the rate of the benefit tax on fuel, t_2 that of the Pigou tax, and S is the lump sum transfer. The optimal policy programme in a competitive political market is an efficient internalization of external costs, a programme that reflects marginal social costs in higher fuel taxes and allows for a lump sum redistribution of inframarginal Pigou tax revenue.

If fuel taxation serves not only as a benefit tax but also as a Pigou tax, then the behaviour of a median voter oriented politician gives rise to the following hypothesis H2.

H2 (incremental Pigouvian tax on fuel): Since individual road transport incurs high external costs (e.g. accidents, pollution) fuel taxes may be used as an instrument of internalization. In a median voter framework with fully responsive government the policy maker is forced to levy a Pigouvian tax and to increase the unit tax on fuel the more, the higher consumer/voters are sensitive with respect to the social cost of individual transport.

Assuming that this sensitivity is mirrored in the popularity of green parties, hypothesis H2 should result in a significant positive relation between this popularity and fuel tax rates.

3.1.3 Exploitation of Automobilists

If we deviate from the pure benefit principle for fuel taxes and allow the politician to use fuel tax revenue for the provision of another public good H (e.g. health), then optimal policy depends on the median voter's preference for both public goods. For the consumer this extension simply introduces an additional parameter in his utility function (1) and optimal demand for C and B derived as the solution of the decision model

$$(12) \max w^m[C^m, F^m(B^m, G), H] \quad \text{s.t.} \quad Y^m \geq C^m + (p+t)B^m$$

is dependent on t, G and H.

On the other hand, the politician has to find the optimal mix of the three instruments G, H and t at his disposal to secure majority in a competitive political environment. The optimal policy programme is again oriented towards the median voter

$$(13) \max v^m(t, G, H) \quad \text{s.t.} \quad t \Sigma B^i(t, G, H) - (G + H) \geq 0$$

If the median voter (together with the 50% of the voters who also support the same policy programme) gains higher marginal utility from another money unit spent on health rather than roads, fuel taxes must be used to increase the supply of public health services until marginal utilities are equalized. The optimal policy programme then generates a redistribution in real terms from fuel (and road) consumers to health consumers. Since earmarking of taxes is ruled out in some countries, e.g. in Germany (although the border line between taxes and compulsory fees is blurred, at least from an economic perspective) there is an incentive to exploit fuel consumers in a competitive political environment, especially if fuel consumers are a minority in the election poll.

H3 (tax exploitation): If fuel tax revenue is not earmarked for public good complements to fuel consumption ("roads") the policy maker will raise the fuel tax rate above the

optimal benefit tax level and spend a share of fuel taxes on noncomplementary public goods in order to redistribute welfare to supporting voters.

In an empirical test such a policy should be reflected in an inverse relation between the fuel tax rate and the share of fuel consumers (automobilists) since it pays to exploit them the more the smaller their weight is in an election poll.

3.1.4 Interest Groups

The decision of the median voter on alternative programmes in transport policy will depend on the existence and the activity of interest groups. Rent seeking lobbies are ready to support policy programmes which might prove beneficial to their members. Since financial grants from lobbyists allow a subsidization of political programmes and increase their political support by voters, a politician has an incentive to accept such donations in order to avoid the loss of political majority.

Automobilist associations call for an improvement of road infrastructure and for fuel taxes to finance these investments, but they will oppose a utilization of fuel taxes for public services which favour nonmembers. No clearcut hypothesis thus can be formulated whether automobilist associations will support an increase or decrease of fuel taxes.

The petrol industry and the car industry will *ceteris paribus* favour lower fuel taxes, in order to avoid a decline in car sales and their profits. On the other hand, both interest groups must care for a sufficient quality of roads in the long run, calling for fuel taxes high enough to provide a road net that secures long term growth in the car market.

Finally, the road construction industry will call for higher fuel taxes in any case, since higher fuel tax revenue will result in higher road investment.

Taking into account the primary targets of different lobbies leads to hypothesis H4.

H4 (interest groups): Petrol and car lobbies will support fuel taxes below the efficient benefit level, the road construction lobby will strive for fuel taxes above that level.

An econometric test will reflect this behaviour of industrial lobbies if fuel tax rates are negatively related to the share of value-added (or the share of employees) in the petrol or the domestic car industry and positively related to the respective indicators for the road construction industry.

3.1.5 Tax Export

A special class of fuel consumers are foreigners who pay fuel taxes as tourists or transit passengers and utilize road and traffic infrastructure but are excluded from the domestic voting process. Posing a higher share of taxes on this group is attractive to the policy maker, since they do not jeopardize reelection but generate tax revenue that can be channelled to voters via feasible transfers (in cash or in kind) and secure majority assistance.

H5 (tax exploitation of foreigners): If fuel taxation permits the redistribution of tax revenue from tourists to domestic voters, then the median voter oriented politician will raise the fuel tax rate above the efficient level.

An empirical test of this hypothesis should show a positive relation between the fuel tax rate and the share of foreign road users and fuel consumers.

An even more attractive source of national welfare gains to improve the likelihood of reelection is tax export to foreign fuel tax arbitrageurs who buy fuel across the border without using the domestic road net. In this case fuel taxes are partly born by the foreign fisc, who loses tax revenue if fuel consumers shift their demand across the border. Rational domestic fuel consumers behave according to model (1), but the policy maker has to consider the additional source of revenue in his optimal policy decision

$$(14) \max v^m(t, G, S^m) \quad \text{s.t.} \quad t \Sigma B^i + t B^a - G - \Sigma S^i \geq 0 \quad .$$

Fuel tax revenue extracted from foreigners may be used for all domestic voters. Therefore, S^m is modelled as a simple money transfer which increases disposable income of the median voter as well. The marginal condition for an optimal fuel tax policy then includes the tax rate elasticity of aggregate fuel consumption by foreigners B^a

$$(15) E(v^m, t)/E(v^m, G) = -[(1 + E(B, t)) + (B^a/B)[1 + E(B^a, t)]]/[(G/tB) - E(B, G)] \quad .$$

If $B^a = 0$ holds equation (15) reduces to marginal condition (10). If G can be financed partially by tax export, the modified Laffer curve (fig. 4) shifts to the left and more attractive policy programmes become feasible which allow for lower tax rates t and/or higher road supply G . An increase in transport services F is the unanimous result for domestic consumers, since the substitution effect and income effect are operating in the same direction. The optimal provision of roads G^* will be increased or reduced depending on the consumption technology for transport services. If the marginal utility of G financed by foreign fuel consumers falls short of opportunity costs for domestic road users, then the budget surplus of the government can be efficiently absorbed by

lump sum transfers S to the voters.

H6 (tax export): If tax differentials to neighbouring countries allow for tax export by international tax arbitrage, then the median voter oriented politician will choose the national fuel tax rate in a way to keep up tax differentials to secure welfare gains from tax export.

In empirical tests this hypothesis should be reflected in a positive relation between the domestic fuel tax rate and the average rate of neighbouring countries. The argument holds as well for a country that aims to constrain tax revenue losses caused by strategic undercutting of tax exporting neighbours.

3.2 Fuel Tax Policy in a Leviathan Model

Whereas in a competitive political market politicians have to follow the preferences of the median voter, there exists discretionary room for the policy maker if the reelection constraint is not binding. The Leviathan hypothesis assumes that the preferences of the politician aim at political power and prestige which can be reached by expanding the public sector and tax revenue. Economically, revenue maximization is constrained by the elasticity of tax bases and a Leviathan policy will realize the fuel tax maximum along the Laffer curve

$$(16) \max \Phi(t, G) = t\Sigma B^i(t, G) \quad \text{s.t.} \quad t\Sigma B^i(t, G) - G \geq 0 .$$

Optimal Leviathan policy selects the revenue maximising fuel tax rate and spends the revenue on the public good "roads". This remains true if tax export is successful and produces additional tax revenue tB^a , but one has to keep in mind that tax export in turn raises domestic fuel consumption as a consequence of higher road expenditure ($\delta B^i / \delta G > 0$).

If the Leviathan politician aims at maximising the net surplus of fuel taxes over road expenditure

$$(16) \max \Phi(t, G) = t\Sigma B^i - G ,$$

then again the Laffer curve maximum is chosen as the optimal policy. But fuel tax revenue is spent on roads only as long as a marginal monetary unit spent on roads increases tax revenue by more than that amount, i.e. the net budget return on marginal road expenditure is positive.

3.2.1 Restriction by Perceived Welfare Losses

A Leviathan politician who is only constrained by the economic reactions of tax avoiding citizens is in a very powerful monopolistic position. Usually, a policy maker will also face political resistance if his Leviathan behaviour is recognized. Political opposition (the voice option) constrains the policy leeway of the incumbent policy maker and he has to trade off his gains in prestige and power following a marginal expansion of his budget against a higher likelihood of losing majority assistance, since the citizens are burdened by a higher tax load. The decision model of a partially constrained politician may be formalized as an extension of (16) in the following way

$$(17) \max \Phi(t, G) = t\Sigma B^i(t, G) - \beta(v_F - v^m(t, G)) \quad \text{s.t.} \quad t\Sigma B^i(t, G) - G \geq 0 .$$

Besides tax revenue the objective function Φ of the policy maker contains a second term which reflects the evaluation of political costs ($\beta > 0$) of depressing the median voter's utility level below an anticipated reference level v_F . The reelection constraint does not strictly bind the policy maker to the preferences of the median voter, but he will only be able to use the political room for higher fuel taxes up to that level, when political opposition in the population outweighs the benefit from further budget expansion.

The policy decision problem (17) is formally equivalent to the one of an "altruistic Leviathan" who appreciates both a higher budget for himself and welfare gains for his voters according to an objective function

$$(18) \Phi(t, G) = t\Sigma B^i + \beta v^m(t, G) .$$

H7 (Leviathan policy with political opposition): In comparison to a strictly binding reelection constraint, which ties the policy maker to the preferences of the median voter, political leeway enables the politician to follow his Leviathan preferences and to raise the fuel tax rate above the efficient level.

In an empirical test, Leviathan behaviour should be reflected in a positive relation between the level (or the change) of fuel tax rates and the popularity of the government.

3.2.2 Restriction by Comparison with Other Countries

Political opposition against a tax policy measure will depend on the citizens' subjective perception and the degree of resentment towards fiscal exploitation by the policy maker. Thresholds of perception and resistance offer the possibility to deviate from the efficient fuel tax level without jeopardizing reelection.

One starting point for the perception of unjustified taxation is the international

comparison of fuel tax levels. A threshold of political opposition will be the average tax rate in neighbour countries. As long as the domestic fuel tax rate does not exceed this threshold the policy maker will be able to calm down political resistance by hinting at foreign examples and will be able to utilize the discretionary room. The corresponding decision model is of the following type

$$(19) \max \Phi(t, G) = tB(t, G) - \beta \delta(t - t^a) L(t - t_0) \quad \text{s.t.} \quad tB(t, G) - G \geq 0 .$$

t^a is the fuel tax rate abroad and t_0 is the unit tax rate in the reference period. $\delta(x)$ is a binary function with zero for $x \leq 0$ and one for $x > 0$. $L(x)$ is a loss function which evaluates the deviation of x from zero. If an increase in the tax rate ($t > t_0$) is not penalized by tax resistance, i.e. as long as $t < t^a$, then a rationally acting Leviathan can use this room for raising fuel taxes. Only when the domestic fuel tax rate exceeds the foreign one, the politician must outweigh higher tax revenue against increasing political opposition.

Modelling tax resistance by (19) is not very attractive economically as long as the international comparison concentrates on fuel tax rates and does not include the country specific public supply of road infrastructure. Information on the road system in neighbouring countries is generally pretty good, so it may be better to base tax resistance on an international comparison of net costs of fuel taxation in a cost/benefit framework.

To specify the objective function of the Leviathan we assume that citizens compare their utility level available at home $v^i(t, G)$ with the level obtainable with tax rates and road supply of the neighbour country $v^i(t^a, G^a)$. The decision problem of the politician then reads as follows

$$(20) \max \Phi(t, G) = tB(t, G) - \beta L[v^m(t^a, G^a) - v^m(t, G)] \quad \text{s.t.} \quad tB(t, G) - G \geq 0 .$$

The room for discretionary tax policy of a Leviathan politician is reduced in accordance with his conjecture of political opposition measured by the loss function L and weighed against additional revenue by the tradeoff parameter $\beta \geq 0$. Whereas (20) is usually interpreted as a restriction of tax policy leeway due to the foreign example of potential welfare gains attainable through copying a superior foreign transport policy, the model also allows for the case where this leeway is extended, when the foreign example reveals a lower welfare level than the actual transport policy at home.

H8 (restriction from international comparisons): A Leviathan-oriented politician will use the discretionary leeway offered by an inferior high tax/expenditure situation abroad and raise tax rates above the efficient domestic level.

An empirical analysis should reveal a positive relation between the level of domestic fuel taxes (especially net of road benefits) and the corresponding level in the neighbouring countries. The positive relation should also hold for changes in the levels.

3.2.3 Restriction by Comparison of Price Changes

One benchmark level for the recognition of excessive tax changes is the rise of fuel prices in comparison to price level changes. Since the fuel tax is a unit tax, inflation erodes the real tax rate and the population is unlikely to fight an increase in the unit tax rate on fuel unless the fuel price grows faster than the general consumer price index. The corresponding decision model has the form

$$(21) \max \Phi(t, G) = t \Sigma B^i(t, G) - \beta \delta[t - t_0(1 + \pi)] L(t - t_0) \quad \text{s.t.} \quad t \Sigma B^i(t, G) - G \geq 0 .$$

In (21) t_0 is the unit tax on fuel in the reference period 0, π is the inflation rate, $\delta(x)$ is the binary function introduced in (20) and $L(x)$ is the loss function. If the objective function and the tradeoff coefficient β allow for a tax rate adjustment without triggering a tax revolt, then a Leviathan policy maker will use the room for an increase in domestic fuel tax rates.

H9 (inflation adjustment): A Leviathan-oriented politician will fully use the discretionary leeway offered by inflation adjustment and raise fuel taxes above this reference level.

If H9 holds a positive relation between the fuel tax rate and the consumer price index (or their respective changes) should be proven in an empirical test.

The indexed unit tax is not the only threshold value that might act as a benchmark to trigger tax resistance if the actual fuel tax rate grows faster than the price index. It may also be argued that fuel consumers concentrate on retail prices of petrol and opposition is articulated if fuel prices grow faster than consumer prices. Then discretionary scope for fuel taxation is restricted to the differential between the wholesale price of fuel and the inflation adjusted retail price. A third possibility is an orientation towards a hypothetical ad valorem tax on fuel. In this case consumers will not oppose a unit tax increase which does not exceed the rise of wholesale fuel prices.

3.2.4 Restriction by Limited Deficit Coverage

Fuel tax increases will be fought less if the population recognizes the necessity of reducing the budget deficit. A rise of fuel taxes might be tolerated as long as the share of fuel taxes to total tax revenue T remains constant. In this case the decision model of the Leviathan politician has to take into account that fuel taxes are used to cover general

public outlays responsible for the deficit and only partly will flow back to the automobilists as road services

$$(22) \max t\Sigma B^i + \beta_1 v^m(t, G, S^m) + \beta_2 \delta[(t\Sigma B^i/T) - (t_0\Sigma B^i_0/T_0)]L(t-t_0) \\ \text{s.t. } t\Sigma B^i - (G + \Sigma S^i) \geq 0.$$

H10 (deficit coverage): A Leviathan-oriented politician will use the discretionary room offered by a scheme of deficit coverage, which leaves the tax shares of a reference period unchanged, and will raise fuel taxes above this reference level.

An empirical analysis in line with this hypothesis should reveal a positive relation between the rise in the unit tax rate and the budget deficit or the growth rates of the unit tax and the deficit, respectively.

4. Empirical Analysis

In order to test these 10 hypotheses empirically, data for the EC countries plus Austria and Switzerland (but excluding Greece due to insufficient data) are used. A pooled cross-section/time-series analysis is undertaken covering the time period from 1979 to 1990 (annual observations), since data for the dependent variable are not available before 1979.

The analysis does not intend to explain differences in the levels of fuel tax rates in the various countries. Rather it is asked how the various determinants identified above are able to explain (1) the qualitative phenomenon that the fuel tax rate is raised in a certain year and country rather than held constant (or is even lowered); and (2) the amount of this increase. Consequently, two equations are estimated empirically. In the first equation the dependent variable is a dummy variable taking the value 1 when the fuel tax rate was increased in the specific year and country, and 0 otherwise (DYTAX). As the adequate estimation procedure, a logit specification (or alternatively a probit procedure) is used. In the second equation the actual increases in the fuel tax rates (measured as percentage changes, TAXPER) are explained using the OLS estimation procedure.

Table 1: Determinants of fuel tax policy: specification of the explanatory variables and theoretically expected signs.

Theoretical hypothesis	variable and expected sign of coefficient	empirical approximation
Median voter model		
H1: benefit tax	ROAD (+)	public expenditures for road construction as % of GDP
H2: Pigouvian tax	ENVIR (+)	
H3: tax exploitation of automobilists	PKWP (-)	motor vehicles per resident
H4: interest groups	PKWPRO (-)	motor vehicles produced per 1000 inhabitants
H5: tax exploitation of foreigners	TOURIS (+)	outlays for tourism in % of GDP
H6: tax export	TAXEXP (+)	fuel price in neighbouring countries (weighted by the common border length and the size of the country)
Leviathan model		
H6: tax export	TAXEXP (+)	fuel price in neighbouring countries (weighted by the common border length and the size of the country)
H7: political opposition / reelection constraint	ELECTN (-)	dummy variable: =1 in election years, =0 otherwise (except Switzerland: =1)
	POPGOV (+)	dummy variable: =1 when the vote share for the government in the last election exceeded 52 %; =0 otherwise
H8: international comparison	TCOM (+)	mean increase in fuel tax rate in EC countries in relation to increase in domestic fuel tax rate
H9: inflation adjustment	INFL (+)	inflation rate
H10: deficit coverage	DEFICIT (+)	public budget deficit in % of GDP

In most of the countries considered, fuel levies are imposed in the form of unit tax rates (e.g. in Germany, Switzerland and Austria) which have been increased (or also decreased, as e.g., in Luxembourg in 1984) only in certain years. In some other countries fuel tax rates are subject to some indexation mechanism as, e.g., in France, where the fuel tax rate is linked to changes in the first income tax bracket. Accordingly, in the respective countries (i.e. France, Netherlands, Great Britain and Ireland) the fuel tax rates vary from year to year, although the increases are small. Yet another target of fuel taxation is characteristic of Portugal and Italy, where fuel taxes are used to compensate for variations in the price of crude oil. As a consequence, pronounced variations in fuel tax rates are prevalent in all the years. Obviously, in the empirical analysis these peculiarities have to be taken into account. So in the regression runs we either include only those countries which follow a discretionary policy in changing their unit tax rate (e.g. Germany, Austria, Switzerland, Luxembourg, Belgium, Denmark and Spain) or alternatively, when all countries are included in the analysis, we add two dummy variables, which take account of the special features of fuel tax policy in countries like France (INDEXF) or Portugal and Italy (INDEXP). Since the dummy variable INDEXP is highly correlated with several other important explanatory variables, however, most regressions are run without Portugal and Italy, i.e. without INDEXP.

Table 1 shows the explanatory variables which correspond to the alternative determinants of fuel tax policy identified before. The empirical approximations and the expected signs for the estimated coefficients are also specified. Due to insufficient data not all of the theoretical hypotheses could be tested. In particular, the incremental Pigouvian tax hypothesis and the interest group hypothesis concerning the road construction lobby had to be excluded from the empirical analysis.

In this paper the estimation results are not discussed in detail, but the main findings will be summarized. The regression results for the logit estimation (of a sample without Portugal and Italy) are given in table 2. There are six hypotheses, which are theoretically consistent with a median voter model. However, in the various specifications tested, only one of the relevant explanatory variables proves to have a dominant impact, i.e. the number of motor vehicles registered in a country. The sign is negative as expected in H3: the more vehicles the less often fuel tax rates are raised, *ceteris paribus*. The evidence for the tax export hypothesis is somewhat mixed. The impact of the aggregate fuel price in neighbouring countries is positive but not significant in specification (1), but it becomes significant when two other insignificant variables, ROAD and TOURIS, are omitted in specification (2). The coefficient shows the expected positive sign, i.e. when the gasoline price in neighbouring countries exceeds the domestic price, then the

policy maker seems to take advantage of this fact and the domestic tax rate is more likely to be increased. When, on the other hand, the gasoline price in neighbouring countries is lower (on average) than in the home country then an increase in the domestic fuel tax rate is less likely to occur. The interest group variable (motor vehicles produced) has the expected positive sign but the impact is not statistically significant. In addition, the two other explanatory variables of specification 1 connected with the hypotheses of a benefit tax (ROAD) and tax exploitation of foreigners (TOURIS) do not influence the fuel tax rate in a significant way. The dummy variable INDEXF is positive and highly significant. Obviously, some sort of indexation results in tax rates to be changed in a more continuous way. One point which requires further investigation concerns the specifics and the reasoning of indexation itself.

In comparison to the failure of most of the hypotheses which are connected with the median voter model there is empirical evidence for several of the hypotheses based on the Leviathan model. Firstly, the highly significant positive coefficient of variable INFL is in line with the inflation adjustment hypothesis, proposing that the higher the inflation rate the more likely the fuel tax rate is raised. Secondly, the political-institutional factor representing the reelection constraint comes out to be important and dominant: in election years the fuel tax rate is less likely to be increased. The respective coefficient shows a negative sign and is highly significant. Thirdly, the data are compatible with the hypothesis that fuel tax policy is restricted by international comparisons. Domestic fuel tax rates are more likely to be increased the higher is the increase in the fuel tax rate in other countries. The estimated coefficient of the budget deficit shows a positive sign, as theoretically expected, but the impact is not statistically significant. A high popularity of the government (approximated by the vote share in the last election) does not provide an incentive to raise fuel tax rates excessively. On the contrary, the coefficient shows an unexpected negative sign but the impact is not significant. Tax export as an economic restriction does not seem to be relevant according to specification (3); the coefficient is positive, but statistically not different from zero.

Additionally, it has been examined (1) whether a central government, which has only a few taxes at its disposal, uses fuel taxes more excessively, and (2) whether the existence of substitutes in taxation (motor vehicle levies) and in traffic regulation (e.g. speed limits) is positively or negatively correlated with fuel taxation. In general, the empirical evidence does not suggest a systematic connection of these measures with fuel taxation in EC countries in the sample period 1979 to 1990.

Table 2: Determinants of fuel tax policy: Logit estimation (dependent variable: DYTAX)

Explanatory variables	expected sign of coeff.	Median voter model		Explanatory variables	expected sign of coeff.	Leviathan model with political opposition	
		(1)	(2)			(3)	(4)
ROAD	(+)	24.4 (0.4)	--	ELECTN	(-)	-1.3* (4.2)	-1.4* (5.6)
PKWP	(-)	-18.7** (6.6)	-14.8** (8.3)	POPGOV	(+)	-0.1 (0.3)	--
PKWPRO	(-)	24.6 (1.7)	--	TAXEXP	(+)	0.4 (1.4)	--
TOURIS	(+)	-3.3 (0.0)	--	TCOM	(+)	36.2* (4.2)	34.9* (4.1)
TAXEXP	(+)	6.5 (1.1)	0.5(*) (3.3)	INFL	(+)	0.2* (6.3)	0.2** (10.4)
INDEXF		2.3** (8.9)	2.7** (15.3)	DEFICIT	(+)	6.6 (0.8)	--
Intercept		4.8* (4.7)	4.3* (6.6)	INDEXF		3.7** (23.8)	3.6** (24.2)
				Intercept		-2.5** (9.6)	-2.4** (12.8)
-2 log Likelihood statistic		38.7**	34.8**	-2 log Likelihood statistic		67.3**	65.4**
Score statistic		30.9**	28.9**	Score statistic		51.3**	49.6**
N		76	87	N		111	111

The figures in parentheses below the estimated coefficients are the Wald Chi-Squares. An asterisk in parentheses shows that the variable has a significant influence at the 90% level of confidence; one asterisk indicates that the variable has a significant influence at the 95% level, and two asterisks at the 99% level of confidence. The -2 log Likelihood statistic and the Score statistic test the joint effect of the explanatory variables included in the model. The asterisks attached to these values correspond to the same confidence levels as the Wald Chi-Square statistic.

The behaviour of European tax policy makers may be contrasted to tax policy decisions of US state governments, analysed in some empirical studies for the United States. Hunter/Nelson (1989) do not find empirical evidence for an impact of the inflation rate on tobacco taxes, another important excise duty. A further difference to our results is that Hunter/Nelson (1989) as well as Mikesell (1978) do not find evidence for an election cycle. Two studies of Hettich/Winer (1984) und Winer/Hettich (1992) show that tax export is not a crucial determinant of income tax policy in the United States; at least, a higher (or lower) income tax level in neighbouring countries does not seem to be the relevant incentive (or deterrent) for national tax rate changes.

5. Tentative Conclusions

The political economy approach offers a framework which allows to explain fuel tax policy as a rational choice of the policy maker. The hypotheses derived from these models are subjected to empirical tests to check their explanatory power. According to problems in the collection of relevant sample data and specification and estimation of the econometric model, the test of competing hypotheses must be regarded as preliminary.

Nevertheless, the empirical analysis shows that political and institutional constraints seem to be important in explaining fuel tax policy. In particular, the reelection constraint, the impact of automobilists as voters, the inflation rate and international comparisons influence national fuel tax policy significantly. On the other hand, the evidence for tax export to be a significant constraint for fuel taxation is rather weak.

If these preliminary results can be supported more generally, the consequences for the EC tax policy will be far reaching. Since the Commission's conjecture of massive strategic exploitation through tax export receives little support from the empirical evidence, the most convincing argument in favour of unified fuel taxes in all EC countries breaks down. Although, on the other hand, empirical evidence does not support the hypothesis that all countries use fuel taxes as an instrument of benefit taxation or of Pigouvian internalization, arguments which emphasize the welfare loss of countries losing this policy instrument gain importance. From a public choice perspective, adherence to the harmonization target in the light of our results should then be interpreted as evidence for a Leviathan at the EC level, where a supranational authority tries to broaden its discretionary power.

In the current situation of uncertainty about the true economic effects and of low willingness of EC members to subscribe to far reaching harmonization plans, a viable

alternative seems to be the envisaged transitional minimum rate regulation. A relatively low EC-wide unit tax on fuel might serve as the minimum threshold against strategic tax competition among EC countries. In principle, fuel tax revenue from this basic tax rate might serve as a fourth financial resource for the EG budget. On top of that supranational unit tax, countries should be free to levy national fuel taxes in order to meet country specific preferences of voters and governments. Such a system closely resembles the current situation in the US, with a low federal tax on gasoline (1989: \$.09/gallon) and additional state tax rates varying between \$.08 and \$.22, although the European tax levels are much higher. Tax arbitrage will not cease to exist then, but national fiscal losses due to tax export will concern surcharge revenue only. An advantage of introducing an EC fuel tax might be that despite cross border arbitrage revenue from the EC tax component flows back to the member countries through lower EC contributions related to the VAT base or the GDP. However, it will be most important to restrict EC tax policy to ensure that the EC output corresponds to the fiscal contributions according to preferences of the European citizens and taxpayers. Feeding the EC Leviathan in an economically and politically efficient way will remain a difficult but important issue in the research agenda of the economic theory of tax policy.

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