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AN EMPIRICAL ASSESSMENT OF THE EFFECTIVENESS OF OIL TAXES

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OVERVIEW

The ongoing public debate about the most efficient and applicable policy interventions to reduce the speed of global warming deserves empirical examination in order to evaluate the effectiveness of the discussed policy instruments. From a practical point of view many scientists will argue that all polluting nations have to reduce their demand for oil and other carbon resources in order to emit less of the climate-damaging carbon dioxide gas. This seems to be reasonable as in fact only few countries in the world are suppliers of carbon resources, so that the set of policy options for most countries is limited to demand side interventions. The internationally most popular and perhaps politically most feasible policy instruments can be summarised under the idea of pigouvian taxation, i.e. the taxation of the consumption of fossil fuels and their complements. Following the pigouvian argument environmental taxes do not have a fiscal motivation but are primarily used to correct for market failures, e.g. negative externalities. These may arise from individual overconsumption of carbon resources as the climate can be regarded as a global public good with initially a price of zero. Therefore, most countries in the world impose a price by setting taxes. This paper explicitly aims at examining the effects of taxes which are aiming at a reduction of the consumption of oil.

METHODS

Oil is used as production factor within an economy. The typical assumptions about the production technology being Cobb-Douglas or CES will result in isoelastic demand curves. Loglinearisation of this demand curve allows the coefficients to be directly interpreted as elasticities. The estimated tax elasticities quantify the percentage change of oil demand for a given one percent increase in the implicit tax rate. We assume small economies that do not influence the oil price with their oil demand. Following the estimation of price elasticities of oil demand by [2] we employ an adaption the partial adjustment model of [4]. Contrary to [2] we use growth rates for the estimation. Further discussion of the approach can be e.g. found in [3], [6] or in [1].

RESULTS

In a first step we have divided the time horizon into four sub-units, 1965-1974, 1975-1986, 1987-1998 and 1999-2007, and pool the independent cross sections across time. In our preferred specification we find for the direct-tax elasticity of demand significantly negative coefficients for all four time periods which is line with the theory of pigouvian taxation: A tax increase on oil goods reduces the demand for oil. The elasticity is quite small from 1975-1986 which is not very surprising as after the first oil crisis (1973-74) and during the second oil crisis (1981-82) – and clearly also in the years before and after – other factors may played a larger role than taxes. However, since 1987 the elasticity becomes stronger, i.e. a change in direct taxes on oil goods affects oil demand to a large degree. We obtain similar results for the taxes on complements of oil goods. After having no influence during the turbulent years from

1975-1986, higher taxes on complements significantly reduce the demand for oil in recent years. Thus we conclude that over the whole sample oil-taxes do not only generate fiscal revenues but also significantly influence the demand for oil and that this influence has increased over time.

In step two we focus on differences regarding the impact of tax policies between the countries in our sample. We observe that generally the direct-tax elasticities of demand are as expected, typically negative, but differ in size quite substantially between the countries. In Portugal, Poland, Greece and Japan the effect of higher direct taxes has the desired direction but is not significant. In contrast, we find very strong effects in Germany, Austria, United Kingdom and Ireland. Still significantly negative but slightly smaller effects we detect in Switzerland and Finland. Hence, for six countries in our sample we can show that pigouvian taxation works. Taking a brief look at the tax-elasticities of demand for complements of oil goods we see that they generally have a smaller influence and are less significant in some countries. Austria is an exception as in both specifications higher taxes on the complements of refinery products reduce the demand for oil. For example this could mean that the introduction of the toll for using Austrian highways could have significantly influenced Austria's demand for oil.

CONCLUSIONS

Our empirical analysis for ten countries for the years 1965-2007 makes three important contributions to the existing literature on estimation of oil demand functions: By for the first time including data on direct taxes on oil refinery products and on taxes on their complementary goods and services, we find that the argument of a pigouvian tax can generally be supported over our sample of ten countries. Second, the influence, however, of direct taxes on oil refinery products differs substantially between countries: While in Portugal, Poland, Greece and Japan the effectiveness of the policy measures cannot be unambiguously shown, we find them to be highly significant and effective in central and northern European countries, like Germany, Austria, United Kingdom and Ireland and Finland. Third, we observe – as could be expected – that the taxes on complements of oil refinery products are less effective in reducing the oil demand and even contradict the desired effect in one case. Beyond a qualitative evaluation of the policy measures we are able to quantify the short-run and the long-run effects. Moreover we are able to show that the effectiveness of this type of eco-taxation has generally improved recently.

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