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The impact of introducing a carbon tax for Scotland

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1. Introduction

The Scottish Government has increasingly adopted a distinctive environmental and energy policy from the UK as a whole. This has been the case despite many important policy instruments remaining reserved to the UK Government. For example, the key "green" elements of the tax system – fuel duties, air passenger duty and the climate change levy – as well as powers over the tax-transfer system; powers over the structure of the electricity market; Renewable Obligation Certificates; the Renewable Transport Fuels Obligation and the Renewable Heat Incentive; Climate Change Agreements; and the Carbon Reduction Commitment; are all under the control of Westminster.

While the Scottish Government has succeeded in making Scottish policy more distinctive, the Committee on Climate Change report into Scottish emissions targets concluded that with current policies, and assuming the current cap on emissions under the EU Emissions Trading Scheme, the Scottish Government's target of a 42% reduction in CO_2 emissions by 2020 will be missed, with emissions falling by only 38% compared to 1990 levels[1].

Most economists regard a carbon tax as the most efficient way to reduce carbon emissions[2]. It is therefore of interest to consider the effect of a Scottish-specific carbon tax. This is particularly relevant given the more demanding environmental targets set by the Scottish Government and the present discussions around increased fiscal autonomy. In the work reported here we have used an energy-economy-environment model of Scotland to simulate the impact of the Scottish Government imposing such a tax on carbon emissions and the level of aggregate (and sectoral) economic activity.

2. General arguments for a carbon tax

- Externalities, such as emissions, are not taken into account when firms make production decisions.
- These externalities can be internalised by government in two ways. A government may set a tax equal to the marginal cost the externality imposes on others. Or it can charge for allowing individuals and organisations to emit – through a permit or allowance system. The principle behind carbon taxes and carbon trading is therefore the same: a price is set for emitting carbon, either through a specific tax or the requirement to purchase a permit.
- Both approaches (a tax or a permit system) provide an effective means for decentralised decision making, i.e. meeting targets at minimum cost to the economy. Setting a price on

[1] This is strongly dependent on the caps set under the EU Emissions Trading System. If these are tightened then the CCC concluded it was possible for Scotland to meet its 2022 targets on emissions with existing instruments.

[2] See, for example, Tullock, G. (1967), "Excess benefit", *Water Resources Research*, Vol. 3, p. 643-644; and Pearce, D. (1991), "The role of carbon taxes in adjusting to global warming", *Economic Journal*, Vol. 101, pp. 938-948.

carbon emissions generates an appropriate set of incentives: individual firms and consumers decide how best to adjust to the increase in price.

- But carbon taxes, or potentially permits, are also sources of revenue for the government, so that when carbon taxes are introduced, other taxes can be reduced.
- This can generate a double-dividend: CO_2 emissions fall whilst the efficiency with which other elements of the economy operate simultaneously rises. Typically this would occur through reduced taxes on employment thereby lowering the cost of labour and encouraging the substitution of labour for other inputs to production.

3. Results and policy implications

- Our modelling reveals a double-dividend (a fall in CO_2 emissions and a simultaneous rise in both GDP and employment) when revenues from a carbon tax are returned to the Scottish economy through a reduction in the tax on labour.
- The fall in the income tax rate in the long run is 5.37%, which is within the range of variation specified under the Scotland Act (2012).
- In the long run, when tax revenues are recycled in this way, employment increases by 1.06%, GDP increases by 0.83%, whilst CO_2 emissions fall by 37.5%.
- Under external recycling (i.e. saving the tax revenues) or when revenues are recycled in the form of government spending, we find no double-dividend. In both cases, CO_2 emissions fall, but the net effect on economic activity and employment is contractionary.
- In the case with a double-dividend, within the Scottish economy, output is higher across the "Manufacturing", "Service" and "Utilities and transport" sectors, while the conventional energy sectors (gas, oil and coal) and fossil-fuel (coal and gas) electricity generation sectors see a reduction in their output of between 10 and 25%. The share of electricity generated by renewables increases in the long-run by slightly more than 42%.
- When we incorporate forward-looking behaviour on the part of agents, the targeted reduction in emissions is reached faster than when agents are assumed to have myopic (e.g. backward-looking) behaviours.
- This latter point highlights the benefits of credibility in the implementation of environmental policy. In order that agents can optimally adjust to policy by anticipating its future effects, those agents must believe that the policy will be maintained in the future. The present Scottish Government has been much clearer in its support for renewables than the present Westminster government, for example. There is a slower change in CO_2 emissions without the commitment to the future, and the (2020) target is not reached until 2025.

4. Conclusions

The CCC has cast doubt on whether the Scottish Government has sufficient policy instruments to meet its demanding emissions targets. At the same time, discussions on devolving fiscal powers further are gaining momentum. We note that the Scottish Government has not proposed a carbon tax, nor has any commitment been made to consider one. However, it is still valuable to consider the likely effects of any Scottish-specific carbon tax[3]. Such a tax would be a genuine option under independence or some future enhancement of devolved fiscal powers. Our simulations indicate that a revenue neutral carbon tax could simultaneously stimulate employment while reducing emissions: the double dividend.

The analysis reported here is at a preliminary stage. We plan more extensive systematic analysis of the factors that would govern both the direction and the scale of the Scottish economy's response to a carbon tax. To the extent that the tax stimulates innovation in low-carbon technologies the double dividend estimates presented here might not be the upper bound. Alternative more narrowly targeted revenue-recycling options, such as reducing tax rates for specific age-groups of the population, might also be worth exploring.

5. Model and simulation strategy

The modelling uses the AMOSENVI multi-sectoral energy-economy-environmental computable general equilibrium model for Scotland, developed by the Fraser of Allander Institute, University of Strathclyde. This model has 19 sectors, nine of which are electricity generation technologies. An *ad valorem* carbon tax is imposed on carbon emissions generated in production, where the tax rate is differentiated according to the carbon content of each fuel.

Further information: G.J. Allan, P. Lecca, P.G. McGregor, J.K. Swales, M. Tamba and M. Winning (2012), "The impact of the introduction of a carbon tax for Scotland", *Fraser Economic Commentary*, April 2012, Special Issue – Economic and energy system modelling, online at http://www.strath.ac.uk/media/departments/economics/fairse/specialissues/Special_Issue_No_3_-_Economic_and_Energy_System_Modelling_-_Apr_2012.pdf