Appendix: Some tax arithmetic

This provides some back of the envelope calculations to assess the impact of an environmental tax reform on disposable income of wage earners; i.e. a reduction wage taxes paid for by increased taxes on (polluting) energy consumption. In the extreme case of a reduction of the wage tax to zero the change in income for the representative wage earner is

$$\Delta = I_W \tau_w - EE_W \tau_E$$

where I_W is (pre tax) wage income, EE_W energy expenditure of wage earners, τ_W and τ_E the tax rates on wage income and energy expenditure respectively. In order to balance the budget the government must impose an energy tax rate of

$$\tau_E = \frac{I_W}{(EE_W + EE_O)} \tau_W$$

where EE_O is energy expenditure paid for by non-wage income.[1] Combining these two equations yields percentage effect on post tax wage income of a revenue neutral environmental tax reform as:

$$\frac{\Delta}{(1-\tau_W) I_W} = \frac{\tau_w}{1-\tau_W} \left(1 - \frac{EE_W}{EE_W + EE_O}\right)$$

For τ_W, current tax rate on earnings I assume 32% which is based on calculations by Patrick Minford for the UK. The share of energy expenditure by wage income in total energy expenditure we can rewrite as

$$\frac{EE_W}{EE_W + EE_O} = \left(1 + \frac{e_O}{s_W e_W}\right)^{-1}$$

where s_w is the wage share of total income, e_W and e_O the share of energy spending for wage income and other income respectively. For s_W I am assuming 0.6.[2] Using the ratio between the bottom and top deciles of income distribution from Wier et al. (see Footnote 4) I am using $\frac{e_O}{e_W} = 0.5$. This yields an increase of 21% for post tax wage income.

[1] I am assuming here that while taxes might alter employment and/or energy consumption levels they do not impact on expenditure. This is consistent with Cobb Douglas production and utility functions and for expositional simplicity. The argument extents to more general cases.

[2] This is roughly consistent with the figures provided in Serres, A. D., Scarpetta, S., and Maisonneuve, C. D. L. (2001). Falling wage shares in Europe and the United States: How important is aggregation bias? *Empirica*, pages 375-401.