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Personal carbon allowances: A revised model to alleviate distributional issues

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ABSTRACT

Personal Carbon Allowances (PCAs) are a policy proposal designed to facilitate carbon emissions reduction and engender carbon consciousness: they were investigated by the UK government in 2006–2008 but subsequently shelved. With continuing growth of atmospheric CO_2 concentrations and increasing interest in behaviour change agendas PCAs are worthy of fresh development.

Wide variation in energy usage between households of similar incomes implies that under the 'standard' model of PCAs significant numbers of low-income high-emitters would have to purchase top-up allowances. If PCAs penalise some of the worst off in society it creates a major political obstacle to their introduction.

Solving this distributional problem by allocating additional allowances to certain groups or offering compensatory state benefits has been investigated and appears costly and only partially effective. This paper proposes a new 'Mean & Max' PCA model whereby higher usage is necessary before purchase of top-up allowances is required; potentially highly effective but consequently the volumes and values of surplus and top-up allowances become significantly different. This difference renders free market carbon allowance trading unworkable, potentially eliminating a hallmark (but publicly unpopular) PCA feature. The new model potentially offers the first solution to the distributional problem since it was highlighted in 2008.

1. Introduction

Whilst individually personal emissions are insignificant, together they constitute about 42% of the national total (Lockwood, 2010; DTI, 2007). It is not possible to meet the legally binding targets for carbon emissions reduction of 80% versus 1990 levels by 2050 (CCA, 2008) unless these are very substantially reduced. Government carbon-saving initiatives to date have focused on central government actions such as renewable energy subsidies: they have been reluctant to place responsibilities on individuals to reduce their own emissions (Kerr and Battye, 2008; Parag and Eyre, 2010).

Whilst there has been a 20% drop in UK residential gas and electricity consumption from 1990 to 2013 (equivalent to 0.7%pa compound) (DECC, 2015a) this compares badly to the 3.8%pa compound reduction necessary to reach 80% by 2050.[1] Multiple studies have shown that individual attitudes and behaviours cause household usage to vary significantly, sometimes by factors of 2 or more in identical properties (Darby, 2006; Wood and Newborough, 2003). PCA proponents suggest that major reductions will not occur from an extension of under-delivering current strategies and to do so means introducing personal attribution of carbon consumption back to the individual with consequent emergence of new social norms around usage (Shove, 2010).

PCAs place focus squarely on individuals to recognise and modify their fossil fuel usage. They emerged in the late 1990's as a method of bringing about gradual, widespread behaviour change and delivering a long-term mechanism for encouraging substantial reduction in fuel use. There are various versions of PCAs, some more developed than others (Ayres, 1997; Fleming, 1997; Hillman, 1998; Starkey and Anderson, 2005) some including public transport, most including aviation, but as a minimum all include the following:

- a free allocation to individuals of allowances from the government, the sum of all allowances being equal to the governments target consumption for the personal sector for the year. These allowances are 'spent' or 'surrendered' whenever a fuel bill is paid (gas, electricity, petrol, diesel, heating oil, coal). They can also be freely transferred to others (eg between cohabitees);
- fossil fuel used in home heating and personal vehicle transport;
- a facility to purchase more allowances if emitting more than the free allowance or ability to sell excess allowances if emitting less than the free allowance;
- the underlying assumption that the free allowance allocation will decrease year-on-year.

Policy options include whether children, the elderly or the disabled should receive additional allowances. Operationally the PCA concept is

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[1] the 37th root of (100–20)/20 is 1.038. (2050–2013 = 37).

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similar to a bank account and debit card, but relates to carbon only, not money. Each individual has a carbon account which is periodically (perhaps monthly) charged with a universal free carbon allowance. Every time fuel is purchased the carbon card is presented (in addition to a payment card) and the level of remaining allowances in the carbon account is checked electronically. If the balance is sufficient the carbon value of the purchase is then removed from the account. Otherwise a top-up allowance purchase is required which is added automatically to the fuel bill the customer is trying to pay. Surplus allowances can be sold for real money. If the purchaser does not present a carbon card, either because they do not have one, have forgotten it or are an overseas visitor, they must buy top-up allowances at point of purchase.

Whilst allowances would be allocated personally under PCAs the concern is whether households (single and multiple occupancy) would suffer overall. Fortunately UK data is predominantly collected at the household level. Expressed graphically, the distribution of the emissions across households is that in Fig. 1, with the vertical line representing the mean.

In conceptual terms the mean level of emissions represents the free allowances given to individuals. More than half (58%) of the households are below the mean and would have surplus allowances (Thumim and White, 2008), but the right-skewed distribution includes a long tail with a proportion of very high emitters. Use of the mean as the yardstick implies that by definition the surplus of allowances from under-emitters balances the top-up allowances required by over-emitters. The recorded emissions and position of the mean varies depending on the items included in the calculation (such as flights) but the basic distributional shape remains.

Fig. 2 plots the frequency distribution of the lowest three income deciles with the vertical line representing the mean of the whole population. The highest income decile is included for comparison. Intervening deciles form a steady broader distribution/higher emissions trend between decile three towards decile ten. "Low Income" in the UK is generally defined as the lowest three income deciles.

It can readily be seen that a significant number of households in the lowest three income deciles have emissions greater than the mean and so would have to purchase additional carbon allowances under the 'standard' model of PCAs. This is the 'distributional problem'. The political problems of introducing a policy which disadvantages some of the poorest in society are considerable (Chamberlin et al., 2015).

Expressing this problem in a different format, Fig. 3 shows the derived means for emissions split by income decile. The distributional problem results from the tight overlap of the emissions from the different income deciles: the potential mean values of the lowest decile and highest deciles overlap.

A government-funded study calculated that 2.1 m households in the lowest three income deciles had emissions exceeding their allowances (assuming that their allowances were set at the mean emissions level) (Thumim and White, 2008). Other authors have attempted to reduce the impact on low-income high-emitters by allocating them more allowances dependent on lifestyle factors such as age, housing type and rurality of location, but the overall impact is limited and the process simply creates classes of winners and losers within the lower deciles. A similar number are still disadvantaged, with 1 m of these households not on benefits and therefore hard to compensate (Bird and Lockwood, 2009; White and Thumim, 2009). Also, these adjustments also require considerable extra detail to be collected, verified and amended as they change, increasing costs.

The purpose of this paper is to propose a modification to the 'standard' PCA model by increasing the level of emissions before allowance

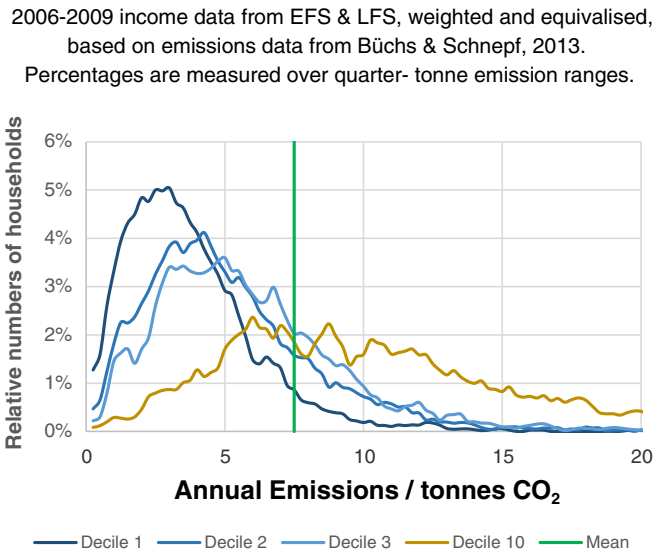
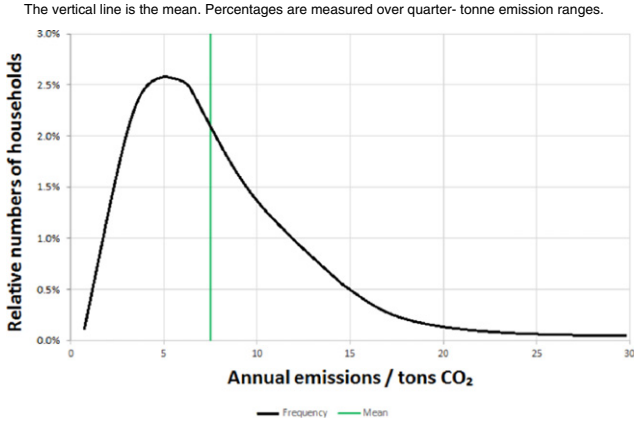
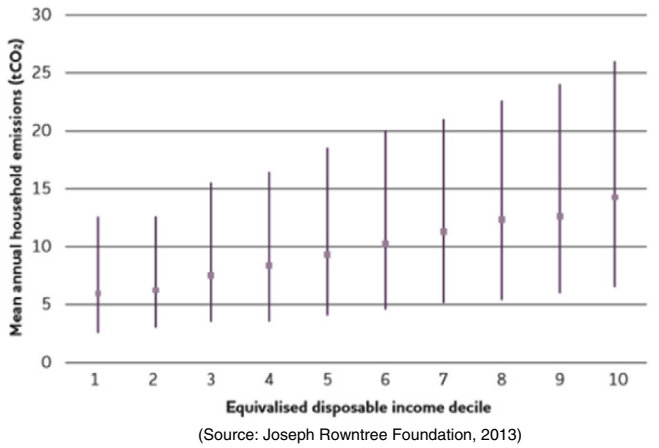


Fig. 2. Emissions in tons by equivalised income decile. 2006–2009 income data from EFS & LFS, weighted and equivalised, based on emissions data from Büchs and Schnepf (2013). Percentages are measured over quarter- tonne emission ranges.



(Source: Author, derived from the database created by Büchs & Schnepf, 2013)

Fig. 1. Emissions from household energy and motor fuel. The vertical line is the mean. Percentages are measured over quarter- tonne emission ranges. (Source: Author, derived from the database created by Büchs and Schnepf (2013)).



(Source: Joseph Rowntree Foundation, 2013)

Fig. 3. Mean annual CO_2 emissions from all sources by equivalised household disposable income decile showing 95% confidence intervals for the mean. (Source: Joseph Rowntree Foundation, 2013).