Energy, expenditure and consumption effects of rebound, Part I

I still have problems with this paper. The notation is really hard to keep in mind – the authors seem to have forgotten that they have been working on this topic for far longer than the average reader, and to adjust for that. For example, the budget constraint (4) would be easier to understand if it stuck to “primitives” – total income must equal the costs of buying the device and of disposing of it (both multiplied by annuitisation factors), of (non-energy) operation and maintenance, the amount spent on all other goods and services (perhaps with no explicit price needed, since it’s normalised to 1) and the cost of energy bought for the device. But that energy cost should be written as the amount of energy service consumed, divided by the efficiency with which energy is converted to the service, multiplied by the price of energy. There’s no need for the initial budget constraint to contain the “savings” N (which is zero, anyway), and creating new versions of your cost variable C, each with another subscript to be memorised, just raises the cognitive load. I’d strongly recommend using G for the quantity of other goods and services, just to reduce the number of C-subscript variables the reader has to keep track of. I realise that you assign that letter to a different concept towards the end of the paper, but equation 36 relies on a very odd assumption in any case – surely any reduction in energy prices would overwhelmingly affect energy consumption! Five appendices is more than enough for most papers, and so I’d drop appendix F and just leave it as a topic for further research. I’ve also now spotted the use of G in section 2.5.3, but I don’t think it’s actually giving you anything important in understanding the derivation.

I realise that economic theory shouldn’t be “easy”, but that doesn’t mean that authors can’t do things to make it easier. Engineers may like dots to denote a flow, but economists often use lower case letters, with capitals for stocks. Annuity factors preceding a capital cost would be lower case. Is that convention clearer? It may be more familiar to your readers. Please be very careful to ensure that you define every term before it is first used in an equation – I don’t think you do so before using q sub O and p sub O in equation 5. Using p sub G alongside G (or g) will reduce the risk that readers start thinking that your current “sub O” variables refer to the original values of energy service consumption and its price.

Where parameters only change once in your analysis, why not just have the original value and a changed rate (perhaps superscripts “o” and “*” or a prime marking)? And if they don’t change at all (income and the price of energy), you don’t need any superscripts. That way, you make it obvious for the reader whether you are using the “old” or the “new” values of a particular parameter when you calculate an effect.

You might get a nice result if you introduced the Compensating Variation into the analysis of your income effect – I think that the “net savings” that are going to create this effect are going to be equal to the monetary value of the initial emplaced energy saving, less the increase in the cost of owning and operating the device (or plus any saving), plus the Compensating Variation for the “price” change of the energy service, which is linked to the two substitution effects you’ve just calculated. Indeed, you show this Compensating Variation in the expenditure diagrams (figures 3 and 6) of Part II.

I’m not sure what the convention on discounting in studies looking at energy savings and embodied energy – if you wanted to use your numbers to get a cost per MJ actually saved, it would be essential to discount everything, for consistency. It could also be argued that emissions in the near term are worse than those occurring later, since they will be in the atmosphere for more of the period most relevant to those currently alive. (The counter-argument that the carbon per unit of energy may fall over time is probably too speculative for more than a footnote.) It’s a bit odd to discount decommissioning costs but to ignore the issue for the initial purchase of the device. I don’t think you need the parts of the appendix that prove that the annuity factor is one over the device lifetime when the interest rate is zero – that’s a standard result in economics, and entirely intuitive (since the annuity factor combines depreciation and the return on outstanding capital, and a zero interest rate gives no return on capital). The assumption that device installation will be spread evenly over time ignores the well-known S-curve pattern with which most innovations are adopted.

Is there a problem with the N (or its description) in line 403 – is it all income, or all of the change in income after spending on energy?

I suspect footnote 20 is a bit strong – the rise in efficiency does make the energy available to the economy go further, and there’s probably some scope for substituting between energy and other inputs, but as those other inputs remain constrained, I suspect there could still be crowding out.

Table A.1 should not be defining something (m) to equal two different things, but I don’t think there’s any point in having an equation with mass in it, so that’s another distraction to cut…

Appendix B.1 is much fuller than it needs to be – there are a lot of expressions that you’re writing out in full that economists would just “take as given”, and if you feel you must derive them for one cost category, you should still just add a sentence which lists the categories that are analogous. I realise that “space” may be cheap in an online appendix, but readers’ attention is a scarce commodity.