In kind calculation and the Kyoto protocol

Neurath's concern with natural resource constraints is obviously relevant in today's world. In Allin and my proposals we allow for marked labour content and selling prices to diverge provided both are clearly marked on the product so that the consumer knows if they are getting good 'value for money'. If goods are marked up due to a temporary shortage of supply, the fact that the labour value of the good as well as its current selling price is displayed in the shops means that consumers can contrast the market price with what Smith called the 'natural price', and hold off consumption in the expectation that prices will fall.

This would not work in the case of abiding natural resource constraints. Suppose an administative economy has to abide by the Kyoto protocol. It then has two over-arching constraints on production – the available labour force and the allowed emissions of $C0_2$. If we allow the consumer goods market to move to an equilibrium where prices coincide with labour values, then we will have a particular vector of final outputs. Just as one can compute labour values one can in principle compute the 'carbon' value of any product or process - this is what Neurath's in-kind calculus implies.

We now have three vectors λ the vector of per-unit labour values, κ the vector of per-unit carbon values, and y the market clearing vector of final outputs when market prices equal labour values. In an economy not bound by the Kyoto protocol, the plan or market must meet the constraint $P \geq \lambda.y$ where P is the working population measured in full time persons[1], and . denotes inner product. Suppose that we have a Kyoto limit on carbon emissions of K then the economy must meet the constraint $K \geq \kappa.y'$ where y' is the actual output vector.

If y the market clearing vector for prices=values, is such that $K < \kappa.y$ then we have a problem. Either all output is proportionately scaled back such that

$$y' = y(\frac{K}{\kappa.y})$$

with a consequent under utilisation of labour resources, or the plan devises a set of re-scaling weights w such that $y' = (y \centerdot w)$with $\centerdot$ being Hadamard product, such that both the full employment and Kyoto constraints are met. The market clearing price for y' will not necessarily guarantee that prices are still equal to labour values.

The end result will be that certain products, whose production ultimately produces large quantities of $C0_2$will end up being sold above their labour values.

Unless and until one has carried out real calculations with real input output tables it is difficult to determine how large will be the induced deviation of prices from values resulting from abiding by the Kyoto protocol.

Suppose for example, that λ and κ turn out to be highly correlated, or in other words, the angles between the vectors are small. This would make it difficult to meet the Kyoto constraint whilst meeting the full employment target, since change in weights which reduce $y.\kappa$ will also reduce $y.\lambda$.

Suppose instead that λ and κ turn out to be weakly correlated, or in geometric terms, that the two vectors are at a substantial angle. In this case there will be a large number of rescalings w that will ensure both Kyoto and employment constraints are met. If the system has a sufficiently high number of degrees of freedom

[1]Some dimensional analysis helps here. Labour values have dimension person-hours = persons×time. y has dimension unit of output per unit time, so $\lambda.y$ has dimension persons.

(broad classes of products), then it should be possible to exploit 'decoherence' to minimise the eventual deviations between prices and values. The point here is that $CO_2$is produced directly or indirectly by almost every production process. A first order solution to meeting Kyoto would involve reducing the scale of those industries i with the highest values $\frac{\kappa_i}{\lambda_i}$, since these reduce carbon emissions fastest whilst causing the least unemployment.

Suppose that a 5% reduction in CO_2 emissions is being sought. Suppose that the use of oil for heating has a high $\frac{\kappa_i}{\lambda_i}$ whereas the growth of fruit has a much lower $\frac{\kappa_i}{\lambda_i}$. This implies that the planning authorities could scale back heating oil production and transfer oil workers to fruit packing plants and so help meet the Kyoto targets, whilst maintaining full employment. The effect on the market clearing prices for consumer goods would be that heating oil would rise above its labour value whilst fruit fell below its labour value, but since both industries are government owned, the notional losses incurred by fruit production could offset the notional 'profit' in fuel oil. Changes in price due to meeting the Kyoto protocol could then be marked as a 'green tax' or a 'green subsidy' on the final price of the goods.

But if the state wholesaling authorities had statistics on the elasticity of demand for different products, they could employ a more sophisticated rule.

Let $e_i$be the elasticity of demand of the ith product. Then the planners should preferentially scale back those industries for which $e_i\frac{\kappa_i}{\lambda_i}$ is highest and redeploy workers to industries for which $e_i\frac{\kappa_i}{\lambda_i}$ is lowest. The net effect is to allow both employment and Kyoto targets to be met with the minimal deviation of prices from labour values.

So Neurath was right about labour values being insufficient for the internal regulation of production. Instead he advocates detailed statistics on the consumption and use of each raw material and intermediate product - what would later be called an in-kind input output table. But as the example above, of meeting the Kyoto protocol shows, meeting such environmental constraints is much easier for a fully planned economy. An economy controlled by detailed in-kind calculations can readily determine if a particular mix of output will achieve a 5% cut in greenhouse gas emissions whilst meeting employment targets. Wholesale prices can later be adjusted to ensure consumer goods markets clear. In only price mechanisms are allowed as a control over greenhouse gas emissions governments face the problems that:

- They will probably not have the detailed in-kind statistics needed to tell upon which products or processes to levy carbon taxes.
- The response of aggregate demand to these price signals is uncertain, so if the performance of countries so far is anything to go on, the Kyoto targets are unlikely to be met until many iterations of adjusting green taxes have occured.
- If governments err in the other direction, by increasing green taxes very sharply to ensure meeting Kyoto targets, they are likely to depress employment.

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