Hayek's Ricardo effect

G. R. Steele

In their review of the Ricardo effect controversy, Moss and Vaughn (1986) give a valuable summary of the background issues. However, they omit one central element. This is the distinction between the marginal efficiency of investment and the marginal efficiency of capital which neither Keynes in *The general theory,* nor the protagonists in the Hayek-Wilson-Kaldor debate, recognised as important. It is the one element which permits, if only in part, Hayek's dynamic analysis to be brought to terms with the comparative static approach adopted by the others.

Modern textbook definitions of the marginal efficiency of investment and the marginal efficiency of capital can be traced to Lerner (1944) (although his terminology for the latter is "marginal productivity of capital"). While accountants will recognise the former as the internal rate of return obtained by setting a stream of future earnings equal to the present cost of a new capital investment, the nature of the marginal efficiency of capital demands more detailed consideration.

For any given period (say a year) entrepreneurs must decide upon the optimal amount of net investment; this is the amount which sets the marginal efficiency of investment (declining with the amount of net investment per period) equal to the rate of interest. The greater the amount of net investment undertaken, the higher will be driven the cost of capital which must lower the marginal efficiency of investment. Thus, in this period, the investment decision "does not decide the *quantity* of capital that it is worth holding at the current rate of interest . . . but *the rate per unit of time* at which the capital is to be acquired, or in other words *the rate of investment*" (Lerner 1944, 333). Over successive periods, the stock of capital will grow, exhausting, in descending order, the most profitable opportunities for new investment expenditure. Not only will new capital face decreasing physical returns, the larger volume of industrial output will be sold at a lower unit price. Inevitably, the marginal efficiency of capital will decline; but while it exceeds the rate of interest, net investment in each successive period will be positive: "The difference between the marginal productivity [efficiency] of capital and the rate of interest is the *force* which makes the stock of equipment grow or decline" (Lerner 1944, 335). From these cir-

Correspondence may be addressed to the author, Dept. of Economics, University of Lancaster, Gillow House, Lancaster L1A 4YX UK.

cumstances, it is possible to define the marginal efficiency of capital as "the marginal efficiency of investment when the rate of net investment is zero" (Lerner 1944, 335) which concludes our definitions.

Ricardo answered the question why it is that a machine *performing* 100 man-years of work must *contain* less than 100 man-years of work. The reason is that, if this were not so, the machine maker would receive no profit; and a profit is required in order to compensate for the amount of time taken to make the machine. More/less capitalistic methods are those which use machines incorporating more/less man-years.

The Ricardo effect relates to the capital content of methods of production. It occurs whenever the price of output (commodities) increases and causes an increase in profits. This increase will be greater for less capitalistic than for more capitalistic methods of production. While greater profitability will encourage increased investment expenditure across the full range of methods of production (capital widening) the incentive will be greatest for the least capitalistic methods of production (capital shallowing). Reaction to this creates the Ricardo effect, as investments are concentrated upon less capitalistic methods of production, with the implied impact upon the capital structure of industry.

In providing a detailed illustration, a more modern definition of capital content is now used: a more/less capitalistic method relates not to the time taken to produce capital goods but, instead, is defined in terms of n, the number of years before the value of a capital investment is fully realised in the discounted value of the commodities produced. It is assumed that production of a given commodity can be achieved using capital with any expected duration of n years.

Initially, investment in each mode of production is assumed to have been taken to the point where the last $100 of investment gave an annual internal rate of return (or marginal efficiency of investment) of 7 percent. In full equilibrium, the marginal efficiency of capital would also be at 0.07. Using discounted case flow criteria, and assuming a constant annual net revenue from the sale of commodities of amount x, we have

$$\$100 \ = \ \$x \sum_{i=1}^{n} \ (1.07)^{-i} \tag{1}$$

$$\$100 \ = \ \$x[1 \ - \ (1.07)^{-n}] \ (0.07)^{-1} \tag{2}$$

such that values of x may be found for any method of production. The following is a selection from the values given by equation (2).

n:	1	5	10	15	20	25	30
x:	$107.0	$24.4	$14.2	$11.0	$9.4	$8.6	$8.1

Since these values reflect a capital structure which is in full equilibrium, it is not possible to deduce the profile of that structure. The analysis relates only to the last unit (here $100) of investment expenditure.

Suppose now that commodity prices rise by 5 per cent (i.e., that each of the values of x given above is multiplied by 1.05). Clearly this must raise the annual internal rate of return (i.e., the annual marginal efficiency of investment) in all methods of production. Precise values may be obtained from equation (2), which now will have r (formerly 0.07) as the unknown variable. By a process of iteration, the following values are obtained.

n:	1	5	10	15	20	25	30
r:	0.124	0.089	0.081	0.078	0.076	0.076	0.075

In every case, the annual marginal efficiency of investment is above the original 0.07 which provides the incentive to invest in all methods of production (capital widening); but the incentive is greatest for the least capitalistic mode of production. Thus, while the stock of capital will be increased in every case, the bias will be towards the shallow end of the capitalistic structure. Increased investment will eventually reduce the annual marginal efficiency of investment in all methods of production.

It is here that the role of the marginal efficiency of capital is relevant. In this disequilibrium situation, there are no reasons why its value should be the same for all the different methods of production. For the Ricardo effect to be avoided, the decline in the marginal efficiency of capital, with respect to net investment over successive periods, would have to be greatest at the shallow end of the structure of capital, and least at the deep end. The presumption must be that any such relationship would constitute a special case; that with no systematic relationship the Ricardo effect would result in the concertina effect acting upon the structure of capital (i.e., capital shallowing).

Hayek argued for the eventual dominance of capital shallowing over capital widening (the Hayek effect?). A prolonged period of monetary expansion would stimulate investment expenditure in the manner described above. Not only would this depress the market rate of interest below the natural rate (in itself a stimulus to investment), but rising prices would push internal rates of return still higher. Increased investment expenditure on capital goods would direct resources from the production of consumers' goods, and so cause the price of the latter to rise still higher: "so long as investment continues to increase, the discrepency between prices and costs of consumers' goods must become progressively larger till the rise in the rate of profit becomes strong enough to make the tendency to change to less durable and expensive types of machinery dominant over the tendency to provide capacity for a larger output" (Hayek

1939, 33). This is the conclusion which was disputed by Kaldor and Wilson. This is the issue which is intractable because of the methodological differences.

Hayek emphasised the supply constraints which arise during the dynamic path of adjustment *before* a final equilibrium is reached. How is a fully employed labour force to be distributed between the different methods of production? Rising commodity prices create cumulative pressure against more capitalistic methods of production. Where investment in less roundabout methods is insufficient to arrest this trend, resource constraints may cause a failure to renew more durable machinery. It is this consideration which produces the Hayek effect, but which cannot arise within the static methodology.

References

Hayek, F. A. 1939. *Profits, interest and investment*. London.
───── 1942. 'The Ricardo effect.' *Economica* (May). Reprinted in *Individuals and economic order*. London.
Lerner, A. P. 1944. *The economics of control*. New York.
Moss, L. S., and K. I. Vaughn 1986. 'Hayek's Ricardo effect: a second look.' *History of Political Economy* 18:4: 545–65.