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CAN AN OIL DISCOVERY LEAD TO A RECESSION?*

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1. Introduction

In a recent paper in this Journal, Eastwood and Venables (referred to as EV from now on) present an analysis of the macroeconomic consequences of an oil discovery in an open-economy model which assumes perfect international capital mobility, rational exchange-rate expectations and sluggish adjustment of domestic goods prices. They show that anticipated future oil revenues can lead to a current recession if spending does not adjust at the moment the oil wealth becomes known (as in the U.K.).1/ However, while their analysis points to potential problems of timing in adjusting to an oil discovery, its implications are in fact relatively optimistic. According to the model presented by EV, no recession can arise if spending is allowed to adjust immediately; further, when there is a time lag between the revelation of higher oil wealth and the increase in spending it allows, the recession that results will be followed by a boom period after spending adjusts.

These results contrast sharply with those of a recent paper by Buiter and Purvis (1983), whose model assumptions are very similar to those of EV. Although Buiter and Purvis say explicitly (p.223) that "oil shocks are unlikely to lead to unemployment," a careful reading of their paper shows that this outcome is indeed consistent with their model for many plausible parameter values. However, because they are primarily concerned with the effects of an oil price rise rather than of an oil discovery, and because they adopt a very different approach to analysing their model from that of EV, it is difficult to compare the two papers.

In this note we attempt to reconcile this apparent contradiction in the literature.2/ In particular, we show that EV's results hinge crucially on their failure to allow for a direct impact of higher oil wealth on money demand. This omission is in our view difficult to justify. On liquidity grounds alone, to the extent that the oil revenue accrues as a transfer to the private sector it should raise transactions demand for money directly. Probably more important is its asset effect as a result of the oil-induced increase in wealth. Even when all the oil revenue accrues to the government, this should raise private sector wealth through the anticipated reduction in future tax liabilities. In any case, we find it difficult to conceive a situation in which an oil discovery would raise spending but leave money demand permanently unaffected. The purpose of our note is to show the important implications of this observation for the effects of an oil discovery when appropriate monetary accommodation does not take place.

2. The EV Model Amended

The model we use is identical to the EV model (which in turn builds on Dornbusch (1976)) except for the inclusion of a direct wealth effect in money demand. The aggregates in this model are money m, an interest bearing asset, actual output y, "normal" output $\bar{y}$, the price of domestic output p, the exchange rate e (the domestic currency cost of a unit of foreign exchange) and the foreign and domestic interest rates r^*, r. (All variables are logs except r^* and r.) f represents the infinite term annuity value of the oil wealth in foreign currency. 3/

The model equations, with all parameters defined to be positive, are:

$$m = \phi y - \lambda r + \alpha p + (1 - \alpha)e + \varepsilon(f + e - p) \qquad (1)$$

$$r = r^* + \dot{e} \tag{2}$$

$$y = \delta(e - p) + \gamma y - \sigma(r - \dot{p}) + \eta(f + e - p) \tag{3}$$

$$\dot{p} = \beta(y - \bar{y}) \tag{4}$$

(1) gives money market equilibrium, 4/ (2) asset market arbitrage between perfectly substitutable foreign and domestic bonds coupled with the assumption of perfect foresight, 5/ (3) represents short-run goods market equilibrium and (4) is a Phillips curve. 6/ Without loss of generality we assume that r^* and $\bar{y}$ (the log of "normal" output) are equal to zero. (1) - (4) are identical to the EV equations if $\varepsilon = 0$ in equation (1).

The steady state values for e and p can be obtained from (1) - (4) by setting $\dot{e} = \dot{p} = 0$ and solving for $\bar{e}$ and $\bar{p}$:

$$\bar{e} = m - \frac{\alpha\eta + \varepsilon\delta}{\delta + \eta} f \tag{5}$$

$$\bar{p} = m + \frac{(1 - \alpha)\eta - \varepsilon\delta}{\delta + \eta} f \tag{6}$$

These expressions are equal to (13) and (14) in EV for $\varepsilon = 0$. (5) gives no surprises: more oil (a rise in f) leads to a long-run nominal appreciation (a fall in $\bar{e}$) that is larger the stronger the wealth effect ε .
Equation (6) is qualitatively different however. The wealth effect leads to a higher real money demand after an increase in f which must be accommodated (given the nominal supply) by a smaller increase in the domestic price than in the EV case ($\varepsilon = 0$) or even a decline.

The case where the domestic price rises in the long run,

$(1 - \alpha)\eta > \varepsilon\delta$, yields results similar to those obtained by EV. We therefore focus in the remainder of this comment on the alternative case, $(1 - \alpha)\eta < \varepsilon\delta$. Inverting (1) and substituting (2) and (3) into (1) and (4) leads to the equations describing the time path of e and p:

$$\dot{e} = \frac{1 - \gamma - \sigma\beta}{(1 - \gamma - \sigma\beta)\lambda + \sigma\phi} \{[1 - (\alpha - \varepsilon) + \frac{(\delta + \eta)\phi}{1 - \gamma - \sigma\beta}](e - \bar{e}) + [\alpha - \varepsilon - \frac{(\delta + \eta)\phi}{1 - \gamma - \sigma\beta}] (p - \bar{p})\} \tag{7}$$

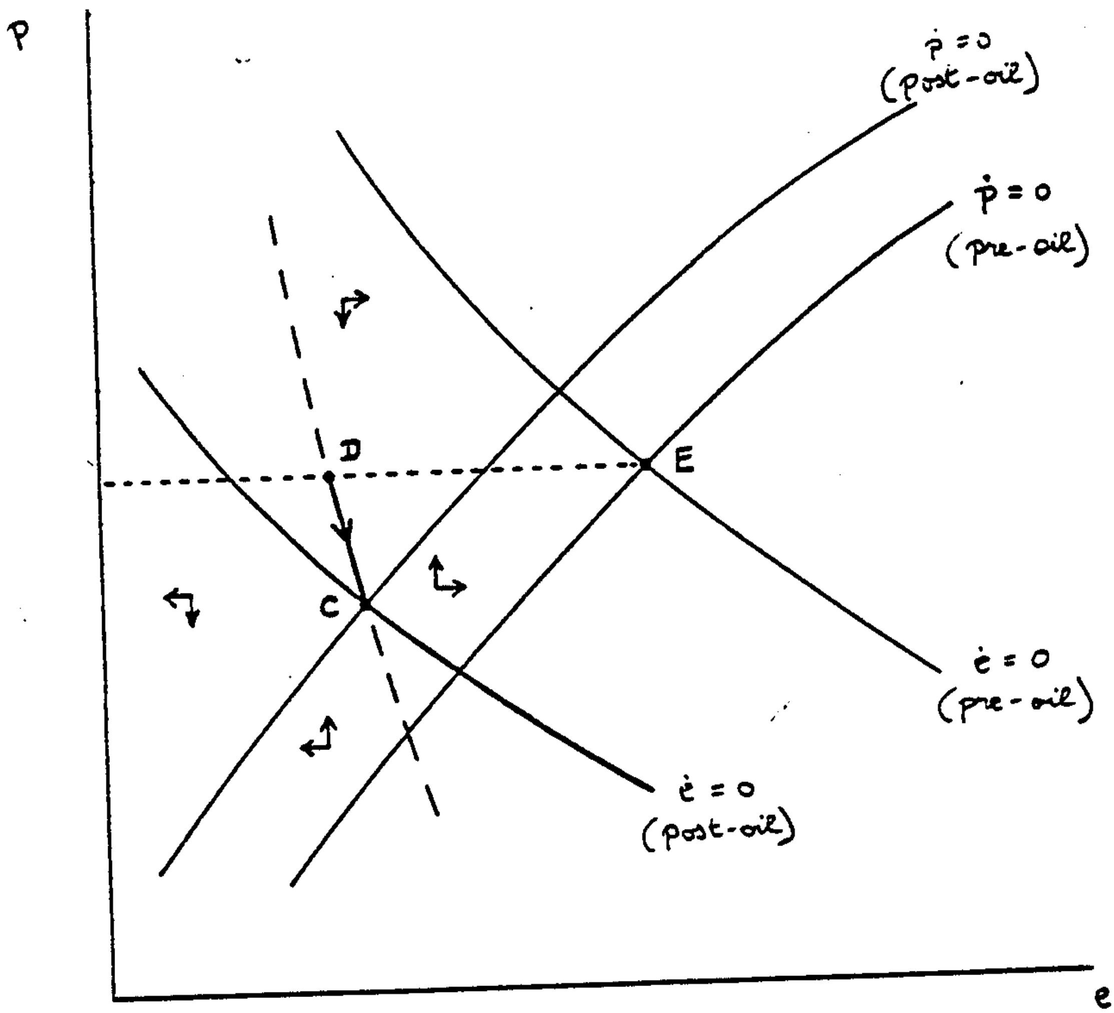
$$\dot{p} = \frac{\beta}{(1 - \gamma - \sigma\beta)\lambda + \sigma\phi} \{[\lambda(\delta + \eta) - \sigma (1 - (\alpha - \varepsilon))] (e - \bar{e}) - [\lambda(\delta + \eta) + \sigma(\alpha - \varepsilon)] (p - \bar{p})\} \tag{8}$$

If we make assumptions analogous to those made by EV (op. cit., p. 291), $(1 - \gamma - \sigma\beta) (\alpha - \varepsilon) > (\delta + \eta)\phi$ and $\lambda(\delta + \eta) > (1 - (\alpha - \varepsilon))\sigma$, and if we assume that there is no lag in the adjustment of domestic spending to the oil discovery, the diagrammatic representation of (7) and (8) is given in Figure 1.

After the discovery, the economy immediately jumps from E to D and then gradually slides down from D to C along the saddle-point path associated with the negative root. During this process (along DC) the exchange rate gradually depreciates after the initial discrete appreciation, another example of overshooting (additional to those of Dornbusch (1976) and Neary and Purvis (1981)). More important is the fact that along DC the domestic price falls, indicating that the economy is in recession ($y < \bar{y}$ when $\dot{p} < 0$ from (4)). The wealth effect of the oil discovery causes such a large appreciation that the increase in aggregate demand it also triggers is insufficient to offset the deflationary impact which the initial appreciation has on the goods market.

Figure 1

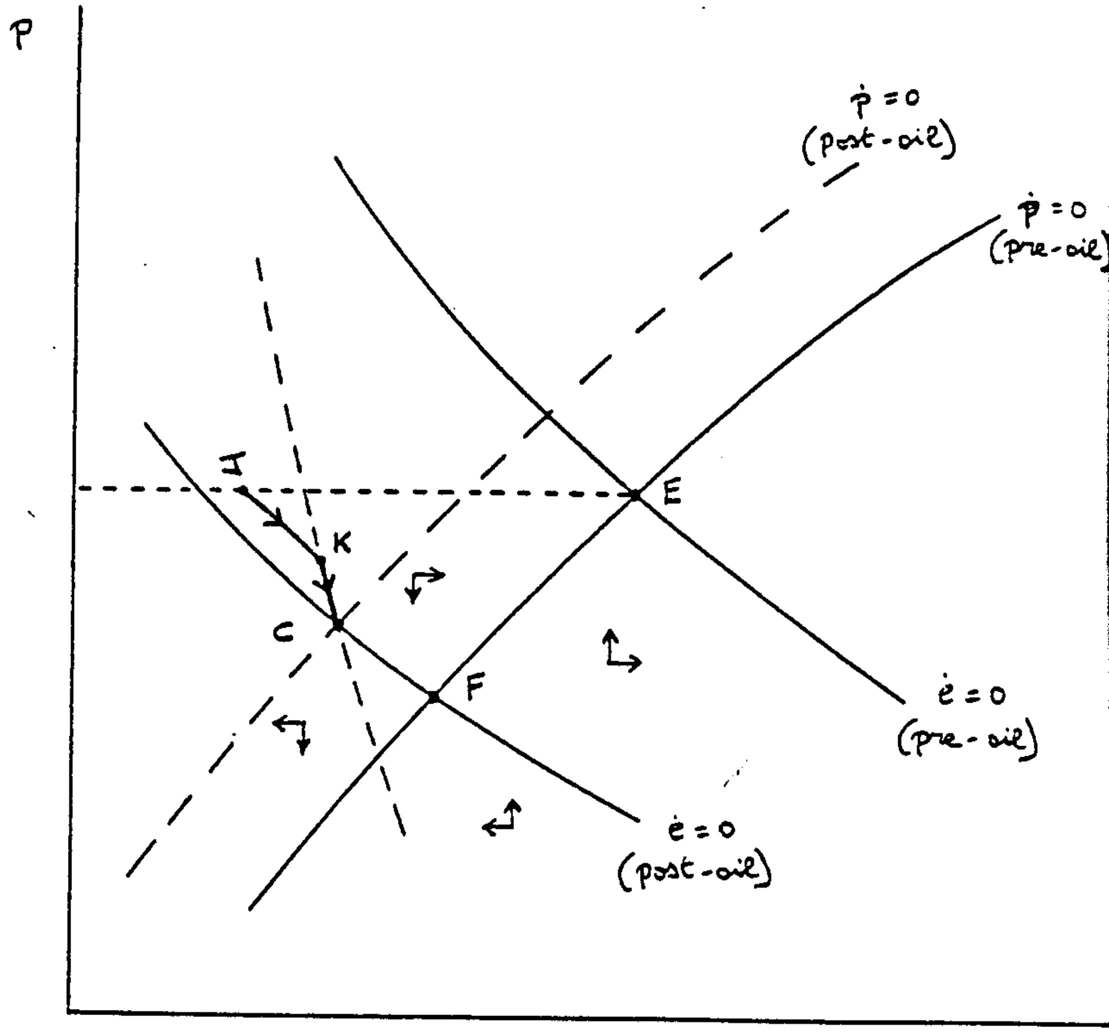
EFFECTS OF AN OIL DISCOVERY: NO SPENDING LAG



This result is purely due to the wealth effect of the resource discovery on money demand and is impossible in the EV configuration (i.e., when $\varepsilon = 0$). Consider now the case where there is a lag in spending (Figure 2). Oil is discovered at time 0, but spending out of oil revenue is zero until T and thereafter all the revenue is spent. This means that the goods market equilibrium locus $\dot{p} = 0$ does not shift until T, as in EV. However, once the discovery is made and revealed at time 0, the asset market equilibrium locus shifts instantaneously. [7/] Accordingly, from 0 to T, the system is governed by the dynamics associated with the pre-shock $\dot{p} = 0$ curve and the post-shock $\dot{e} = 0$ curve as indicated by the arrows in Figure 2 (i.e., the dynamics which would obtain indefinitely if the new long-run equilibrium were at F rather than at C) . The wealth effect, plus the anticipation of future demand increases, leads to a discrete appreciation at time 0 (from E to J), large enough to insure that the new saddlepath associated with the two post-shock loci is reached at T precisely. Between time 0 and T the economy drifts South East along JK with a depreciating exchange rate, a falling domestic price and therefore a depressed economy ($y < \bar{y}$), as in the case considered by EV. Where our results diverge from EV however is in the time path after T. Contrary to what happens in EV, the recession does not end at T. The exchange rate now gradually depreciates along KC, but the domestic price continues to fall, indicating a continuing recession ($y < \bar{y}$). In the EV scenario the period after T is characterized by a boom ($y > \bar{y}$).

Figure 2

EFFECTS OF AN OIL DISCOVERY: T-PERIOD SPENDING LAG



3. Conclusion

In this note we amend the EV analysis of the potential recessionary impact of higher oil revenues by incorporating a direct wealth effect on asset markets. Clearly, with a strictly positive wealth elasticity of money demand, higher wealth leads to an incipient excess demand for money after an oil discovery; to accommodate this the real money stock has to rise. This leads first to a greater appreciation of the exchange rate and to a lower post-shock equilibrium price level than in the case considered by EV. In fact we show that the possibility of an actual decline in the domestic price cannot be ruled out. [8/] In that case higher oil revenues lead to a recession even without a spending lag; moreover, if there is a spending lag we show that the recession induced by the nominal exchange rate appreciation taking place "up front" will not be followed by a boom once spending responds but will continue past that time instead. The root of the problem is that the direct wealth effect of higher oil wealth increases the demand for money, which, given the nominal money supply, subjects the economy to a contractionary shock which may be sufficiently great to offset the direct expansionary effects of the oil discovery on domestic spending. The policy conclusion is obvious: an accommodating monetary policy will avoid the recession without undue inflationary pressure.

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FOOTNOTES

1/ The explanation is straightforward: if the oil wealth becomes known now, but the spending it allows will only come on stream sometime in the future (say at time T), a discrete appreciation would have to take place at T if nothing happened before then for standard "Dutch Disease" reasons (c.f. Corden and Neary (1982) and Wijnbergen (1980)). This would imply anticipated infinite capital gains at T for holders of sterling assets. Asset-market arbitrage will ensure however that such gains will not be realized: a current appreciation will result to such an extent that the jump at T will be ruled out. The implications for the real economy are clear: an appreciation now while domestic spending does not respond until after T switches demand away from home goods with a recession as a result.

2/ The first version of this note was written simply as a comment on EV. We are grateful to a referee for pointing out that the substance of our criticism is implicit in Buiter and Purvis.

3/ We follow EV in measuring the real present value of oil wealth in home currency by f+e-p. This may be calculated in either of two equivalent ways: either by capitalising the stream of future foreign currency oil receipts at the (constant) foreign real interest rate, r*, and then converting to home currency at the current real exchange rate, e-p; or, by converting future revenues to home currency at the appropriate real exchange rate and then capitalising this stream at the (variable) own rate of interest on home goods, $r^* + \dot{e} - \dot{p}$. A formal demonstration of the equivalence of these two approaches is available from the authors.

4/ A referee has pointed out that our result would be strengthened by putting expenditure A $(= \alpha(y + f + e - p))$ as an argument in our money demand function. This can easily be seen to be correct by inserting the expression for A in (1) to get:

$$m = \phi\gamma y + \alpha p + (1 - \alpha)e + (\varepsilon + \phi\gamma)(f + e - p) - \lambda r \qquad (1^a).$$

This looks like our equation but with a bigger impact of an increase in f on money demand $(\varepsilon + \phi\gamma$ instead of $\varepsilon)$. To maintain comformity with EV however we chose to adhere to their money demand formulation.

5/ We follow EV in assuming that exchange-rate expectations are rational but none of our conclusions depend on this. As shown in Neary (1982), the initial recessionary impact of the oil discovery in the case considered in Figure 1 below is greater under static expectations.

6/ Changes in the domestic price are measured through with respect to foreign prices. The model may easily be extended to incorporate trend rates of growth in p and m: see Buiter and Purvis (1983).

7/ Of course, the same capital-market imperfections which give rise to the spending lag may also delay the oil discovery's effect on money demand. It can easily be checked that assuming a lagged response of money demand is unlikely to affect our principal qualitative conclusion that p falls steadily and hence that the economy remains in recession until the new-long run equilibrium at C is attained.

8/ It is easily shown that the recessionary outcome is consistent with plausible values for the key parameters. For example, assuming that α (the share of domestic goods in spending) equals 0.75, η (the marginal propensity to absorb domestic output out of oil wealth, expressed as an elasticity) equals 0.6 and δ (the price elasticity of demand for domestic output) equals 0.5, a recession must ensue for any value of ε (the oil-wealth elasticity of money demand) in excess of 0.30. Some evidence suggesting the empirical likelihood of the case we consider is given by Bond and Knobl (1982) and Spencer (1983).