IMF WORKING PAPER

WP/88/5

INTERNATIONAL MONETARY FUND

Research Department

The Effects of Currency Substitution on the Response of the Current Account to Supply Shocks

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January 19, 1988

Abstract

Standard real models predict that a permanent increase in oil prices would result in a current account surplus. This is due to the fact that investment falls while saving remains unchanged. This paper shows that if currency substitution is introduced into the analysis, the same shock could cause a current account deficit. Furthermore, the higher the dependence of the economy on oil, the larger would be the deficit. The presence of foreign money makes it optimal for the public to decrease saving following the terms of trade deterioration. The fall in saving could be larger than the decline in investment.

JEL Classification Numbers:

4310, 4312

* This paper is based on part of the author's doctoral dissertation at the University of Chicago. The author would like to thank the members of of his thesis committee, Joshua Aizenman, Jacob Frenkel, and John Huizinga, for guidance and helpful suggestions and Guillermo Calvo and Mohsin Khan for valuable comments. Any errors are the responsibility of the author.

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Summary

The response of the current account to supply shocks in the context of models that incorporate saving-investment behavior has received considerable attention in the literature. These real models predict that a permanent negative supply shock from an increase in oil prices would result in a current account surplus since the terms of trade deterioration does not affect saving--consumption and wealth decrease by the same amount--while investment falls. The evidence, however, suggests that the current account usually worsens in response to a terms of trade deterioration.

This paper shows that in the context of a monetary model with flexible exchange rates and currency substitution, a current account deficit could arise following a permanent worsening of the terms of trade brought about by higher oil prices. With foreign money available, the public can absorb part of the loss in wealth by holding lower foreign money balances so consumption does not fall by the full amount that wealth does. The terms of trade deterioration leads, therefore, to a decrease in saving. Furthermore, the higher the dependence of the economy on oil, the larger the fall in saving, and the more likely it is that this effect will more than offset the decline in investment, thus generating a current account deficit.

It is also argued that, in the presence of fixed exchange rates, identical results would be obtained even if there were no currency substitution. This is because the constancy of the exchange rate allows domestic money to perform the same shock-absorber role that foreign money plays in the currency substitution model.

I. Introduction

The oil price increases of 1973-74 and 1979-80 brought about a large literature dealing with the response of the current account to supply shocks in the context of intertemporal optimizing real models. In one of the more influential papers in this area, Sachs (1981) develops a two-period model of an economy producing, consuming, investing, and exporting a final good and importing an intermediary input, oil. A temporary oil price increase induces a current account deficit because of the desire of the household to smooth out consumption over time. In contrast, a permanent oil shock generates a surplus in the current account. This key result follows from the fact that there is no change in saving while investment falls. 1/

Empirical evidence for oil-importing countries--particularly developing countries--indicates, however, that current account deficits persisted throughout the 1970s and into the 1980s. In contrasting the predictions of the model with the empirical evidence, Sachs (1981) argues that since the first oil shock turned out to be permanent, it seems reasonable to assume that this is what people generally anticipated, thus discarding as an explanation for the observed current account deficits that economic agents could have perceived the shock as temporary. One has to rely on alternative explanations, such as the effects induced by a fall in the world rate of interest, to generate the possibility of a deficit. Marion and Svensson (1984b) show that the world real interest rate will fall if it is assumed that OPEC's marginal propensity to consume is less than that of the rest of the world. If the increase in absorption in oil-importing countries that follows dominates the drop in GDP, a deficit will arise. When non-traded goods are introduced into the picture, however, Marion (1984) indicates that the direction of the change in the current account following a permanent oil shock depends critically on the relative production technologies in the traded and non-traded goods sectors.

It should be noted that the constancy of the rate of time preference, which is assumed in all of these models, plays an important role as suggested by Svensson and Razin (1983). They develop a many-good, two-period model, with no investment, to study the Harberger-Laursen-Metzler (hereafter H-L-M) effect. They show that, given identically homothetically weakly separable preferences, a rate of time preference which is an increasing function of the welfare level, as in Obstfeld (1981), implies that the current account improves following a terms of trade deterioration.

1/ Oil and capital are assumed to be complements, in the sense of their cross derivative being positive. This is supported by econometric evidence as pointed out by Sachs (1981).

On the other hand, the response of the current account in the context of optimizing monetary models with flexible exchange rates and investment seems to have received less attention. The difficulties encountered by real models in accounting for observed deficits in oil-importing countries suggest that this may be a fruitful line of research in that it could point out to additional--i.e., monetary--channels through which an oil shock could impact on a small open economy.

The presence of money in itself, however, does not alter the picture. Fender and Nandakumar (1985) develop a two-period, two-good, Sidrausky-type model to study fiscal policy, the "Dutch Disease," and the effects of oil shocks. They find that a future anticipated oil price increase could, under some circumstances, generate a current account deficit. From this it follows that a permanent oil shock could also result in a deficit. But this outcome seems to derive from the presence of non-traded goods, along the lines suggested by Marion (1984). In fact, it is straightforward to show that if money enters separably into the utility function, money is only a "veil" in that the results of standard real models--for instance, Svensson (1984)--are reproduced. 1/ Clearly, this is to be expected, since changes in the stock of real money which result from changes in wealth are brought about by movements in the exchange rate.

The purpose of this paper is to show that if currency substitution is allowed for, the results of real or domestic-money-only models are substantially affected. In the presence of currency substitution, a permanent oil shock could now result in a current account deficit. Furthermore, the higher the oil-dependence of the economy--as measured by the level of pre-shock oil imports--the larger the deficit. Sachs (1981) reports that, as far as oil-importing countries are concerned, the change in the current account relative to GNP is negatively correlated with the pre-shock ratio of oil imports to GNP--the correlation coefficient being -0.7--for the period 1968-74. 2/ In real models, the change in the current account does not depend on the initial level of oil imports. 3/ This is because consumption drops by the same amount that real income does, thus leaving saving unaffected. When there is currency substitution, however, the possibility of a decrease in saving arises, which is

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1/ See Vegh (1987).

2/ Sachs (1981) also finds that for the OECD oil-importing countries, a 1 percentage point greater oil dependence in 1968-73 corresponds to a drop in the ratio of the current account to GNP of 0.9 percentage points in 1974-79. Sachs claims that these results come primarily from the first years after the shock.

3/ We disregard the effect on the partial derivative of the investment function with respect to the price of oil, which is ambiguous in any case.

financed by running down the stock of foreign money balances. This H-L-M effect depends on the magnitude of the fall in real income, which in turn is dictated by the initial level of oil imports. The larger the decrease in saving, the more likely it is that it will offset the fall in investment, thus generating a current account deficit.

Leaving aside the sign of the change in the current account, it should be noted that one can also interpret real models as suggesting that, following a permanent oil shock, variations in investment dominate current account movements. However, as pointed out by Fischer (1981), the evidence does not bear out this prediction. Fischer (1981) shows that the mean absolute changes in the ratio of saving to GNP have been larger than those in the ratio of investment to GNP for both OECD and developing countries. Hence, it is an attractive feature of the currency substitution model that it generates movements in both saving and investment.

Tables 1 and 2 illustrate some of the issues involved. Table 1 shows that the current account deficit worsened for both developed and developing countries. In particular, the figures for the developed countries best exemplify the way in which a deterioration of the current account comes about in the presence of currency substitution, namely by a drop in saving that exceeds the fall in investment. This is not the case for the developing countries. Naturally, this may simply be due to the effects of factors other than the oil shock in itself, such as falling world real interest rates or shifts in investment opportunities--as suggested by Sachs (1981). It should be noted, however, that there exists a great diversity among the experiences of individual countries. In all four Asian economies included in the sample, the investment and saving ratios both increased. However, as Table 2 shows, among the four net oil-importing Latin American countries that were part of the sample, in three cases--Argentina, Brazil, and Chile--the saving ratio fell, as did the investment ratio in two cases--Chile and Colombia.

Khan and Knight (1983) provide a formal analysis of the influence of external and internal factors on the current account of non-oil 1/ developing countries. They used pooled time-series cross-section data for a sample of 32 countries during the period 1973-80. Among other findings, they report that the effect of a change in the terms of trade

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1/ The category non-oil developing countries excludes those developing countries that are oil exporters, defined as those whose oil exports both accounted for at least two thirds of total exports and were at least 100 million barrels a year (roughly equivalent to 1 percent of annual world exports) during 1978-80. See, for instance, Goldsbrough and Zaidi (1986), for details on these classification categories used by the IMF from 1980 to 1984.

on the current account is positive and statistically significant. More precisely, a 1 percent deterioration in the terms of trade would lead, on average, to a decline of about 1/2 of 1 percentage point in the ratio of the current account to exports. Furthermore, changes in the terms of trade turn out to be, among the six explanatory variables considered, the most important one. 1/

The paper proceeds as follows. In Section II, a two-period model of currency substitution is presented. The inclusion of both monies, which are the only assets, in the utility function is meant to capture the services that money provides other than being a store of value. 2/ This framework has been used by, among others, Calvo (1980, 1985) and Liviatan (1981). The implicit assumption is that, because of legal restrictions, domestic and foreign money are not perfect substitutes. A condition for the current account to deteriorate following a permanent oil shock is derived from the model. The larger the pre-shock oil imports, the more likely it is that the condition will hold. In Section III, building upon an insight developed in the previous section, we study a fixed-exchange-rate model and conclude that it reproduces the relevant results, even if the household no longer cares about foreign money. This is simply because, under fixed rates, domestic money acts as if it were foreign money. The possibility that, under fixed exchange rates, a deterioration in the terms of trade could lead to a deficit has already been pointed out by Michener (1984), in the context of an optimizing version of the-monetary-approach-to-the-balance-of-payments models. The much simpler model of this section isolates this effect and makes the point that, under a constant path of the fixed exchange rate, the workings of the currency substitution model and the fixed rates model are identical. Section IV contains some concluding remarks.

1/ As measured by the relevant Beta coefficients. The other explanatory variables are the rate of growth of industrial countries, the level of foreign real interest rates, the change in real effective exchange rates, the ratio of domestic fiscal deficits to GDP, and a time trend.

2/ This setup has been adopted for simplicity. The results would not change if bonds were allowed for and both monies were viewed as reducing transaction costs. This is because, for the issues being discussed in this paper, the key ingredient is that money be valued and not why it is valued. However, when dealing with issues such as the optimal inflation tax, the question of why money is valued plays a critical role in determining the outcome of the analysis. Hence, it becomes essential that the analysis be explicit on this point (see Vegh (1987)) for a discussion).

Table 1. Saving, Investment, and the Current Account for Developed and Selected Less-Developed Countries

	1965-1973 (Average)	1974-1979 (Average)
Developed Countries		
Investment/GNP	21.6	21.3
Saving/GNP	23.1	22.0
Current Account/GNP	0.3	-0.2
Selected LDC's		
Investment/GNP	20.4	22.6
Saving/GNP	20.6	21.9
Current Account/GNP	-1.8	-3.1

Source: Sachs (1981).

Table 2. Saving, Investment, and the Current Account for Selected Latin-American Countries

	1965-1973 (Average)	1974-1979 (Average)
Argentina		
Investment/GNP	19.8	21.2
Saving/GNP	20.2	19.1
Current Account/GNP	-0.2	-3.3
Brazil		
Investment/GNP	22.6	23.4
Saving/GNP	23.2	21.0
Current Account/GNP	-1.7	-3.6
Chile		
Investment/GNP	13.8	10.1
Saving/GNP	13.3	8.3
Current Account/GNP	-1.6	-0.2
Colombia		
Investment/GNP	19.7	19.2
Saving/GNP	18.3	22.5
Current Account/GNP	-2.7	0.7

Source: Sachs (1981).

II. A Currency Substitution Model

Consider a two-period small open economy which produces a final, tradable good whose world price is given and taken to be unity. Production of the good requires labor, capital, and oil. The latter has to be imported, since there is no domestic production. The price of oil in terms of foreign currency is q--which is also the relative price of oil in terms of the final good. Capital is given in the first period and can be augmented by investing so that $k_2 = \bar{k}_1 + i$, where k_t stands for period t capital stock and i for investment. Wages adjust to ensure continuous full employment of labor.

In order to specify the production side, we will resort to the dual functions--see Dixit and Norman (1980)--and follow the analysis developed by Svensson (1984). It is assumed that there exists a well-behaved concave production given by:

$$x_t = f_t(k_t, n_t, z_t) \qquad t = 1, 2.$$

where x_t stands for output of the final good, n_t for full employment labor, and z_t for oil input. Define the domestic product in period t, Y^t, as:

$$Y^t(e_t, e_tq_t, k_t, n_t) \equiv \max_{(x_t, z_t)} \{e_tx_t - e_tq_tz_t : x_t = f_t(k_t, n_t, z_t), k_t \text{ and } n_t \text{ given}\}$$

where e_t denotes the (flexible) nominal exchange rate--the price of a unit of foreign currency in terms of domestic currency--in period t. Note that since Y^t is homogeneous of degree one in prices, we can write:

$$Y^t(e_t, e_tq_t, k_t, n_t) = e_tY^t(1, q_t, k_t, n_t).$$

The equilibrium level of investment is given by the solution to the following problem:

$$\max_{(i)} \quad Re_2Y^2(1, q_2, \bar{k}_1 + i, n_2) - e_1i$$

where $R = e_1/e_2$ is the domestic nominal discount factor. 1/ The optimality condition:

$$Y^2_{k_2}(1, q_2, \bar{k}_1 + i, n_2) = 1$$

1/ The world real interest rate is taken to be zero since foreign money is the only traded asset. Foreign inflation is also assumed to be zero.

where a subscript to Y denotes partial differentiation, $Y^2_{k_2} = \partial Y^2/\partial k_2$-- defines the investment function:

$$i = i(q_2, \overline{k}_1)$$

Under the assumption that oil and capital are cooperative factors, i_q, which denotes the partial derivative of the investment function with respect to the price of oil, is negative (see Svensson (1984)).

The household faces the following maximization problem 1/:

$$\underset{\{c_1,\ c_2,\ M_1,\ M_2,\ F_1,\ F_2\}}{\text{Max}} \quad \alpha \log c_1 + \delta \log \frac{M_1}{e_1} + \sigma \log F_1 + \beta[\alpha \log c_2 + \delta \log \frac{M_2}{e_2} + \sigma \log F_2]$$

subject to:

$$(1) \quad e_1c_1 + M_1 + e_1F_1 + e_1i = e_1Y^1 + \overline{M}_1 + e_1\overline{F}$$

$$(2) \quad e_2c_2 + M_2 + e_2F_2 = e_2Y^2 + \overline{M}_2 + M_1 + e_2F_1$$

where c_t stands for consumption in period t, M_t and F_t for foreign and domestic money held in period t, respectively, $\overline{M}_t$ for domestic money issued and transferred to the household by the government in period t, and $\overline{F}$ for initial foreign money holdings.

At an optimum, the following must hold:

$$(3) \quad \frac{\sigma}{F_1} = \frac{\alpha}{c_1} - \frac{\alpha\beta}{c_2}$$

$$(4) \quad \frac{c_2}{\alpha} = \frac{F_2}{\sigma}$$

1/ The logarithmic specification of the utility function is adopted because it simplifies the algebraic manipulations. A general formulation, however, would lead to similar results.

(5) $$\frac{\delta}{M_1} = \frac{\alpha}{e_1 c_1} - \frac{\alpha\beta}{e_2 c_2}$$

(6) $$\frac{\delta}{M_2} = \frac{\alpha}{e_2 c_2}$$

Equations (1)-(6) together with the two money market equilibrium conditions, $\bar{M}_1 = M_1$ and $\bar{M}_1 + \bar{M}_2 = M_2$, form a system of eight equations that determines the eight endogenous variables of the model: c_1, c_2, M_1, M_2, F_1, F_2, e_1, and e_2.

If money market equilibrium is imposed on equations (5) and (6), it follows that, given $\bar{M}_1$ and $\bar{M}_2$, any shock that reduces wealth, and hence consumption, will induce a proportional depreciation of the exchange rate. This stems from the fact that nominal expenditure in consumption is totally determined by the money supply.

Substituting equation (4) into equations (1)-(3) and taking into account the money market equilibrium conditions, the following subsystem, which determines F_1, F_2, and c_1, is obtained:

(7) $$F_1 - \bar{F} = Y^1 - i - c_1$$

(8) $$[1 + (\alpha/\sigma)]F_2 - F_1 = Y^2$$

(9) $$\frac{\sigma}{F_1} + \frac{\sigma\beta}{F_2} = \frac{\alpha}{c_1}$$

Equation (7) represents the balance of payments equilibrium condition for the first period. Taking into account equation (4), which relates second-period consumption and foreign money balances, equation (8) can be viewed as the balance of payments equilibrium condition for the second period. Equation (9) has a standard interpretation: since one unit of resources can either be held as a unit of foreign money during both periods or be consumed in the first one, the utility derived, at the margin, from these two alternative uses has to be the same. Note, for further reference, that equations (3) and (6) imply that $\beta\sigma c_1 - \alpha F_2 < 0$ and $\sigma c_1 - \alpha F_1 < 0$.

By totally differentiating equations (7)-(9) and taking into account the optimal investment decision and the standard properties of the domestic product function, the effects of changes in the price of oil on F_1, F_2, c_1, and--using equation (4)--c_2 can be analyzed.

1. Temporary increase in oil prices

A temporary shock is defined as $dq_1>0$ and $dq_2=0$. The following results obtain:

$$(10) \qquad \frac{dc_1}{dq_1} = -\left(\frac{A + B}{\Gamma}\right) z < 0$$

$$(11) \qquad \frac{dF_1}{dq_1} = - \frac{C}{\Gamma} z < 0$$

$$(12) \qquad \frac{dF_2}{dq_1} = -\left[\frac{1}{1+(\alpha/\sigma)}\right]\frac{C}{\Gamma} z < 0$$

$$(13) \qquad \frac{dc_2}{dq_1} = -\left[\frac{\alpha /\sigma}{1+(\alpha/\sigma)}\right]\frac{C}{\Gamma} z < 0$$

$$(14) \qquad \frac{d(F_2-F_1)}{dq_1} = \left[\frac{\alpha /\sigma}{1+(\alpha/\sigma)}\right]\frac{C}{\Gamma} z > 0$$

where:

$$A \equiv -[1+(\alpha/\sigma)]\ (\beta\sigma c_1 - \alpha F_2) > 0$$

$$B \equiv -(\sigma c_1 - \alpha F_1) > 0$$

$$C \equiv [1+(\alpha/\sigma)]\ (\sigma F_2 + \beta\sigma F_1) > 0$$

$$\Gamma \equiv A + B + C > 0$$

It will be assumed that $z_1=z_2=z$; that is, initial oil imports are the same in both periods. Equations (11) and (14) indicate that the current account worsens in the first period while it improves in the second one. Consumption falls in both periods--equations (10) and (13)--so that the exchange rate depreciates by the same proportion. Since the oil price increase is temporary, the intuition behind these results lies in the desire of the household to smooth out consumption over time. Thus, while production falls by z in the first period, consumption decreases only by a fraction of z, as reflected in equation (11). Since investment is not affected, the current account worsens. In the second period, production remains unchanged but consumption decreases, thus generating a surplus. It is important to note that the presence of currency substitution allows the household to decrease lifetime consumption by less than would otherwise be the case. This can be inferred from the fact that the fall in total consumption, given by the sum of equations (10) and (13), falls short of z--the magnitude by which wealth decreases--by the same amount that second-period foreign money balances fall. While, in this case, the fact that foreign money balances absorb part of the fall in wealth does not affect the qualitative nature of the results when compared to those obtained in real or domestic-money-only models, it becomes a crucial feature when the oil price increase is permanent, as will be discussed in detail below.

2. Future anticipated oil price increase

This is defined as a situation in which $dq_1 = 0$ while $dq_2 > 0$. The following expressions obtain:

$$(15) \qquad \frac{dc_1}{dq_2} = -\frac{A}{\Gamma} i_q - \frac{B}{\Gamma} z \gtrless 0$$

$$(16) \qquad \frac{dF_1}{dq_2} = -\left[\frac{B + C}{\Gamma}\right] i_q + \frac{B}{\Gamma} z > 0$$

$$(17) \qquad \frac{dF_2}{dq_2} = \frac{1}{1 + (\alpha/\sigma)}\left[\frac{A}{\Gamma} i_q - \frac{(A + C)}{\Gamma}\right] z < 0$$

$$(18) \qquad \frac{dc_2}{dq_2} = \frac{(\alpha/\sigma)}{1 + (\alpha/\sigma)}\left[\frac{A}{\Gamma} i_q - \left(\frac{A + C}{\Gamma}\right) z\right] < 0$$

$$(19) \qquad \frac{d(F_2 - F_1)}{dq_2} = \frac{1}{\Gamma}\left[\frac{A}{1 + (\alpha/\sigma)} + B + C\right] i_q - \frac{1}{\Gamma}\left[\frac{A + C}{1 + (\alpha/\sigma)} + B\right] z < 0$$

A future anticipated shock causes an improvement in the current account in the present--equation (16)--and a worsening in the future--equation (19). It reduces future consumption--equation (18)--but has an ambiguous effect on present consumption--equation (15). In the absence of currency substitution, or in real models, present consumption decreases by a fraction of the fall in wealth, which is given by z. This effect is the second term in equation (15). But now there is an additional effect as represented by the first term in that equation. Why does i_q affect the change in consumption? Note that a higher z implies that there is a greater dependence on oil so that the negative wealth effect is larger. On the other hand, the magnitude of i_q does not affect wealth since, at the margin, investment in physical capital has the same return as that in foreign money--which is zero in this case. Therefore, one has to conclude that some margin is broken in the current model. Indeed, note that, other things being equal, a higher i_q would translate itself, on a one-to-one basis, into a higher current account surplus, that is a higher F_1. This is in fact all there is to it in real models. But, in the current model, the rise in F_1 breaks the following margin:

$$(20) \quad \frac{\sigma}{F_1} = \frac{\alpha}{c_1} - \frac{\beta\alpha}{c_2}$$

Hence, either c_1 rises and c_2 falls, or c_1 rises by more than c_2 does. Now, c_2 always moves in the same direction that F_2 does--by (4); furthermore, it must be the case that the sum of the changes in c_1, c_2, and F_2 have to add to zero since no wealth effect is involved. The implication is that c_1 rises while F_2 and c_2 fall. In turn, the rise in c_1 means that the current account surplus increases by less than on a one-to-one basis with the higher i_q. There is now a new channel through which i_q affects consumption and therefore the current account. Put differently, the higher current account surplus, which implies higher holdings of foreign currency, decreases their marginal utility and thus affects the above margin relating the marginal utilities of consumption across periods. Naturally, a similar condition holds for domestic money, namely:

$$(21) \qquad \frac{\delta}{M_1} = \frac{\alpha}{e_1 c_1} - \frac{\alpha\beta}{e_2 c_2}$$

This margin, however, is not affected by a higher i_q since the stock of domestic money remains the same. The crucial ingredient is the presence of foreign currency. This last condition, however, suggests that under fixed exchanges rates--where the stock of domestic money is endogenous and would be affected by a higher i_q--consumption would have to adjust to restore the margin, thus affecting saving. In other words, condition (21) would be truly analogous to (20). That this is indeed the case will be proven in Section III.

3. Permanent increase in oil prices

This is defined as a situation in which $dq_1 = dq_2 = dq$. The following holds:

$$(22) \qquad \frac{dF_1}{dq} = -\left(\frac{B + C}{\Gamma}\right) i_q - \left(\frac{C - B}{\Gamma}\right) z \gtrless 0$$

$$(23) \qquad \frac{dc_1}{dq} = -\frac{A}{\Gamma} i_q - \left(\frac{2B + A}{\Gamma}\right) z \gtrless 0$$

$$(24) \qquad \frac{dF_2}{dq} = \frac{1}{1 + (\alpha/\sigma)} \left[\frac{A}{\Gamma} i_q - \left(\frac{A + 2C}{\Gamma}\right) z\right] < 0$$

$$(25) \qquad \frac{dc_2}{dq} = \frac{\alpha/\sigma}{1 + (\alpha/\sigma)} \left[\frac{A}{\Gamma} i_q - \left(\frac{A + 2C}{\Gamma}\right) z\right] < 0$$

A sufficient condition for $C-B>0$ is $\beta>\alpha/(\sigma+\alpha)$ which seems very likely--with equal weights in the utility function, the condition becomes $\beta>1/2$. We assume this holds. As it can be easily verified, this same condition is sufficient to ensure that $(2B + A)/\Gamma<1$. Equation (22) indicates that the change in the current account in the first period is ambiguous. This stems from the fact that the change in present consumption--equation (23)--is affected by the magnitude of i_q as discussed above. This implies that consumption declines by less than production falls, thus reducing saving. The reduction in saving is financed by a fall in second-period foreign balances. To see this, consolidate the budget constraints and differentiate to obtain:

$$\frac{dc_1}{dq} + \frac{dc_2}{dq} + \frac{dF_2}{dq} = -2z$$

which implies, given that $\frac{dF_2}{dq} < 0$, that:

$$\frac{dc_1}{dq} + \frac{dc_2}{dq} > -2z.$$

Lifetime consumption declines by less than wealth does. In other words, the household uses part of its foreign currency holdings as a shock-absorber.

From (22) it follows that for the current account to worsen it must be true that:

$$\frac{z}{-i_q} > \frac{B+C}{C-B} > 1. \text{ 1/}$$

The higher the level of initial oil imports, the more likely it is that this condition will hold. In particular, if the current account is initially balanced, a deficit will follow.

1/ It should be pointed out that, since this expression involves endogenous variables, we are implicitly assuming that it can be met for some values of the parameters. While there seems to be no reason why this should not be the case, a formal verification would involve finding closed-form solutions.

The expression for the change in the current account in the second period is given by:

$$\frac{d(F_2-F_1)}{dq} = \left[\frac{A}{1+(\alpha/\sigma)} + B + C\right]\frac{i_q}{\Gamma} - \left[\frac{A+2C}{1+(\alpha/\sigma)} + B - C\right]\frac{z}{\Gamma} < 0$$

which indicates that it worsens. 1/ Since the household has the option of reducing its financial wealth, the current account may in fact deteriorate in both periods.

In this section, it has been shown that in the context of currency substitution the response of the current account to a permanent oil shock is contingent on oil dependency. This is due, basically, to a H-L-M effect, namely saving decreases in response to the terms of trade deterioration. The crucial role played in the model by the foreign currency makes it intuitively clear that similar results would obtain in a fixed-exchange-rate model. We turn to this issue next.

III. A Fixed Exchange Rate Model

It was discussed above why equation (21) suggested the possibility that, in a regime of fixed exchange rates, similar results to those obtained under flexible rates in the currency substitution model could be reached. In a world of fixed rates, changes in the exchange rate cannot bring about equilibrium in the domestic money market. Rather the adjustment must come through quantities. The excess supply of real money balances due to the decline in wealth will have to be "shipped abroad" via the Central Bank reserves. Naturally, this is very much at the basis of the monetary approach to the balance of payments. 2/ It seems appropriate, then, to briefly review the results obtained under classical versions of the monetary approach--with money being the only asset.

In the simplest version--and assuming there is some domestic production of oil, a rise in the price of any tradable good, in particular an imported input, increases the price level thus raising money demand--which is assumed to depend on nominal income--and causes a balance of payments--or current account--surplus in the short run. There has to be some domestic

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1/ The coefficient of z is taken to be positive. Note that equal weights in the utility function is a sufficient, though not necessary, condition to ensure this result.

2/ The classic collection of papers on the subject is Frenkel and Johnson (1976). See also IMF (1977).

production of oil to get any effect at all because no account is taken of the loss in real income. Now, if the loss in real income is brought into the picture, it will constitute a force towards a deficit since it decreases money demand. But, as shown by Caves and Jones (1981), if the economy produces any oil, the price effect will still dominate, assuming unitary income elasticity of the demand for money. There would be no effect at all if there were no domestic production because the two effects would exactly cancel each other out.

Rodriguez (1976) provides an early attempt at generating a deficit in the balance of payments. In his model, expenditures respond to permanent income but the latter is adjusted only with a lag when the shock hits. Real balances, then, play the role of shock absorber in the short run. The mechanism by which the deficit comes about is thus of an entirely different nature from the one presently discussed, as has been noted by Michener (1984). In optimization models, it is precisely the fact that consumers revise immediately their wealth downwards which induces them to reduce their money holdings.

Jones (1979) relies on world equilibrium considerations to bring about a deficit. He argues that, with a given world supply of money, the price level would be unchanged so that we would be left with the terms of trade effect which calls for a deficit. In the present model, the price level relevant for the household also stays constant since it does not consume oil directly. 1/ We are then left with a wealth effect, in addition to the investment substitution effect.

Michener (1984) develops an optimizing version of the-monetary-approach-to-the-balance-of-payments models where he discusses, among other issues, the effect of a change in the terms of trade on the balance of payments. The model includes an exportable, an importable, and a non-traded good. Michener (1984) notes that a sufficiently strong income effect could provoke a fall in the price index, which in turn implies that steady state nominal balances must decline. The model developed here can be viewed as a simpler version of Michener's, the objective being that of isolating the effect of a terms of trade shock. It does, however, allow for investment and concentrates on an intermediate good. The main purpose, though, remains that of illustrating the analogy with the currency substitution model.

The model remains the same as before but now only domestic real balances enter the utility function. It is the foreign exchange authority which is in charge of the transactions with foreigners. As pointed

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1/ In real models, Svensson (1984) makes the point that if oil is consumed directly (heat or gasoline), the effect on the current account of a permanent oil shock becomes ambiguous due to substitution effects in consumption.

out by Helpman and Razin (1979), the foreign exchange authority, under fixed rates, serves only as an intermediary between the household and foreigners while, under floating rates, the private sector transacts directly with foreigners. This is how consistency is achieved in formulating the same problem under alternative exchange rate regimes.

The household faces the following optimization problem:

$$\max_{\{c_1,\ c_2,\ M_1,\ M_2\}} \alpha \log c_1 + \delta \log \frac{M_1}{\bar{e}_1} + \beta \left[\alpha \log c_2 + \delta \log \frac{M_2}{\bar{e}_2} \right]$$

subject to:

$$\bar{e}_1 c_1 + M_1 + \bar{e}_1 i = \bar{e}_1 Y^1 + \bar{M} \tag{26}$$

$$\bar{e}_2 c_2 + M_2 = \bar{e}_2 Y^2 + M_1 + T \tag{27}$$

where $\bar{e}_t$ denotes the (fixed) exchange rate, $\bar{M}$ is the initial stock of money that the household receives from the foreign exchange authority, and $\bar{M}=\bar{e}_1\bar{F}$, where $\bar{F}$ is the initial stock of foreign currency now in the hands of the foreign exchange authority. It will be assumed that the foreign exchange authority transfers to the household the capital gains on the stock of foreign money, so that $T \equiv F_1(\bar{e}_2-\bar{e}_1)$. The constraints of the foreign exchange authority are given by--assuming away domestic credit creation:

$$F_1 = \bar{F} + (Y^1 - i - c_1) \tag{28}$$

$$F_2 - F_1 = Y^2 - c_2 \tag{29}$$

At an optimum the following must hold:

$$\frac{\delta}{M_1} = \frac{\alpha}{e_1 c_1} - \frac{\beta\alpha}{e_2 c_2} \tag{30}$$

(31) $$\frac{\delta}{M_2} = \frac{\alpha}{\bar{e}_2 c_2}$$

Equations (26)-(31) form a system of six equations in six unknowns: M_1, M_2, c_1, c_2, F_1, and F_2. Substituting equations (26) and (27) into equations (28) and (29) and making use of the fact that $\bar{M} = \bar{e}_1\bar{F}$, it follows that $M_1 = \bar{e}_1 F_1$ and $M_2 = \bar{e}_2 F_2$. The latter together with equation (31) implies that $c_2/\alpha = F_2/\delta$. This, in turn, means that equations (29) and (30) can be rewritten as, respectively:

(32) $$[1 + (\alpha/\delta)]F_2 - F_1 = Y^2$$

(33) $$\frac{\delta}{\bar{e}_1 F_1} + \frac{\beta\delta}{\bar{e}_2 F_2} = \frac{\alpha}{\bar{e}_1 c_1}$$

Note that if $\bar{e}_1 = \bar{e}_2$, that is the exchange rate is constant over time--as opposed to a crawling peg, for instance--equations (28), (32), and (33) form the same system as before (with δ in place of σ), given by equations (7), (8), and (9). This is because when the household uses domestic currency, the fixed exchange rate ensures that its value in terms of foreign currency remains unchanged. If there is a high dependence on oil, then, a permanent oil shock will result in a worsening of the current account. Under fixed exchange rates, domestic real balances act as if they were foreign money balances and are able to perform the shock absorber role which they cannot under flexible rates.

As suggested earlier, a key difference with standard versions of the monetary approach to the balance of payments is that there is no price level effect in the present model due to the fact that oil is an intermediate good; only the wealth effect remains. The wealth effect calls for a reduction in real balances and constitutes, therefore, a force towards a current account--or balance of payments--deficit. On the other hand, the fall in investment implies, other things being equal, a shift towards foreign investment which, in this model, is equivalent to the acquisition of foreign money since there are no other foreign assets. A high oil dependence makes it more likely that the former effect will prevail.

IV. Conclusions

The motivation for the line of research pursued in this paper has been the observation that standard real models find it difficult to explain current account deficits in response to permanent oil shocks. It was shown that if currency substitution is introduced into the picture, the model predicts that a deficit may arise and that its magnitude depends on the degree of oil dependence of the economy. This is consistent with observed behavior. The basic mechanism at work is that the fall in real income that results from the oil shock does not translate itself into a one-to-one reduction in lifetime consumption. Rather saving decreases as oil prices rise. This is possible because part of the loss in real income is absorbed by lower foreign money balances. 1/ Put differently, the presence of currency substitution generates a Harberger-Laursen-Metzler effect even when the rate of time preference is constant. Finally, it was shown that under fixed exchange rates the results were identical to those that obtain in the currency substitution model.

1/ It is interesting to note, as Guillermo Calvo pointed out to me, that the fact that one can view the stock of foreign money as being equivalent to a stock of tradable durable goods suggests that a real model with a durable consumption good could generate similar implications concerning the response of the current account to a permanent oil price increase.

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