Commodity markets and the international transmission of fiscal shocks

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Commodity Markets and the International Transmission of Fiscal Shocks

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Abstract

The "engine of growth" argument holds that an economic expansion in a large country increases the growth of its trading partners. Growth in developing countries is routinely linked to growth patterns in the industrial economies. This paper examines the role of commodity markets in transmitting disturbances internationally and finds that contrary to the implications of the "engine of growth" argument, a fiscal-induced expansion in a large commodity-importing country could either increase or decrease growth in the developing commodity-exporting country, and unambiguously reduces output in the second commodity-importing country.

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Contents

I. Introduction

After stagnating during 1980-82, U.S. economic growth rebounded sharply in early 1983 and the U.S. began one of the longest sustained economic expansions during the post-war period. Early in the recovery it was hoped that the U.S. performance would act as a catalyst and generate renewed growth abroad, particularly in developing countries that had been severely impacted by rising debt servicing costs and deteriorating terms of trade (see Figure 1). These expectations had their foundations in the familiar "engine of growth" argument (see for example, Lewis, 1980) that, in its simplest form, holds that an economic expansion in a large country, such as the U.S., increases the growth of its trading partners. As Table 1 illustrates, six years into the recovery these positive "spillover effects" have fallen short of expectations and in some instances, have failed to materialize altogether.

There are many reasons why growth in a large developed country may not be positively transmitted to its developing trading partners (see Dornbusch, 1985, and Goldstein and Khan, 1982). Some of the factors that weaken the "positive linkage" include, the low share of exports in GNP in many developing countries, and/or the lack of complementary factors (infrastructure, financial markets etc.) that could translate an increase in export earnings to higher growth, and the higher share of agriculture in GDP (particularly, in low income countries) with the associated vulnerability of agricultural production to local or regional exogenous events (e.g. droughts). Similarly, inverse transmission within the industrial country group can be the consequence of a variety of factors (see Frankel, 1986a, and 1986b). A complete analysis of these channels is beyond the scope of this paper. However, this paper will focus on an important channel of transmission--the international commodity market. The sluggish performance of per capita GDP in the primary commodity exporters during 1983-87 may, in fact, be attributed to the unfavorable performance of their terms of trade (Figure 1). As shown in Figure 1, the terms of trade of primary commodity exporters declined at an average annual rate of 2.8 percent during 1980-87, a much sharper deterioration than the 0.4 percent averaged in the 1965-79 period. Far less clear--and the puzzle that is addressed in the paper--is why that commodity terms of trade did not respond more vigorously to the accel- eration in growth in the industrial countries over this period.

Section II develops the "short-run" model of relative commodity price and the real exchange rate determination. The inclusion of commodities, in addition to labor, as an input in the production process is similar to that of Findlay and Rodriguez (1977) and Obstfeld (1980), but with a key difference in that the small country assumption is not made. Following Krugman (1983), the analysis employs a three-country setting: a commodity supplier, which exhibits the broad characteristics of a developing economy, and two commodity-importing "industrial" economies. In this framework, shocks in the "home" country have repercussions abroad--both as the developing country as well as the other commodity importer.

Table 1. Growth Patterns in Industrial and Developing Countries

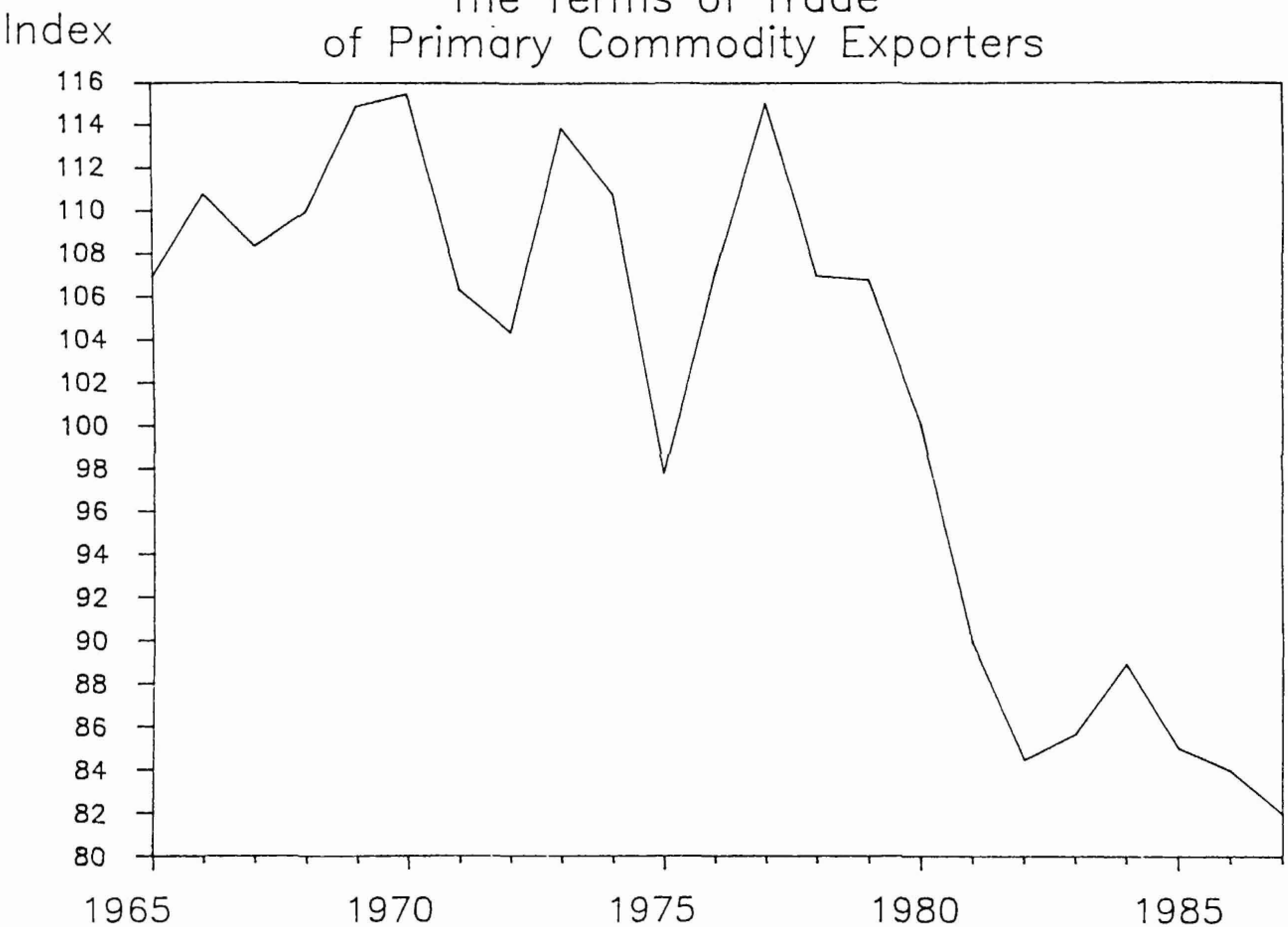
(Average Annual Growth Rates)

	1966-79	1980-82	1983-87
Primary Product Exporters			
Real GDP	5.0	1.9	2.9
Per Capita GDP	2.5	-0.8	0.6
Industrial Countries			
Real GNP	3.6	0.8	3.3
Total Domestic Demand	3.6	0.2	3.7
United States			
Real GNP	3.1	-0.3	3.8
Total Domestic Demand	3.6	-0.5	4.7

Source: IMF, World Economic Outlook, 1988.

Figure 1

The Terms of Trade
of Primary Commodity Exporters



Source: IMF, World Economic Outlook, 1988

In particular, we find that an increase in government spending in the "home" country provides the usual domestic stimulus, but by driving up world commodity demand in the presence of a fixed supply, "crowds-out" foreign demand and reduces output in the second commodity-importing country. This contrasts with the positive transmission effects of fiscal policy in the well-known Mundell-Fleming model (see Mundell, 1968).

While the assumption that commodity supply is fixed at a point in time is adequate for "short-run" analysis, it is unrealistic to assume commodity suppliers are insensitive to the economic environment of their trading partners over time. The commodity market is an important channel in the international transmission of disturbances, as noted by Cagan (1980), Frankel (1986b), and Giavazzi and Giovannini (1985). As such, it is appropriate to incorporate the response of the commodity supplier to external shocks in the analysis.

In Section III we endogenize commodity supplies by allowing the commodity exporter to react to changes in the terms of trade. We find that output in the developing country will rise/fall if their terms of trade improve/deteriorate, (as in Khan and Montiel, 1987, for the small country case) and that the latter will be determined by their consumption basket. Specifically, an expansion in fiscal spending in the "home" country (which unambiguously raises domestic output), worsens the terms of trade of the commodity exporter and reduces their output if their consumption is biased in favor of the "home" good. The converse applies if the commodity supplier prefers the good manufactured by the second commodity-importing country. Further, we show that the negative association between the real exchange rate of the U.S. dollar and real commodity prices, documented in Dornbusch (1985), is a reduced form relationship that varies with the underlying consumption preferences of the commodity exporters.

The concluding section reviews the results and discusses some of the extensions of the model.

II. The Short-Run Model

This section describes a static two-factor neoclassical model. As in Krugman (1983), we have three countries--the "home" country, which we will refer to as country A, a second commodity-importing country, which will be denoted by B, and country C, the commodity supplier. Countries A and B, which represent industrial economies, employ two factors in the production process: labor which is country specific and a commodity which is internationally traded and imported by both countries. Country C, representative of a developing country, employs only labor in producing its commodity export. This commodity will also be denoted by the letter C.

Following the usual assumptions underlying the neoclassical model, the supplies of the non-traded input, labor, are predetermined in a given period in all three countries. This has the effect of making the supply of commodities fixed at any point in time, an assumption that appears reasonable for short-run analysis.

For simplicity, we assume that only countries A and B can have independent values for their respective currencies, and that country C "pegs" its currency to that of country A. This allows us to consider only one nominal exchange rate, e, as the number of domestic currency units (country A) per one unit of foreign (country B) currency.

We assume that the law of one price prevails in the commodity market; given the definition of the nominal exchange rate, this can be expressed as,

$$q^A = eq^B$$

where q^A and q^B represent the domestic and foreign price of the commodity input, and e is the nominal exchange rate.

Country A produces "good 1", while country B produces "good 2". These two goods are imperfect substitutes so that while the law of one price may apply individually, relative prices vary; we can define the real exchange rate as the relative price of the manufactured goods of country A versus the manufactured goods of country B, or:

$$R = P_1/eP_2$$

where P_1 and P_2 are the respective prices of these manufactures.

The production functions determining output (Y) in the three countries are given by:

$$Y^j = Y^j(L^j, C^j) \qquad j=A,B \tag{1}$$

$$Y^C = Y^C(L^C) = C \tag{1a}$$

Profit maximizing behavior under perfect competition yields the following marginal conditions:

$$W^A/P_1 = Y_L{}^A \tag{2}$$

$$W^B/P_2 = Y_L{}^B \tag{2a}$$

$$q^A/P_1 = Y_C{}^A \tag{3}$$

$$Rq^A/P_1 = Y_C{}^B \tag{3a}$$

where the W's represent nominal wages in countries A and B. Output is a rising function of its inputs, and the usual assumptions are also made that Y_{LL}^j, $Y_{CC}^j < 0$, and $Y_{CL}^j > 0$.

The marginal condition for country C will, of course, depend on whether the commodity supplier behaves as a competitor or as a monopolist. Both cases will be dealt with in the subsequent section. For now, with commodity output assumed fixed, this marginal condition can be temporarily ignored.

There are three equilibrium conditions in the "real" sector. Commodity market equilibrium requires,

$$C^A + C^B = \bar{C} = Y^C \qquad (4)$$

while equilibrium in the home good market (Good 1) requires,

$$\Sigma_j \ [D^1(R, Y^j - T^j) + G_1{}^j] = Y^A \quad j=A,B,C \qquad (5)$$

where D_1 is a function that represents total private demand for "good 1"; demand depends positively on the income terms and negatively on the real exchange rate. To keep the analysis as simple as possible, we have assumed that private demands for the manufactured goods do not depend on the interest rate. As will be shown subsequently, this simplifying assumption will allow us to "dichotomize" the real and financial sub-sectors.

The G's represent government demands for the same product. Similarly, equilibrium in the foreign good market requires,

$$\Sigma_j \ [D_2(R, Y^j - T^j) + G_2{}^j] = Y^B \qquad j=A,B,C \qquad (6)$$

where demand depends positively on the real exchange rate.

For simplicity, we will subsequently assume that governments purchase only their respective home products and finance their expenditures by a lump-sum tax levied on households. Thus, we focus on the reallocative effects of fiscal policy à la Metzler (Metzler, 1949).

Money demand in both industrial countries has the usual functional form, and money market equilibrium requires,

$$M^A/P_1 = l^A(Y^A, i^A); \qquad (7)$$

$$M^B/P_2 = l^B(Y^B, i^B). \qquad (7a)$$

In the industrial countries, the money stock is deflated by the price of the respective home good under the assumption that households consume more of the good they produce. A more general case--deflating by a price index that accords weights to both final goods would be somewhat more complicated without adding anything to the analysis. Country C's currency is pegged to the "home" country currency, and the "world" interest rate is taken as given.

Asset choice is limited to the bonds of the industrial countries, but these are perfect substitutes so that the interest parity condition holds,

$$ {}^{A} = i^{B} + \epsilon, \tag{8} $$

where ϵ is the expected exchange rate change. Residents of each country can only hold their domestic currency and the internationally traded bond. As is characteristic of neoclassical models, the "real" and "financial" sectors are fully dichotomized, and consequently, all real variables are neutral with respect to nominal magnitudes.

With the labor supplies predetermined, equations (3) and (3a) yield expressions for C^A and C^B in terms of the real exchange rate and real commodity prices. From commodity market equilibrium (equation 4), we can obtain an expression for real commodity prices; equilibrium in the home goods market (equation 5) yields an expression for the real exchange rate. By Walras' Law the clearing of these two markets will insure that the third market clears.

With output already determined, interest rates in countries A and B can be expressed in terms of the respective prices and the exogenous variables. Substituting these terms into the interest rate parity condition (equation 8) and, for simplicity, assuming that country A and country B have identical money demand functions, ϵ, the expected exchange rate change, can be expressed in terms of the relative price of goods 1 and 2, the (thus-far) exogenous commodity supply, and the policy variables.

Recalling the definition of the real exchange rate, P_1/eP_2 can be written in terms of e and R. With a reduced form expression for the real exchange rate already available, this substitution yields a dynamic equation, which for the perfect foresight case, equals the actual change,

$$ De = \Gamma(e,\ C;\ X), \tag{9} $$

where $De = (1/e)de/dt$ and X is a 3x1 vector of policy variables. The contents of X are:

$$ X' = [G^A,\ M^A,\ M^B]. $$

These are government spending in country A, and the money supplies in countries A and B. The partial derivatives are as follows:

Γ_0 and $\Gamma_1 > 0$ for e and C respectively
$\Gamma_2 > 0$ for the fiscal variable in country A

and,

$\Gamma_3 < 0$, $\Gamma_4 > 0$ for the monetary variables in countries A and B respectively.

Explicit forms for these partial derivatives are presented in the Appendix.

With dC = 0, the system can be described by a single dynamic equation given by (9), not unlike the system in Mussa (1982). 1/

1. Solving the real side of the model

With world commodity supplies fixed, an increase in government spending in country A raises aggregate demand for good 1, simultaneously driving up the real exchange rate and reducing commodity costs in country A. The appreciation in the real exchange rate translates into higher commodity costs in country B, reducing their output.

Since the model divides into real and nominal sub-sectors, we can apply the traditional apparatus of trade theory to establish the basic properties our more complicated framework rests upon. With commodity supplies fixed in the short run, the production sector, defined by equations (1) through (4), determines output possibilities for the goods of country A and B. Given the already specified assumptions about behavior, this defines a concave production possibilities frontier, given by TU in Figure 2.

If preferences are identical in the three consuming nations, we could describe the goods choice (subject to the usual qualifications) by world social indifference schedules. For implicity, utility is assumed to be homothetic so that all the potential indifference schedules may be written as radial expansions of one, say the HH' curve in the figure.

For the closed world economy, the tangency of an indifference schedule with the transformation curve defines an interior solution (point E). This defines the production point and the terms of trade. However, *governments intervene in the world market*. In this simple model, we assume that the government of country A purchases G_1^A of the home good per period financed by taxes. (We assume that in country B and country C government spending is zero.)

1/ Also see Stockman and Obstfeld (1983).

The spending in country A uniformly withdraws G_1A units of the home good from the market--seen as the private transformation schedule RS in the figure (see, for instance, Meade, 1950, for a detailed derivation). The private consumption point shifts to F, reflecting both an income-reducing effect of higher taxes and a substitution effect of a higher relative price of the good of country A. Comparing these points, we observe that after an increase in government spending in country A: (a) the terms of trade shift toward country A; (b) production in country A rises; and, (c) production in country B falls. This effect follows a Metzlerian channel: taxation redistributes income to an economic agent--the government--that consumes relatively more of the home good (Metzler, 1949).

2. Monetary dynamics

In financial markets, the nominal exchange rate will move to ensure that interest parity holds at all times. Consequently, an increase in government spending in country A will require an immediate nominal exchange rate appreciation. This is illustrated in Figure 3 for both anticipated and unanticipated changes in government spending.

As depicted, an unanticipated increase in G_1^A at time t_1 leads to an instantaneous adjustment as the exchange rate appreciates from e_0 to e_1. This follows because the single dynamic equation has one positive root; initial conditions must be chosen so that the system stays at rest at the steady state. An announcement of the policy change at time t0 leads to more complicated dynamics. Long-run stability requires that e decline at time t_0 and continues to appreciate, as indicated by the dashed line, until the new policy takes effect at t_1. However, it is unrealistic to assume that such "shocks" to the industrial countries will not be transmitted to the commodity supplier via their effects on relative prices. For this reason, more adequate supply dynamics are incorporated in the analysis in the following section.

III. Variable Commodity Output in the Long-Run Model

The static assumption of an unchanging supply of world commodities is quite restrictive. In particular, it appears unreasonable to assume that the long-run supply of labor services in the commodity-producing country, and hence productive capacity, is completely insensitive to economic developments. If we return to the framework of Figure 2, it is unrealistic to assume that the world transformation frontier is invariant to country C's consumption possibilities. A shift in relative prices, for instance, may call forth a change in the quantity of commodities supplied to the world market over time.

Figure 2
An Increase in Government Spending with Fixed World Commodity Supplies

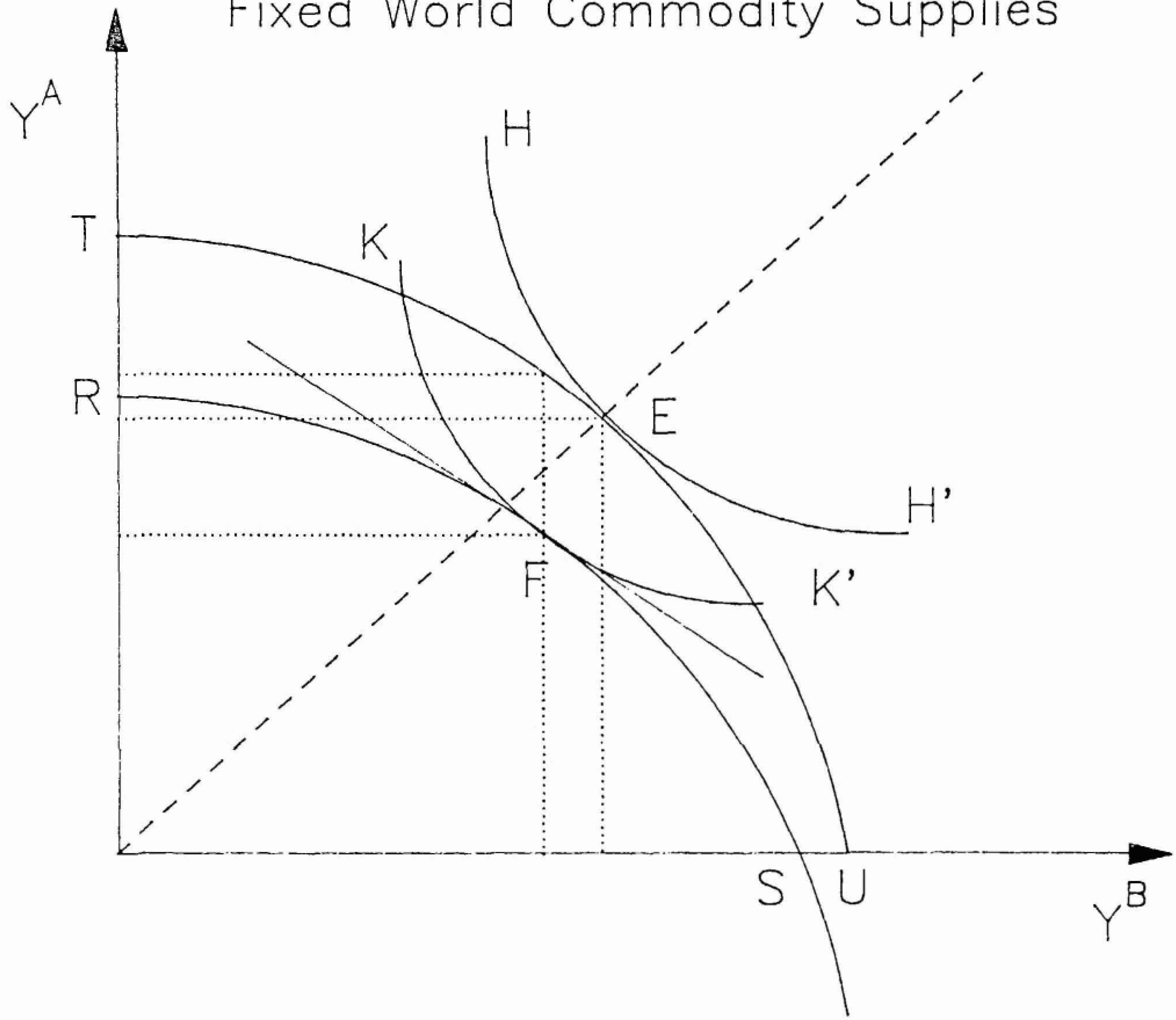
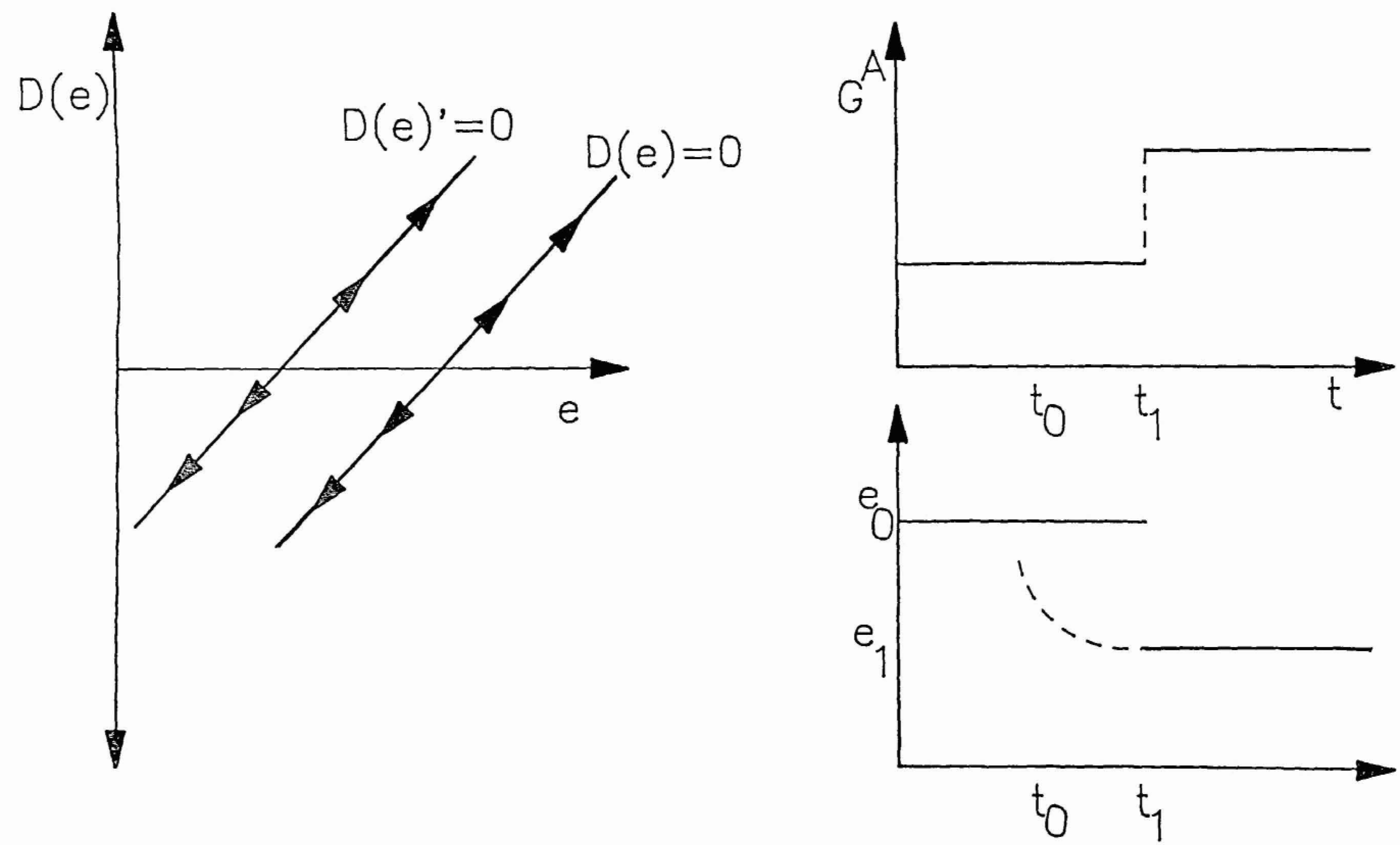


Figure 3

Unanticipated and Anticipated Increases in Government Spending in Country A with Fixed World Commodity Supplies



We assume that the "steady-state" supply of labor in the commodity producing nation is given by,

$$L^C = L^C(W^C/P^C) \tag{10}$$

where the labor supply responds positively to changes in the real wage. The "consumer price index" in country C, P^C, is a geometric price index of the form,

$$P^C = P_1{}^{\sigma}(eP_2)^{1-\sigma} = P_1R^{\sigma-1}$$

where σ and $(1-\sigma)$, the weights attached to the prices of goods 1 and 2 in the index, represent the share of each good in country C's consumption basket. Since both of the goods consumed in the commodity exporting country are imported, there are no real priors to suggest that consumption be biased in favor of one good or the other.

We can rewrite (10) as,

$$L^C = L^C[(W^C/q^A)(q^A/P_1)R^{1-\sigma}] \tag{10a}$$

which is a positive function of its arguments.

With (10a) illustrating the long-run labor supply of the commodity producing country, and W^C/q^A representing marginal costs, a "steady-state" level of commodity output can be calculated for both the competitive case and the monopolist case. Suppose that commodity output gravitates toward its steady-state value according to,

$$DC = \alpha(C^* - C) \qquad \alpha > 0 \tag{11}$$

where α represents the speed of adjustment, $DC = (1/C)dC/dt$, and C^* represents the "steady-state" level of the commodity. This partial adjustment scheme--assumed here rather than derived--is, under certain conditions, consistent with the optimal solution of a planner facing quadratic adjustment costs (Lucas, 1967).

The adjustment scheme provides the second dynamic equation of the system and jointly with (9) determines the course of all the endogenous variables of the system. Equation (11), after making the substitution for the "appropriate" C^* becomes,

$$DC = \Phi(e, C; X). \tag{12}$$

The partial derivatives are as follows:

$\Phi_0 = 0$, $\Phi_1 < 0$ for e and C respectively.

These elasticities follow from the specification of adjustment costs, and are invariant to whether the "steady state" is the result of perfect competition or monopolistic practices. The partial derivatives that correspond to the policy variables are $\Phi_3 = \Phi_4 = 0$; Φ_2 changes in sign and magnitude in accordance with the supply practices and consumption preferences of country C. As a consequence, the assessment of the fiscal policy multipliers will be dealt with in detail in the subsequent sections.

The dynamics of the system linearized around the steady state values of e and C can be summarized by:

$$\begin{bmatrix} De \\ DC \end{bmatrix} = \theta \begin{bmatrix} e-e^* \\ C-C^* \end{bmatrix} + \theta^* X^*$$

where θ is a 2x2 matrix of partial derivatives and θ^* is a 2x3 matrix of the partials corresponding to the exogenous variables in the 3x2 matrix denoted by X*. (See Appendix).

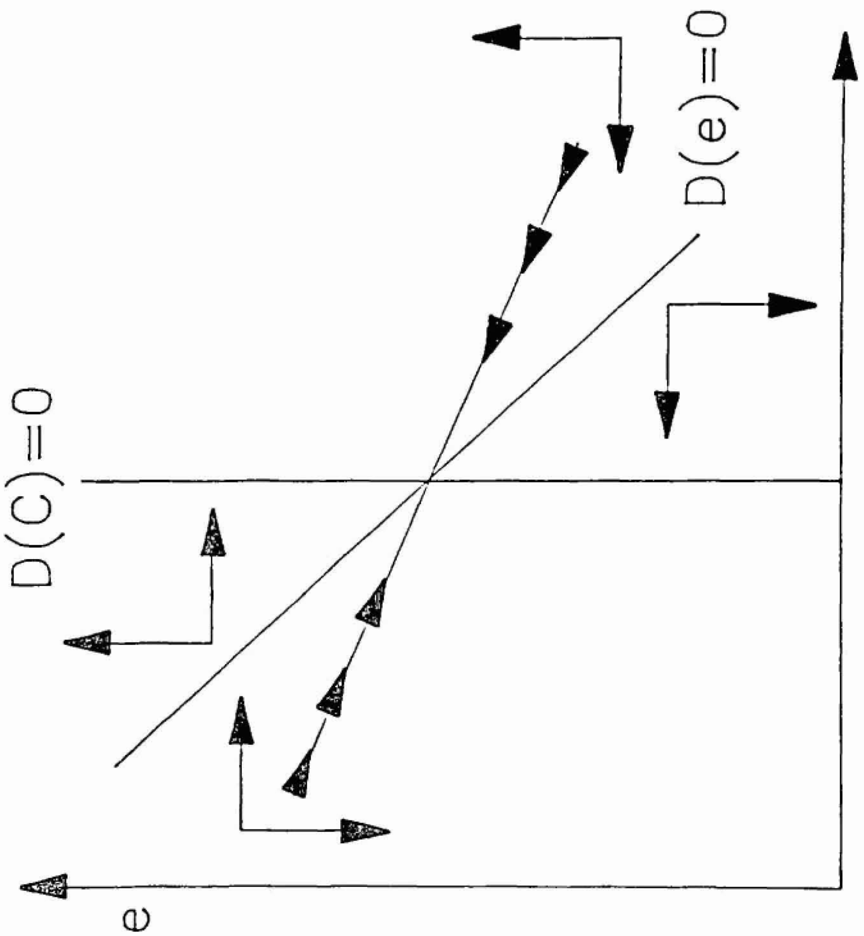
The existence of a unique non-explosive solution requires that the system have one positive and one negative root; this can be determined by ascertaining the sign of the determinant of θ. If the determinant is negative, then the system has one positive and one negative characteristic root.

Assessing the existence of saddlepath stability is straightforward since it only requires that $\Gamma_0\Phi_1 < 0$ in this set of dynamic equations. Given that $\Gamma_0 = -1/l_i$ and $\Phi_1 = -\alpha$ all that is required is that the interest elasticity of money demand, l_i, (which is common to countries A and B) be negative and that the speed of adjustment, α, of the actual to steady-state commodity stocks be positive. In summary, it requires that the parameters of the system make "economic sense" which, following Mussa (1984), are the only cases considered here.

Figure 4 depicts the phase diagrams for the system under the assumption that X* is constant at some level, say $\bar{X}^*$. The vertical line gives the combinations of C and e that make DC = 0, while the downward sloped schedule is the locus of e and C that make De = 0. We show below that the position and the extent to which these schedules shift after a shock depend on two aspects of commodity exporters' behavior: (1) whether suppliers act competitively or monopolistically and (2) the consumption patterns of commodity suppliers. In all cases, however, these schedules will retain the slopes depicted in Figure 4.

If the commodity exporter behaves as a competitor, then the relevant marginal condition would be given by:

Figure 4



$$W^C/q^A = Y_L{}^C. \tag{13}$$

From the labor supply function we can obtain an expression for W^C/q^A in terms of the real exchange rate and real domestic commodity prices. Because labor market equilibrium requires that this expression equal (13), we can then proceed to solve for the "steady-state" employment level in the commodity-exporting country. From (1a) the steady-state level of commodities, C*, can be calculated. This will be the C* that appears in (12), closing the system.

Alternatively, for the case of the monopolist commodity producer facing world demand, profit maximization requires that marginal revenue be equal to marginal cost; this translates into,

$$Cd(q^A/P_1) + (q^A/P_1)dC = d(W^C/q^A). \tag{14}$$

The labor supply function can be solved for the real wage, W^C/q^A, in terms of R and q^A/P_1. The production function yields an expression for employment, L^C, in terms of C, and with reduced forms available for the real exchange rate and commodity prices, equation (14) will yield a reduced form expression for C*, the steady-state stock of commodities. As before, substituting the derived expression for C* into (12) closes the system.

Given this system, we can proceed to analyze the effects of a fiscal expansion in country A. Consider a "shock" to this system via an increase in government spending. As before, this policy change produces a simultaneous appreciation in the real exchange rate and a decline in q^A/P_1 on impact. The rise in R will tend to increase the amount of labor supplied at the "steady-state" in country C, while the reduction in commodity prices will tend to diminish it.

The outcome depends on the consumption basket of the commodity exporter. If country C consumes more of "good 1" than of "good 2", [$\sigma > 1/2$], then the terms of trade deteriorate and the steady-state level of employment in country C and commodity output will fall below the current level. If consumers in the commodity-exporting nation consume goods 1 and 2 in equal proportions, then the steady-state output of commodities will be approximately unchanged. If more of "good 2" is consumed then, the commodity exporter will experience an improvement in the terms of trade and commodity output will be higher.

The welfare implications for the commodity importers also depend on the consumption preferences of the commodity exporter. Income in country A rises unambiguously as a result of the increase in domestic fiscal expenditure. However, in the case where country C consumes more of "good 1", the long-run policy multiplier will be smaller than the "short-run" multiplier that holds the commodity supply constant, while the opposite is true for $\sigma < 1/2$. Under all of these scenarios output in country B falls unambiguously, but the magnitude of the decline will vary with σ.

In the case where both goods are consumed in equal proportions by country C, given that the new steady state commodity stock will, at most, only marginally differ from the initial level, the implications for the real exchange rate, real commodity prices and output in countries A and B are not appreciably different from the "short-run" case that holds supply fixed. Table 2 summarizes these results.

Figure 5 depicts an increase in government spending for the case where the commodity exporter consumes more of "good 2" than "good 1". Under such an assumption, as previously discussed, the terms of trade improve and the employment level and output of the commodity producer rise and shift the DC=0 schedule to the right. This would be the case consistent with the "engine of growth" argument. At the same time, interest rates rise in country A by less than abroad and produce a downward shift in the De=0 schedule.

This may seem counterintuitive if one considers that output rises in country A and falls in country B. However, to understand why the interest rate spread $(i^A - i^B)$ narrows, it is necessary to determine what happens to relative prices, P_1/P_2, as well as relative output, Y^A/Y^B. Relative prices fall on impact, in fact, they overshoot their steady state value. In addition, as Table 2 illustrates, in the case where commodity supplies rise over time, Y_A undershoots while Y_B overshoots. So that on impact, Y_A/Y_B changes by less than in the steady state. The "price effect" dominates so that real balances in country A, M^A/P_1, fall by less than real balances in country B, M^B/P_2. Because of the change in relative prices, country A can "accommodate" its rise in money demand with a smaller rise in the interest rate than country B; this translates into a decline in the interest rate spread, $(i^A - i^B)$, which requires a continued appreciation in the nominal exchange rate, e, in order to induce domestic agents to hold their lower yielding assets. No exchange rate overshooting occurs.

Figure 6 illustrates the case where country C's consumption is biased in favor of good 1. In this scenario, it is the decline in q^A/P_1 that dominates the commodity supply response, and the new steady state stock of the commodity will be lower, at $DC' = 0$. Thus the transmission is contrary to what the engine of growth would suggest. As before, the $De = 0$ schedule shifts down to $De' = 0$ and the new steady state will be associated with e_1 (an appreciation). Note however that the adjustment path to this lower level of e is distinctly different from the previous case. Both nominal and real exchange rates overshoot in this case.

As in the previous case, output in country A rises, output in country B falls, and P_1/P_2 falls, in this instance undershooting its long-run

Table 2. Fiscal Policy Multipliers Under Alternative Scenarios

	"Short-Run" Fixed Commodity Supply	"Long Run" Variable Commodity Supply		
	$C = \bar{C}$	$\sigma > 1/2$	$\sigma = 1/2$	$\sigma < 1/2$
Y^A	a_2	a_1	a_2	a_3
Y^B	$-d_2$	$-d_3$	$-d_2$	$-d_1$
$Y^C = C$	---	$-c$	---	$+c$

The letters stand for the appropriate multiplier. All the terms are positive except those with a minus sign and the subscripts denote size in ascending order ($a_1 < a_2 < a_3$ and $d_1 < d_2 < d_3$). See Figure 2 for a graphical illustration.

level. But in this case, Y^A/Y^B changes the most on impact, as Y^A "overshoots" while Y^B undershoots its steady state level. This "income effect" swamps the "price effect" and the interest rate spread widens, inducing the exchange rate to overshoot.

For the case where the commodity supplier behaves as a monopolist, the long-run impact of fiscal policy will depend crucially on the consumption preferences of the commodity supplier, as in the competitive case. An increase in government spending, for the case where country C consumes more of good 2, will follow the outcome illustrated in Figure 5 and so on.

There is, not surprisingly, a different set of long-run policy multipliers than those associated with the perfect competition case. An increase in government spending in country A, for $\sigma < 1/2$, will produce a smaller expansion in the steady state level of commodity output than the response warranted by a competitive supplier, while the output contraction for the opposite case will be greater. As a consequence, real commodity prices will be higher and the aggregate output of the commodity importing countries will be lower than in the competitive case.

It is interesting to observe, that during the period in which the dollar appreciated and commodity prices fell sharply (in dollar terms) primary commodity exporters were importing substantially more goods from the U.S. than from any other country, as Tables 3 and 4 highlight.

Almost 30 percent of the imports of this group came from the U.S. over the 1980-84 period. Further, of the 64 developing primary commodity exporters, 23 countries listed the U.S. as its single largest trading partner; and for those 23 countries, the U.S. was the source for 60 percent of their total imports. Thus, the case in which $\sigma > 1/2$ is more than a theoretical curiosum.

The deterioration in the terms of trade of these commodity exporters first shown in Figure 1 and the anemic performance of their per capita GNP seen in Table 1 are fully consistent with the model presented in this paper; however, the model only applies to developing countries that are commodity exporters. For example, our framework follows Dornbusch (1985) and exhibits are inverse association between the real exchange rate of the dollar vis-a-vis its major trading partners and the terms of trade of developing countries. Table 5 presents the correlations among two measures of the U.S. dollar's exchange value and the terms of trade for two groups of developing countries. As seen in the first two columns of the table, only the commodity exporting group--the subject of this paper--exhibits a significant negative correlation between their terms of trade and both measures of the value of the dollar.

Figure 5

An Increase in Government Spending in Country A with Variable Commodity Supplies For $\sigma > (1-\sigma)$

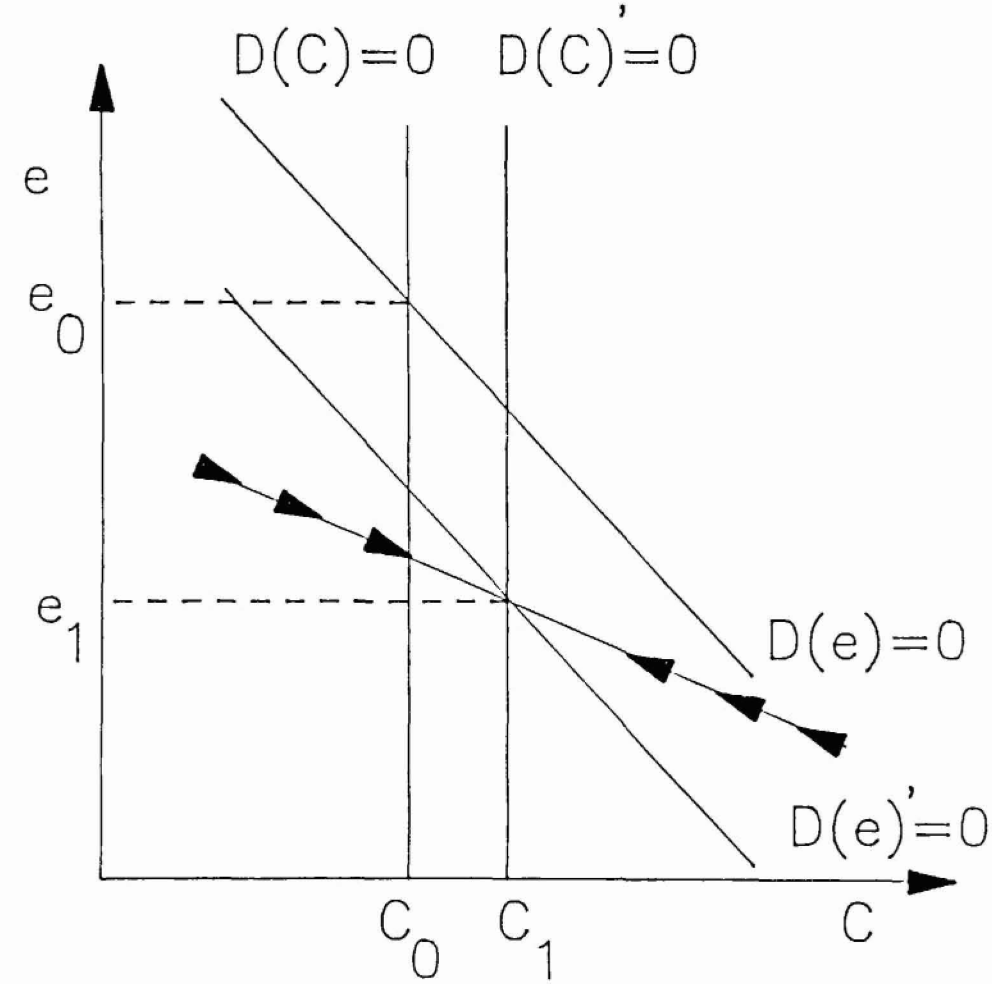


Figure 6

An Increase in Government Spending in Country A with Variable Commodity Supplies For $\sigma < (1-\sigma)$

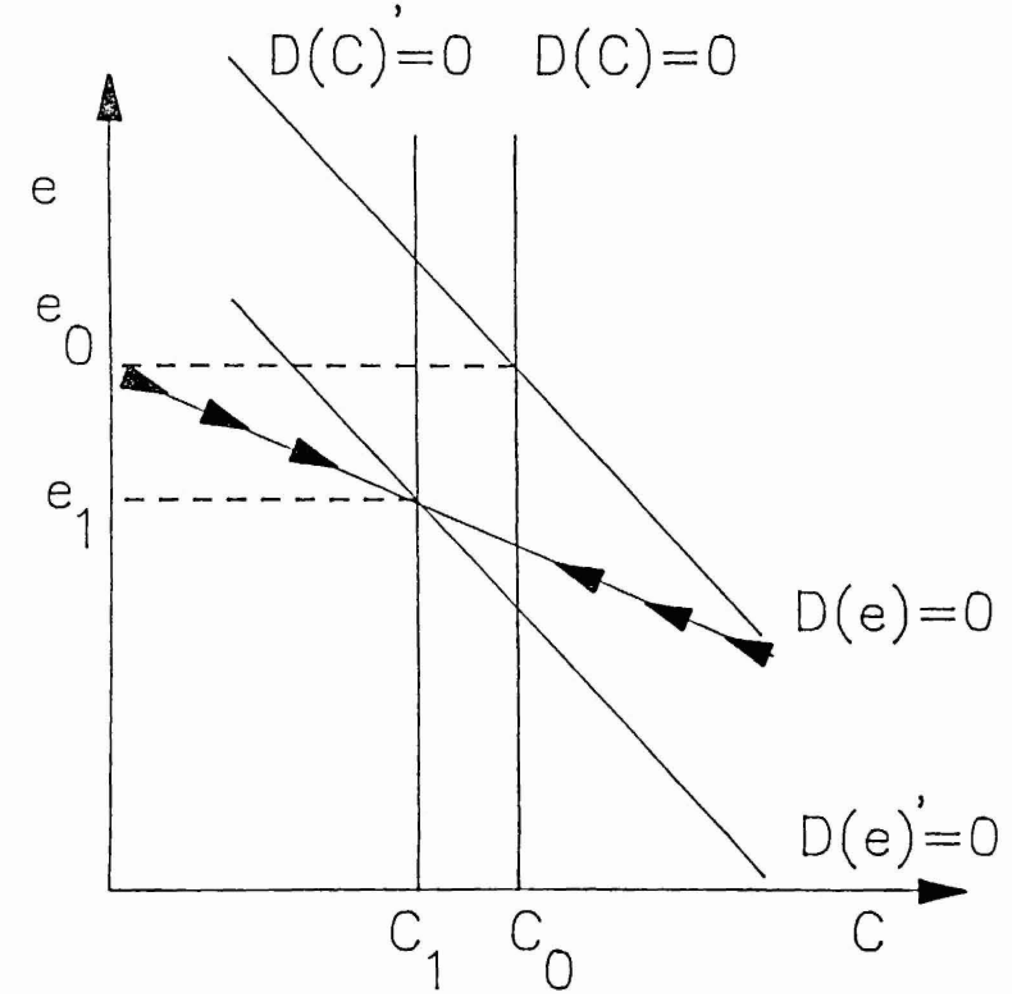


Table 3. Import Patterns of the Developing Primary Exporting Countries 1980-84
(Percent)

Country	Share in Total Imports from Industrialized Countries
United States	29.3
Japan	18.9
Germany	11.2
France	8.4
Other Industrial	32.2

Source: IMF, Direction of Trade Statistics.

Table 4. The Largest Trading Partners of Developing Primary Commodity Exporters (1980-84)

	U.S.	Japan	Germany	France	Other Industrial	Total*
Number of Countries for Which the Major Trading Partner is;	23	7	0	15	23	68
Percent of Total Imports accounted for by Sub-group	60.4	20.1	0	9.5	10	100

Source: IMF, <u>Direction of Trade Statistics</u>.

* Excludes Bhutan, Botswana, Comoros, Cote d' Ivoire, Sao Tome and Principe, St. Kitts and Nevis, and Swaziland for which comparable data was not recorded.

Table 5. Correlation Among the Real Exchange Rate of the U.S.Dollar and Developing Countries Terms of Trade (1975-87)

Real Value of U.S. Dollar	Developing Commodity Exporters	Developing Manufacturing Exporters
Wholesale prices	-0.503	-0.197
Value Added Deflator	-0.224	0.025

Source: IMF, International Financial Statistics.

IV. Concluding Comments

The framework presented in the previous sections is similar to that employed by Findlay (1980) and Krugman (1983). However, unlike the model of Findlay, it includes a second commodity importing country, so that the transmission of shocks to the "home" country can be analyzed not only for the commodity supplier, but for the other trading partners as well. A key difference from the Krugman model, which employs a three-country setting, is that commodity supply dynamics are endogenized and explicitly modeled for both competitive and monopolist commodity suppliers.

The "short-run" expansionary impact of a rise in government spending in the home country and the neutrality of money in a neoclassical framework are standard results. Of more interest are: (a) the foreign repercussions of domestic fiscal policy, and (b) how those "foreign" variables will alter fiscal policy effectiveness in the "long-run".

In particular, what the previous analysis illustrates is one of the many channels that can qualify the "engine of growth "argument. An economic expansion in a large country, such as the U.S., may not be sufficient for inducing growth in the developing primary-commodity exporting countries. And if the policies pursued in the industrial country result in a worsening in the terms of trade for the commodity exporter (illustrated by the case where the commodity exporter consumes more of the good that has had the relative price increase) the transmission effect will be negative. This suggests that the co-variation in output can be either positive or negative, leaving the question, in effect, as an empirical one.

It is interesting to note that even in the country where the policy change takes place, the effectiveness of fiscal policy in stimulating output over time will depend crucially on the behavior of the commodity supplier. In this framework, the formation of a cartel of commodity producers would curtail the ability of fiscal policy to affect output in the industrial countries.

The variety of exchange rate responses implied by the model is also of interest. As is typical in a flexible price model, monetary policy produces an instantaneous adjustment to the new steady state exchange rate, while exchange rate overshooting becomes a fiscal phenomenon. However, even for fiscal policy the overshooting result is not uniform and will depend on whether the new steady-state commodity stock is lower or higher than the previous one.

In general, the model highlights the importance of the commodity market in transmitting shocks internationally and shows how policy effectiveness depends on the economic characteristics of both industrial and developing country trading partners alike. However, understanding the association between activity in the industrial and developing countries require an understanding of the developing countries economic structure. We have shown how simple--and realistic--alterations in supply behavior and consumption preferences can reverse the traditional locomotive effect.

The partial derivatives of the first dynamic equation of the system (equation 9) are given by;

$$\Gamma_0 = -1/l_i > 0$$

$$\Gamma_1 = \frac{l_y a_0 R + l(Y_C{}^A + RY_C{}^B)b_1}{b_0 l_i R} \gtrless 0$$

$$\Gamma_2 = -\frac{l_y Y_C{}^A (Y_C{}^A + Y_C{}^B)R - l(Y_C{}^A + RY_C{}^B)}{b_0 l_i R} > 0$$

$$\Gamma_3 = M^A/P_1 l_i < 0$$

$$\Gamma_4 = -M^B/P_2 l_i > 0$$

where,

$$a_0 = D_1{}^R R(Y_C{}^A Y_{CC}{}^B - Y_C{}^B Y_{CC}{}^A) + (Y_C^A)^2 Y_C^B [D_{1y}{}^B - (1-D_{1y}{}^A)] + Y_C{}^A D_{1y}{}^C (Y_C{}^A + Y_C{}^B) \gtrless 0$$

$$b_0 = (Y_C{}^A + RY_C{}^B)D_{1R} + (1-D_{1y}{}^A)(Y_C{}^A)2 + D_{1y}{}^B Y_C{}^A Y_C{}^B > 0$$

$$b_1 = (1-D_{1y}{}^A)Y_C{}^A Y_{CC}{}^B - D_{1y}{}^B R Y_C{}^B Y_{CC}{}^A - D_{1Y}C^A \gtrless 0$$

The partial derivatives for the second dynamic equation (equation 12) are;

$$\Phi_0 = 0$$

$$\Phi_1 = \alpha < 0$$

$$\Phi_3 = 0$$

$$\Phi 4 = 0$$

For the competitive solution:

$$\Phi_2 = \frac{\sigma\{L^{C'}(Y_L{}^C)^2\, Y_C{}^A R^{-\sigma}[Y_{CC}{}^B(1-\sigma)\sigma\, RY_{CC}{}^A]\}}{b_2 + L^{C'}(Y_L{}^C)^2\, R^{-\sigma}\{RY_{CC}{}^A\, Y_{CC}{}^B b_0 + Y_C{}^A b_1[Y_{CC}{}^B(1-\sigma)\sigma RY_{CC}{}^A]\}}$$

where,

$$b_2 = (Y_{CC}{}^B + RY_{CC}{}^A)(L^{C'}Y_C{}^A R^{1-\sigma} Y_{LL}{}^C - 1)$$

$$\Phi_2 < 0 \text{ for } \sigma > 1/2$$

$$\Phi_2 = 0 \text{ for } \sigma = 1/2$$

$$\Phi_2 > 0 \text{ for } \sigma < 1/2$$

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