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WORLD SHOCKS, MACROECONOMIC RESPONSE, AND THE PRODUCTIVITY PUZZLE

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ABSTRACT

On the basis of a comparative growth analysis of ten major industrial countries, it is shown that the productivity slowdown of the 1970s can be attributed to a combination of the energy and raw material price shocks and the contractionary macroeconomic policies that were followed in response to these shocks. For a raw material intensive sector the rise in the relative price of material inputs has lowered gross output per unit of the other complementary factors, labour and capital. For the aggregated manufacturing sector of the ten economies this explains on average about 60% of the productivity slowdown. A more disaggregated analysis for U.K. manufacturing industries is also given.

On the demand side, terms of trade deterioration has reduced real income and consumption and the profit squeeze has lowered investment demand. Fear of inflation and current account deficits has imparted a further deflationary bias to aggregate demand management in most industrial countries. Depressed demand and greater output variability have hampered factor reallocation in response to the exogenous shocks.

The overriding role of demand contraction, particularly in the non-manufacturing industries, is shown in a comparative analysis of the aggregate business sector and a partial view of labour productivity growth in the service industries of these economies.

The industrial countries can be contrasted with the middle income developing countries where output and productivity continued to grow more evenly after 1973, at the cost of large current account deficits and higher persistent inflation. This provides further evidence that productivity growth is closely linked to macroeconomic response.

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WORLD SHOCKS, MACRO-ECONOMIC RESPONSE, AND THE PRODUCTIVITY PUZZLE*

INTRODUCTION

The output and productivity slowdown of the 1970s seems a unique phenomenon when viewed against the background of the whole of the post-Second World War period. It has been widespread and has affected virtually all industrial countries. It also seems to have been fairly widespread sectorally, although this aspect has not yet been adequately investigated.

Conventional growth accounting procedures (e.g., Denison, 1979, Kendrick, 1981) decompose the slowdown in terms of quantity, quality, and utilization of labour and capital inputs, research and development effort, environmental regulations, etc. While these yield some partial explanations and may narrow down the extent of the puzzle, they leave one unsatisfied because there is a dominant characteristic of the slowdown that eludes such explanation. With a few exceptions, the beginning of the phenomenon can be dated at about 1973, when a major break occurs in the slope of the

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various time series. For a growth-accounting approach this is a rather disturbing feature. Changes in the research and development effort, conventional input qualities, and environmental regulations are gradual processes. They can hardly explain sharp turning points, let alone the close synchronization of developments across countries. On the other hand, the very existence of such a watershed may provide a helpful lead for economic research. Rather than trying to chisel away the phenomenon into little boxes, one can start the analysis at the other end, so to say. One may concentrate on the turning point itself, try to characterize the response to the worldwide shocks of the 1970s, and then ask to what extent the events themselves could help to explain the apparent productivity slowdown. Such an approach may still leave some open questions but it has the advantage of a search for common causes as well as enabling one to gain insight from the differences in response among countries or sectors.

The first and obvious candidate for analysis is the sharp increase in the price of energy. This in itself may not explain much, but when viewed in the context of the general increase in the price of industrial raw materials that occurred in the 1970s, does provide a lead. For a raw-material intensive activity the conventional two-factor view of the production process is only valid when the relative price of the raw material (in output units) or its unit input stays constant. When its relative price rises and it is a complementary factor of production, productivity per unit of the other factors, labour and capital, must fall. Profits must also fall, the extent of the fall depending on the extent of real wage rigidity. The profit squeeze will cause an investment slowdown which in turn affects the accumulation of capital thereby causing a further slowdown in labour productivity. As we shall see, the supply shifts of 1973-74 and

1979-80 go quite a long way towards explaining the slowdown in the manufacturing sector of some major industrial countries and also account for international differences. The direct link between the raw-material price shock and the productivity slowdown in manufacturing (first analysed in Bruno, 1981) is further explored for a cross section of ten OECD countries, in Section I, which also contains a more disaggregated study of U.K. manufacturing industries.

Raw materials alone do not give a complete answer for manufacturing, let alone for nonmanufacturing industries. As is well known, the oil and raw-material price shocks have not only shifted aggregate supply for most industrial countries, they have also set in motion contractionary forces on the demand side. Terms-of-trade deterioration has reduced real income and consumption; the profit squeeze has reduced investment demand; the fear of inflation and of ensuing current-account deficits has also imparted a deflationary bias to aggregate demand management in virtually all industrial countries. Finally, there is the reinforcing interaction of contracting export markets. A large part of the 1970s slowdown in output and productivity growth can be ascribed to the combined effect of these demand-side factors. This is discussed in part in the context of the manufacturing sector (Section I) and more extensively in Section II, where an international comparison of the aggregate business sector is studied. A brief view of service industries is also given. It will be argued that it is most probably the interaction of depressed demand (and greater output variability) with the supply shocks that provides the main explanation for the aggregate productivity slowdown.

A major reason for the demand squeeze comes from the anti-inflation bias of macro-economic policy in the major industrial countries. This is briefly constrasted in Section III with the more expansionary policies pursued by the middle-income developing countries, whose output and productivity both continued to grow after 1973, but at the cost of higher persistent inflation and large current-account deficits. While this option can probably not be pursued by all countries simultaneously, it supports the argument that productivity growth and macro-economic response are closely linked.

I. INPUT SUBSTITUTION, DEMAND, AND THE PRODUCTIVITY SLOWDOWN: AN INTERNATIONAL COMPARISON OF THE MANUFACTURING SECTOR

A convenient starting point for empirical study is provided by comparative developments in the manufacturing sector of the industrial countries. This sector differs less from one country to another than the total business economy and it is heavily dependent on purchased material inputs. Moreover, there is sufficient cross-country variation in both the extent of the slowdown in factor productivity and the magnitude of the input price shock to allow a test of the possible relationship between the two.

The approach here is to extend the conventional two-factor production framework by adding a third input, purchased materials or intermediate goods, and proceed under the simplifying assumption that gross output in manufacturing can be described in terms of a linearly homogeneous two-level function $Q = Q[V(K, L, T), N]$, where V is a real value added index, K and L are capital and labour, N represents the composite material input, and T represents pure technical progress. An earlier paper (Bruno, 1981) expounded the empirical conditions permitting such separability of V and N. While this assumption may not be legitimate when considering the energy input by itself, it most probably is in the case of non-energy inputs (see, e.g., Berndt and Wood, 1979). Given the smallness of the direct energy input in the composite N for manufacturing (of the order of 10 percent), such an approximation may be empirically valid.

Using lower-case letters for logarithms ($q = \log Q$, etc.) and dotted symbols for time derivatives, and denoting the output elasticity of intermediate goods by β and that of capital within V by ϕ we can write

$$\dot{q} = (1 - \beta)\dot{v} + \beta\dot{n} = (1 - \beta)[\lambda + \phi\dot{k} + (1 - \phi)\dot{\ell}] + \beta\dot{n} \tag{1}$$

where λ is the rate of technical progress in V.

Next we assume that the elasticity of substitution between V and N is constant (denoted by σ) from which it follows that

$$\dot{n} = \dot{q} - \sigma\dot{\pi}_n , \tag{2}$$

where π_n is the (log) relative price of the intermediate input. Substituting into (1) we get

$$\dot{q} - [\phi\dot{k} + (1 - \phi)\dot{\ell}] = \lambda - \sigma(1 - \beta)^{-1}\beta\dot{\pi}_n . \tag{3}$$

The left-hand side of equation (3) represents the change in factor productivity as measured in terms of gross ouput relative to the weighted capital and labour input. The share of ϕ will be constant if V(K, L) is a Cobb-Douglas production function. On the right-hand side of (3) we have a conventional time-shift factor (λ) which is augmented or reduced by a material-input price term according as relative raw-material prices fall or rise over time. The coefficient of $\hat{\pi}_n$ in (3) is the product of the relative share of N and V in Q $[\beta/(1 - \beta)]$ and their elasticity of substitution (σ). If we had constant proportions $(\sigma = 0)$ or no change in input prices $(\hat{\pi}_n = 0)$ this substitution term would be immaterial and the measurement of factor productivity would be invariant to the role of raw materials or to the choice of output measure (gross output or some GDP artifact).

In my earlier paper a similar framework was applied to four large industrial countries (the United States, the United Kingdom, Germany, and Japan) and direct estimates of the parameters $(\phi, \beta, \sigma, \lambda)$ were obtained from a two-equation system consisting of (3) and the associated factor-price frontier. The model also allowed for some cyclical variation in factor utilization. This and related studies (Bruno and Sachs, 1982, Lipton, 1981) suggested an estimate of σ of the order of 0.3-0.4 for the United States, the United Kingdom, and Germany, and 0.7-0.8 for Japan. While the hypothesis gives a good explanation of the relative ranking of the productivity slowdown for the four countries as well as a quantitative fit for the lowest (Germany) and highest (Japan), there is a sizable unexplained residual for the United Kingdom and a more moderate one for the United States. It could also be argued that the implied estimate of σ for Japan is somewhat high. At any rate, there seems little doubt that a fall in productivity is associated with a rise in raw-material prices. The data also confirm such an effect for each of the two shocks (1973-74 and 1979-80) separately.

Table 1 gives the relevant average growth data for a wider sample of ten OECD countries for the periods 1955-73 and 1974-80. Column (4) shows the productivity slowdown measured under the assumption that $\phi = 0.35$

Table 1. Selected Data on Average Growth in Manufacturing and Aggregate Demand, Ten OECD Countries: Change in Annual Percentage Rate of Growth from 1955-73 to 1974-80

	Output	Labour	Capital	Factor productivity	Materials input prices[a/]	Public consumption	Domestic absorption
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
United States	-3.1	-2.2	-0.9	-1.3	3.3	-0.7	-2.0
United Kingdom	-5.1	-3.3	-2.6	-2.0	6.4	-0.7	-2.1
Belgium	-5.4	-4.5	-1.4	-2.0	5.0	-1.6	-1.9
France	-4.2	-3.6	-0.1	-1.8	5.3	-0.7	-2.8
Germany	-4.8	-3.7	-4.2	-0.9	1.9	-1.6	-2.2
Italy	-3.7	-1.0	-1.8	-2.4	11.0	-1.6	-3.0
Netherlands	-4.7	-3.6	-1.4	-1.8	7.4	0.2	-2.7
Sweden	-4.9	-1.0	-2.4	-3.3	7.8	-1.2	-2.1
Canada	-4.1	-1.8	-0.8	-2.7	5.7	-3.6	-2.3
Japan	-8.5	-6.0	-3.7	-3.3	5.3	-1.5	-7.1
Mean	-4.9	-3.1	-1.9	-2.2	5.9	-1.3	-2.8

[a/] Change from 1955-72 to 1973-79

Source: Output and manhour data from Bureau of Labor Statistics, U.S. Department of Labor; Capital Stock data based on Artus (1977) and updated; Materials input prices based on OECD and wholesale price statistics of various countries. Public consumption from OECD, *National Income Accounts*.

(obtained from a cross-section regression). Inspection of the figures for the drop in labour and capital inputs [columns (2) and (3)] reveals that this measure is not very sensitive to the choice of ϕ [a change of ± 0.05 in ϕ changes the entries in column (4) by 0.06 on average]. There is considerable variation in the estimated slowdown around the mean of 2.2 percent (from a base of 3.9 percent for 1955-73), the figures ranging from less than 1 percent for Germany to more than 3 percent for Japan and Sweden.

Neither oil nor raw material prices were constant during the high growth period preceding 1972 (see Bosworth and Lawrence, 1982, for a detailed study). Once the effects of the Korean boom had worked themselves out, they declined steadily at a real annual rate of 0.5-1.0 percent from 1955 until 1971-72. The trend was reversed at the beginning of the 1970s, culminating in the price explosion of 1973-74. Raw-material prices then came down again until a new shock hit both types of goods in 1979-80.

The magnitude of the total real input price shock $(\Delta\dot{\pi}_n)$ is here measured by the differences in average growth from 1955-72 to 1973-79 [column (5); Table 1]. Much of the cross-country variation in $\Delta\dot{\pi}_n$, though by no means all of it, stems from differential movements of the real effective exchange rate that mitigated or accentuated the effect of the exogenous shock on domestic relative prices. It is important to stress again that even the external part of the real price increases is only in part directly due to energy prices, although extraction costs, etc., may have been indirectly affected by the energy crisis. (For more details on the large increase in primary non-fuel export prices see Kravis and Lipsey, 1981.)

A first shot at assessing the possible association between raw-material prices and factor productivity growth is obtained by taking observations on average growth in each of the two sub-periods, 1955-73 and 1974-80, for the ten countries listed in Table 1, a total of 20 observations (not detailed here), and pretending that they come from a common underlying production model. Obviously, such an approach ignores the possible intercountry differences in basic productivity growth, quite apart from possible differences in other parameters.

It is interesting to note that even this simple regression (Table 2, line 1) yields a significant and quite plausible estimate for the input-price term (-0.25). As long as basic country differences in production parameters are not correlated with the differences in raw-material price changes this might give an unbiased estimate of the $\dot{\pi}_n$ term in equation (3). However, while it can be argued that the shares ϕ and β, and possibly the elasticity of substitution (σ), are similar in different countries, factor productivity (λ) almost certainly varies. Moreover, the higher the basic factor productivity growth, the more likely it is that real exchange-rate appreciation would be higher (or depreciation lower) and *ceteris paribus*, $\dot{\pi}_n$ would thus be lower. This would introduce an upward bias in the estimated effect of $\dot{\pi}_n$. Some evidence of this can be obtained when one introduces the growth of public consumption expenditure $(\dot{g})$ into the regression. Since it is correlated with real appreciation, its coefficient is overstated in the regression and that of $\dot{\pi}_n$ is substantially reduced.

One way of overcoming this statistical problem, at the cost of a severe cut in degrees of freedom, is by going to the first differences of average growth rates. If it is assumed that countries may differ in basic productivity attributes but that in themselves these attributes are time

Table 2. Selected Regressions of Average Factor Productivity Growth in Manufacturing: Ten OECD Countries, I 1955-73 and II 1974-80

	Constant	Input prices $(\dot{\pi}_n)$[a]	Public consumption $(\dot{g})$	Total domestic absorption $(\dot{a})$	$\bar{R}^2$	SE
Growth levels (I and II); 20 observations						
3(1)	3.47	-0.25			0.21	1.56
	0.43	0.10				
3(2)	0.29	-0.13	0.79		0.97	1.28
	1.08	0.09	0.25			
Growth increment (II - I); 10 observations						
3	-1.18	-0.17			0.19	0.70
	0.60	0.09				
4[b]	-0.96	-0.18			0.37	0.57
	0.49	0.08				
5	-0.76	-0.17	0.27		0.27	0.67
	0.65	0.08	0.20			
6	-0.56	-0.16		0.24	0.37	0.62
	0.63	0.08		0.13		
7[c]	0	-0.21		0.31	0.39	0.61
		0.06		0.11		
8[b] [c]	0	-0.26	0.31		0.43	0.54
		0.04	0.14			

a/ Lagged one year.

b/ Excluding Japan. Number of observations 9.

c/ Regression forced through the origin.

invariant, the problem is side-stepped. The resulting regression (Table 2, line 3) shows two things. With a value of β of about 0.35 the coefficient of -0.17 suggests an average elasticity of substitution of 0.32. At the same time the significant negative intercept (-1.18) suggests a common element of the slowdown which is not captured by the raw-material factor. It is interesting to note that the exclusion of Japan, an outlier, from this regression only raises the $\Delta\dot{\pi}_n$ coefficient to 0.18, but the standard error falls (from 0.094 to 0.076), and $\bar{R}^2$ rises considerably (from 0.19 to 0.37).

Regressions 5 and 6 add the deceleration in public expenditure and total domestic absorption, respectively [see columns (6) and (7) of Table 1]. These variables seem to improve the explanatory power considerably, make the intercept nonsignificant, and hardly change the estimate of $\Delta\dot{\pi}_n$. For a regression on 10 observations this is a satisfactory result. It is important to stress that the deceleration in total absorption $(\Delta\dot{a})$ is virtually uncorrelated with the acceleration in raw-material prices (the correlation coefficient between $\Delta\dot{a}$ and $\Delta\dot{\pi}_n$ is -0.06) so that $\Delta\dot{a}$ may be considered a truly independent factor. For a subsector such as manufacturing it can probably also be considered exogenous.

On the assumption that these two variables exhaust the productivity slowdown we obtain the next regression (Table 2, line 7), which is forced through the origin. This raises the estimate of σ to 0.39 and is the preferred regression. Table 3 shows the estimated components of the slowdown and the errors of the regression by country. It is interesting that with this simple model the four large countries previously mentioned all come out virtually on the regression line (errors ranging between 0

Table 3. Components of Productivity Slowdown in Manufacturing: 1955-73 to 1974-80[a/]

(percent)

	Factor productivity slowdown (1)	*Of which* input prices (2)	Demand slowdown (3)	Unexplained residual (4)
United States	-1.34	-0.69	-0.61	-0.04
United Kingdom	-2.05	-1.34	-0.66	-0.05
Belgium	-1.96	-1.05	-0.58	-0.33
France	-1.84	-1.11	-0.87	0.14
Germany	-0.95	-0.40	-0.66	0.11
Italy	-2.37	-2.31	-0.92	0.86
Netherlands	-1.79	-1.55	-0.83	0.59
Sweden	-3.38	-1.64	-0.65	-1.09
Canada	-2.66	-1.20	-0.71	-0.75
Japan	-3.30	-1.11	-2.19	0.00
Mean	-2.16	-1.24	-0.87	(-0.05)

a/ Based on regression 6, Table 2.

and 0.1). On average raw materials explain about 60 percent of the slowdown, with the demand squeeze explaining the remaining 40 percent. Two outliers for which the regression under-explains are Sweden and Canada and one extreme over-explained case is Italy.

A glance at column (7) of Table 1 shows that Japan had by far the largest demand squeeze. With such a small sample there is a danger of accidentally attributing significance to a variable which only comes in as a result of one extreme observation. Indeed, when regression 7 is run without Japan the coefficient of $\dot{a}$ is rendered nonsignificant, though it retains the same estimated value. However, the alternative regression 8, using public consumption $(\Delta\dot{g})$ as a proxy for demand management, is highly significant and the estimated effect of raw-material prices is even higher in this case (possibly reflecting an indirect income effect--the share of this component in the slowdown rises to 75 percent). The earlier reservation concerning correlation between $\dot{g}$ and $\dot{\pi}_n$ does not apply in this case as the correlation coefficient for the increments $\Delta\dot{g}$ and $\Delta\dot{\pi}_n$ is virtually nil (0.055). For this regression Canada is no longer an outlier but the error for Sweden remains high. Another demand factor, exports, was also tried, but although it helps, the marginal improvement in the estimate does not justify its separate mention here. Also, its exogeneity with respect to productivity growth is probably more suspect. The relationship between demand and productivity is discussed in greater detail in the next section.

At this stage we come to another important concomitant of the shock of the 1970s. Not only has the average growth level changed but so has its variability. Looking at the variance of output growth in manufacturing during sub-periods from 1955 to 1980 it can be shown that except in two countries, Denmark and Japan, the variance (or standard deviation) increased after 1973 even though output growth dropped substantially. The coefficient of variation, which is the ratio of the standard deviation to the mean [shown in columns (1) and (2) of Table 4] has on average grown by a factor of five. While this ratio is, of course, largely affected by what has happened to its denominator (mean growth rate), it is nonetheless indicative of the unprecedented change that has taken place in the economic environment. At a time of severe fluctuations in output the average optimal use of inputs per unit of output is necessarily greater than in a situation of greater certainty. Average factor productivity must thus fall. Geometrically this can be illustrated by comparing the mean cost of two points on opposite branches of a U-shaped cost curve with the point of minimum-cost production (assuming this is the equivalent output level under certainty). Under uncertainty producers may opt for flatter cost curves but at the price of a higher minimum cost. Some such argument may account for an outlier like Sweden where the increase in relative variability of output growth was particularly large (mean output actually dropped in the late 1970s). It is also known that in this country reallocation of factors was hampered by government subsidies to ailing industries.

A more disaggregated view

Our view of manufacturing output as the outcome of an aggregate production process is clearly an abstraction. The estimated effect of material inputs still leaves open the question as to whether it is the outcome of analogous substitution processes within subsectors or the result of a change in the composition of demand in response to relative price changes.

Table 4. Variance of Output Growth in Manufacturing and Total GDP: Coefficient of Output Variation

	Manufacturing		GDP	
	1955-73	1974-80	1960-73	1974-79
United States	1.3	4.7	0.5	0.9
United Kingdom	1.0	2.2	0.4	1.7
Belgium	0.4	3.2	0.2	1.2
France	0.3	1.2	0.1	0.6
Germany	0.7	2.1	0.5	0.9
Italy	0.5	1.7	0.7	1.5
Netherlands	0.5	2.4	-	-
Sweden	0.4	13.4	0.4	1.3
Canada	0.6	2.4	0.3	0.7
Japan	0.5	1.0	0.3	0.1
Mean	0.6	3.4	0.4	1.0

Source: Bureau of Labor Statistics, U.S. Department of Labor, and OECD, *National Income Accounts.*

The more disaggregated a view we take, the more likely it is that the latter will dominate. A partial look inside the 'black box' is provided by considering an intermediate division of the sector into major 2-digit industries. The results of such an experiment for U.K. manufacturing are reported in Table 5 and are based on an ongoing study by Louis Dicks-Mireaux. Input prices were measured for each of the major industries (from an input-output breakdown). Factor productivity growth, as defined in equation (3), using separate shares (ϕ) for each industry [see column (1), Table 5], was regressed on share-weighted lagged input price change as well as on the growth of total GDP (a proxy for aggregate demand pressure).

Column (2) of the table gives the measured share of materials and intermediate inputs by industry. It here includes not only purchased inputs from outside manufacturing (as was the case in the earlier aggregate regressions) but also inputs that are internal to the broader manufacturing sector (30 percent on average). The figures in italics indicate the imported part of the material input. Columns (3), (4) and (5) give the estimated coefficients (and standard errors) of the total productivity shift, λ, the elasticity of substitution, σ, and the elasticity of GDP growth, $\dot{v}$; of the two regressions in each industry, (a) excludes and (b) includes $\dot{v}$.

The regressions by and large confirm the results for the aggregate sector. For 10 out of 14 industries the substitution term [column (4)] is negative and in most cases highly significant. In only one industry (order 8, instrument engineering) is the coefficient significantly positive and in the remaining three (orders 7, 12, 14-15) it is zero or positive but not significant. It should be noted that in these four industries the share of the import component is very low (10 percent or less). Except for food (order 3) the estimated elasticity of substitution ranges from 0.25 to 0.56--the average for the ten industries is 0.39 in the (a) regressions and 0.27 in the (b) regressions. Inclusion of total GDP growth takes away some of the indirect effect of raw-material prices, as we saw in the aggregate regression. At this level of disaggregation the substitution effect, or whatever phenomenon this variable measures, is obviously significant in explaining productivity slowdown by industry.

Similar results have also been obtained in an ongoing study based on Israeli data by M. Bar-Nathan of the Bank of Israel. He obtains significant negative coefficients for $\dot{\pi}_n$ in 10 out of 17 major industries with all other industries showing nonsignificant coefficients. The estimated average σ of 0.6 is somewhat higher than in the United Kingdom, but his regressions did not include aggregate GDP, only average hours worked (as a proxy for demand).

We conclude this section with a comment on the input substitution hypothesis and the relevance of alternative theories. In this study we have treated gross capital stock as a homogeneous input over time. It may be argued that one result of a rise in energy prices may be that pre-1973 capital becomes obsolete. In this case our measure of average factor productivity would be biased. A useful alternative approach (recently started by Baily, 1981) would be to measure the change in capital stock and productivity in a way that takes this factor explicitly into account.

Which of these alternative views of the role of energy and materials in production turns out to be empirically more fruitful must await further study. Both, however, share the position that the productivity slowdown

Table 5. Factor Productivity Regressions for 14 U.K. Manufacturing Industries: circa *1960 to 1980*[a/]

Sector[b/]	Initial year	Measured shares φ (1)	Measured shares β (2)		Estimated parameters λ (3)	Estimated parameters σ (4)	Estimated parameters $\dot{v}$ (5)	Statistics $\bar{R}^2$ (6)	Statistics D.W. (7)
3 Food	1957	0.47	0.76	a	5.25	-0.05		0.13	1.88
			0.20		2.51	0.02			
				b	5.25	-0.04	0.35	0.42	2.09
					0.20	0.02	0.10		
4 Coal and petroleum	1962	0.56	0.58	a	2.39	-0.51		0.42	1.46
			0.47		1.35	0.14			
				b	1.64	-0.30	1.40	0.49	2.02
					1.34	0.17	0.76		
5 Chemicals	1962	0.43	0.58	a	4.06	-0.37		0.49	0.96
			0.17		0.86	0.09			
				b	3.39	-0.18	1.23	0.64	1.95
					0.76	0.10	0.43		
6 Metals manufactures	1965	0.20	0.66	a	-1.06	-0.54		0.07	1.52
			0.22		1.79	0.37			
				b	-0.85	-0.16	2.51	0.53	2.28
					1.27	0.28	0.65		
7 Mechanical engineering	1965	0.29	0.49	a	1.46	0.04		0.07	1.52
			0.05		1.00	0.27			
				b	1.20	0.51	1.55	0.46	1.54
					0.71	0.23	0.41		
8 Instrument engineering	1970	0.23	0.43	a	3.03	0.04		0.67	2.60
			0.08		0.52	0.08			
				b	2.93	0.43	0.34	0.70	2.30
					0.50	0.09	0.24		
9 Electrical engineering	1965	0.24	0.53	a	3.52	-0.25		0.17	1.39
			0.10		0.91	0.12			
				b	3.21	-0.10	0.94	0.32	1.13
					0.84	0.13	0.46		
11 Vehicles	1970	0.13	0.60	a	-0.36	-0.28		0.15	1.62
			0.06		0.90	0.17			
				b	-0.36	-0.29	0.27	0.10	1.86
					0.92	0.18	0.38		

Table 5 (contd). Factor Productivity Regressions for 14 U.K. Manufacturing Industries: circa *1960 to 1980*[a]

	Sector[b]	Initial year	Measured shares			Estimated parameters			Statistics	
			ϕ (1)	β (2)		λ (3)	σ (4)	$\dot{v}$ (5)	$\bar{R}^2$ (6)	D.W. (7)
12	Metal goods n.e.s.	1970	0.25	0.57	a	-1.51	0.02		-0.11	1.22
				0.10		1.33	0.22			
					b	-1.74	0.26	1.28	0.37	2.18
						0.01	0.19	0.46		
13	Textiles	1953	0.29	0.50	a	1.86	-0.49		0.21	1.29
				0.21		0.94	0.17			
					b	1.86	-0.45	0.00	0.17	1.29
						0.96	0.18	0.01		
14-15	Leather and clothing	1965	0.16	0.58	a	2.26	0.06		-0.06	1.35
				0.12		1.00	0.19			
					b	2.03	0.22	1.12	0.27	1.58
						0.84	0.17	0.42		
16	Construction materials	1971	0.22	0.54	a	2.62	-0.56		0.24	1.10
				0.06		1.59	0.29			
					b	2.37	-0.43	1.18	0.53	0.98
						1.26	0.28	0.49		
17	Timber and furniture	1957	0.22	0.52	a	1.83	-0.47		0.26	2.13
				0.29		0.98	0.16			
					b	1.82	-0.45	0.01	0.26	2.15
						0.98	0.16	0.01		
18	Paper and printing	1957	0.31	0.59	a	1.12	-0.34		0.19	1.84
				0.17		0.78	0.14			
					b	1.12	-0.34	0.00	0.17	1.86
						0.78	0.14	0.01		

[a] Small numerals are standard errors. Figures in italics in column (2) represent shares of imported inputs.

[b] The numbering of sectors corresponds to SIC orders. Orders 10 (shipbuilding) and 19 (miscellaneous) were omitted, 14 and 15 combined.

Source: Based on detailed data compiled by Louis Dicks-Mireaux from miscellaneous CSO publications.

in manufacturing must somehow be related to the input price shocks of the 1970s.

II. PRODUCTIVITY COMPARISONS FOR THE AGGREGATE BUSINESS SECTOR

We now turn to a more aggregative view of the total business sector. While manufacturing and its subsectors are heavy users of raw materials, the same cannot be said of most of the nonmanufacturing sectors and yet the productivity slowdown in the economy as a whole seems, if anything, to have been more marked than in manufacturing. To what extent can any of the arguments advanced above also be applied to the broader economy?

If we consider the economy as an aggregate productive framework, this time employing labour and capital in conjunction with total imports, there would be some analogy with our previous discussion. An increase in relative import prices would cause substitution against imports, and aggregate gross output (measured in some suitable form, per unit of the two other factors) would grow more slowly. There are some important differences here, however. First of all, unlike in the case of manufacturing, there is no need to resort to a gross output measure (the analogue would presumably be total real use of resources). Both the quantity and the price of total imports are directly measurable so that one could, at least in principle, attempt to construct a real GDP index which is free of import price bias, and relate it to the inputs of labour and capital. Any remaining effect of an increase in real import prices on an unbiased factor-productivity measure could then only be the result of misallocation of factors caused by the real shock or it's interaction with depressed aggregate demand or the increase in output variability, arguments that would apply equally well outside the manufacturing sector.

However, this would not, strictly speaking, be the same as the input-substitution argument (part of the fall in demand is itself a reflection of a terms-of-trade effect on real income--see below).

In trying to search for a test of these ideas our point of departure is a recent study by Kendrick (1981). In this study the productivity slowdown from 1960-73 to 1974-79 in nine OECD countries (the ten used here excluding the Netherlands) is analysed in terms of the aggregate GDP of the business sector and its average factor (labour and capital) use. With minor modifications, columns (1) to (3) of Table 6 replicate Kendrick's data. Column (4) shows an average factor-productivity slowdown which, on the face of it, looks more marked than in manufacturing [cf. column (4) of Table 1], and is particularly high for Italy and Japan (the figures are otherwise quite similar). Kendrick applied a Denison-type growth-accounting approach to the component analysis of this change. Other than the conventional changes in labour quality and technical knowledge, the main factors that account for the slowdown (Kendrick, 1981, p. 141, Table 7) are reallocation of labour, economies of scale, capacity utilization, and government regulations. Together these items account, in his analysis, for 1.5 points out of an average 2.4 percent slowdown in factor productivity.

While the problem of oil and raw-material prices is mentioned in Kendrick's discussion, no attempt is made to measure its contribution. Government regulations is the only item that could be associated with an increase in the cost of materials but it only amounts to 0.4 points of the 1.5 mentioned. The other three factors could be associated with the demand squeeze argument (or the interaction between the demand squeeze and the real shock).

Table 6. Selected Data on Average Growth in the Business Sector, Nine OECD Countries: Change in Annual Percentage Growth Rate from 1960-73 to 1974-79

	GDP[a/]	Labour[a/]	Capital[a/]	Factor productivity[b/]	Measurement bias[c/]	Relative import prices[d/]	Relative import share[e/]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
United States	-1.5	0.5	-1.4	-1.3	0.4	8.2	0.09
United Kingdom	-2.4	-0.5	-0.5	-1.9	0.8	5.5	0.28
Belgium	-3.2	-1.5	-1.7	-1.6	0.6	-3.3	0.58
France	-2.6	-0.9	-0.8	-1.7	0.4	0.1	0.18
Germany	-2.4	-0.9	-2.0	-1.1	0.1	-2.1	0.10
Italy	-3.0	3.2	-0.9	-4.8	0.0	14.1	0.23
Sweden	-4.1	-0.8	-0.7	-3.3	0.2	4.2	0.29
Canada	-2.6	0.6	0.1	-3.0	0.9	4.0	0.26
Japan	-6.6	-0.5	-4.5	-4.7	0.9	6.6	0.12
Mean	-3.2	-0.1	-1.4	-2.6	0.5	4.1	0.24

a/ Kendrick's (1981) estimates, based on OECD data at 1975 prices.

b/ The share of capital weighted at 0.35.

c/ The difference in incremental growth between GDP measured on a Divisia index basis and GDP at 1975 prices.

d/ The change in growth rates of import prices relative to GDP.

e/ Average ratio of imports to GDP during 1974-79.

In trying to apply our framework to the data the first point to be made relates to the problem of GDP measurement. The OECD data on which Kendrick's analysis is based measure GDP at constant 1975 prices, using a conventional double deflation procedure. I have shown elsewhere (Bruno, 1981) that double deflation may cause a systematic bias when import prices change monotonically in either direction. Specifically, in this case, one would expect to get an upward bias in the GDP growth measure relative to a Divisia index for the earlier years in which there was a consistent fall in relative import/GDP prices. For the period 1974-79, using an intra-period (1975) base could work either way.

GDP was re-estimated using a moving weight Divisia index. There was an average upward bias of 0.31 percent for 1960-73 and an average downward bias in GDP growth of 0.16 percent for 1973-79. The total bias over the two periods thus amounts to 0.47 percent, which is quite sizable, relative to the average deceleration in factor productivity. For some countries (e.g., the United Kingdom) the relative importance of the bias is even greater [see column (5), Table 6]. Part of the deceleration then, is nothing but a statistical artifact directly associated with a shift from a period of falling relative import prices to a period of rising ones! [This problem was mentioned in an OECD document (1980) but not really followed through to its logical conclusion. Note that moving from a 1970 to a 1975 base does not resolve it.]

Once we correct for the measurement bias we can proceed to look at the relationship between the modified factor-productivity figures and the relevant supply and demand variables. The first regression in Table 7 relates 18 average growth-rate observations (nine countries for two periods) to the share-weighted rate of change of import prices relative

Table 7. Selected Regressions of Productivity Growth[a] in the Business Sector: Nine OECD Countries, I 1960-73 and II 1974-79

	Constant	Relative import prices $(\dot{p}_m - \dot{p}_v)$	Public consumption $(\dot{g})$	Total domestic absorption $(\dot{a})$	Interaction $(\dot{p}_m - \dot{p}_v)\dot{a}$	$\bar{R}^2$	SE
Growth levels (I and II); 18 observations							
1	2.28	-0.76				0.30	1.34
	0.32	0.27					
2	-0.33	-0.40	0.72			0.56	1.06
	0.85	0.24	0.22				
3[b]	0.15	-0.60		0.57		0.75	0.79
	0.49	0.28		0.12			
4[b]	0.11			0.54	-0.18	0.81	0.70
	0.43			0.11	0.08		
Growth increment (II - I); 9 observations							
5	-1.79	-0.63				0.33	1.18
	0.42	0.28					
6	-0.53	-0.53		0.48		0.60	0.92
	0.62	0.23		0.20			
7	0	-0.53		0.63		0.61[c]	0.90
		0.22		0.11			
8	0	-0.71	0.96			0.07[c]	1.39
		0.33	0.29				
9	0			0.66	-0.23	0.57	0.92
				0.15	0.11		

[a] Average productivity growth corrected for measurement bias.

[b] Estimated by two-stage least squares with $\dot{g}$ and $(\dot{p}^*_m - \dot{p}^*_x)$ as instruments.

[c] $\bar{R}^2$ relative to $y = 0$, $\bar{R}^2 = 0.89$, 0.73 in lines 7 and 8 respectively.

to the Divisia index of GDP prices (consistent with the quantity measure employed above). [Only the acceleration (or deceleration) of import prices is given in column (6) of Table 6; column (7) shows the average relative M/V share for the second period.] Adding a demand variable ($\dot{g}$ or $\dot{a}$), as is done in regressions 2 and 3, does not remove the effect of import prices even though the underlying GDP quantity measure should, in principle, be free of the direct effect of relative import prices. Moreover, whatever effect import prices had on real income should have been neutralized by the inclusion of the domestic absorption variable (a two-stage procedure was employed in regressions 3 and 4). The alternative view that it is only the the interaction of import prices and demand that matters is represented by regression 4, for which the fit is slightly better (including $\dot{p}_m - \dot{p}_v$ separately in this regression adds nothing).

Recalling the argument about the possible endogeneity and reverse causality of the relative-price term these regressions were also run using the relative import/U.S. export price $(\dot{p}_m^* - \dot{p}_x^*)$, which is free of real exchange-rate effects, and obtained similar, though less significant results (there is less intercountry variation in this index). It might also be objected that the sample is too small. Unfortunately, no capital-stock data are available for other OECD countries. However, little is lost by regressing labour productivity rather than factor productivity on these variables. When we extend the sample to include 19 OECD countries, the 38-observation regression of $\dot{v} - \dot{\ell}$ gives (with γ denoting weights):

$$\dot{v} - \dot{\ell} = \underset{1.02}{2.24} - \underset{0.38}{0.71}(\dot{p}_m^* - \dot{p}_x^*)\gamma + \underset{0.21}{0.44}\dot{g} \qquad (\bar{R}^2 = 0.20) .$$

Using $\dot{a}$ instead of $\dot{g}$ in this regression gives an elasticity of 1.00 (±0.14) with $\bar{R}^2 = 0.63$, but the coefficient of $(\dot{p}_m^* - \dot{p}_x^*)\gamma$ becomes positive and nonsignificant. Since $\dot{a}$ is highly negatively correlated (-0.645) with the price factor (which $\dot{g}$ is not) this may be a reflection of the fact that all of the terms-of-trade effect is already captured by the absorption variable, while $\dot{g}$ represents a more independent demand pull variable.

Regressions 5 to 9 present results, using the same price variable, in terms of incremental growth, for which internal correlation between the explanatory variables is much smaller. The last three regressions again force a zero constant (in regression 2 it is not significant once $\dot{a}$ is introduced). An analogous regression with $(\dot{p}_m^* - \dot{p}_x^*)\gamma$ gives very similar results, again less significant.

Table 8 presents the breakdown by components and the residuals for regression 7. The net role of import prices is here much smaller than for the manufacturing sector by itself, with the demand factor taking a much larger share. Similar results are obtained for the alternative regression 8. Sweden is an outlier and so are Belgium and Italy. The large increase in output variability shown in columns (3) and (4) of Table 4 may be part of the explanation for Belgium and Sweden (in both countries real wages were also quite rigid).

This discussion shows that the basic argument about the role of the supply shock and the demand response also applies with some modification to the aggregate private sector. By implication one would expect to find that in non-manufacturing, less material-intensive, sectors (such as services) it is mainly the demand squeeze that accounts for the slowdown. Some evidence is provided by looking at such partial data as there are for the service sector in these economies. The growth of GDP per employed person $(\dot{v}_s - \dot{\ell}_s)$ in the nine OECD countries and the two periods (data

Table 8. Components of Productivity Slowdown in the Business Sector: 1960-73 to 1974-79

(percent)

	Factor productivity slowdown a/	*Of which:* Import prices	Demand slowdown	Unexplained residual
United States	-0.9	-0.4	-1.0	0.5
United Kingdom	-1.1	-0.8	-1.3	1.0
Belgium	-1.0	1.2	-1.2	-1.0
France	-1.4	0.1	-1.7	0.2
Germany	-1.0	0.2	-1.3	0.1
Italy	-4.8	-1.6	-2.2	-1.0
Sweden	-3.2	-0.5	-1.3	-1.4
Canada	-2.1	-0.5	-1.3	-0.3
Japan	-3.8	-0.3	-4.3	0.8
Mean	-2.1	-0.3	-1.7	-0.1

a/ Corrected for measurement bias [see Table 6, column (4)].

from OECD, 1980) was regressed on total domestic absorption ($\dot{a}$) and the relative price of imports, using public consumption growth and the terms of trade ($\dot{p}_m^* - \dot{p}_x^*$) as instruments. This gives

$$\dot{v}_s - \dot{\ell}_s = \underset{0.59}{-0.75} + \underset{0.34}{0.01}(\dot{p}_m - \dot{p}_v) + \underset{0.15}{0.79}\dot{a} \qquad (\bar{R}^2 = 0.70).$$

The disappearance of the import price variable from this regression (it does appear highly significant in a regression in which $\dot{g}$ replaces $\dot{a}$) suggests very clearly that here it is only demand that matters directly. The latter is in turn affected by government fiscal policy as well as by the terms of trade (the elasticity with respect to each is about 1).

We now have further evidence to support the claim that the intensity of material-input use in a sector must have had something to do with the effect of the rise in material-input prices on productivity. Manufacturing industries were heavily affected, services apparently not. We can now go back to the earlier part of the discussion and ask--when one aggregates across sectors, some of which were directly hit by input prices and some of which were not, how would one expect the aggregate economy to behave? On the face of it, we have corrected for the import price bias, and any internal relative price changes should wash out in aggregate GDP as well as in the factor input and productivity measures, provided there is full factor mobility between sectors. If, however, these assumptions do not hold, e.g., if factors do not reallocate freely, then a shock to any one sector may also show in the aggregate. This argument can be made more precise.

Suppose the economy consists of several sectors producing a total GNP, V, which is broken down into $V_0 = V_0(K_0, L_0)$, a reference sector in which no disturbance occurs, and $V_i = V_i(K_i, L_i, T_i)$ $(i = 1,2,\ldots,n)$ representing the other sectors. K_i and L_i are the respective factor inputs, and T_i are exogenous shift terms (technology, material input prices, etc.). Denoting relative output prices (in terms of V_0 as numeraire) by P_i, we have

$$V = V_0(K_0, L_0) + \Sigma P_i V_i(K_i, L_i, T_i) \ . \tag{4}$$

For changes we get

$$\begin{aligned}\Delta V = {} & (\partial V_0/\partial K_0)\Delta K_0 + \Sigma P_i(\partial V_i/\partial K_i)\Delta K_i \\ & + (\partial V_0/\partial L_0)\Delta L_0 + \Sigma P_i(\partial V_i/\partial L_i)\Delta L_i \\ & \qquad + \Sigma(\partial V_i/\partial T_i)\Delta T_i \ .\end{aligned} \tag{5}$$

Denote $\sum_{i=0}^{n} K_i = K$, $\sum_{i=0}^{n} L_i = L$, $\partial V_0/\partial K_0 = R$, $\partial V_0/\partial L_0 = W$, and $RK/V = \phi$, $\Delta V/V = \dot{v}$. After some manipulation we can rewrite (5) in the form

$$\begin{aligned}\dot{v} - [\phi\dot{k} + (1 - \phi)\dot{\ell}] = {} & \Sigma(T_i/V)\dot{t}_i \\ & + \Sigma(K_i/V)(P_i\partial V_i/\partial K_i - R)\dot{k}_i \\ & + \Sigma(L_i/V)(P_i\partial V_i/\partial L_i - W)\dot{\ell}_i \ .\end{aligned} \tag{6}$$

The left-hand side of equation (6) represents aggregate factor productivity as conventionally measured. The right-hand side consists of three terms. The first is the sum of the sectoral shift factors; the other two are terms involving divergences of marginal factor productivities from real factor returns multiplied by the rates of change of factors by sector.

Suppose there is a negative disturbance $(\dot{t}_i < 0)$ in any one sector which is not matched by a positive disturbance in another. There are two ways in which this will not fully translate to the left-hand side of (6). Either V_i and aggregate V may be measured with T_i properly netted out; or factors always reallocate in the 'right' direction, i.e., $\dot{k}_i \gtrless 0$ whenever $P_i \partial V_i / \partial K_i \gtrless R$ (and similarly for $\dot{\ell}_i$). The whole rationale of aggregate productivity measurement rests on the assumption that in the long run and on average marginal products of factors equalize across sectors, so that the last two terms in equation (6) disappear while V, K, and L are measured so that the only T_i disturbances that can appear are of a pure technology kind. In the situation that prevailed in the 1970s, with real shocks, depressed demand, and increased uncertainty, probably none of these conditions held. Because of capital immobility and sluggish labour adjustment there are built-in asymmetries between expanding and contracting sectors which may impart a negative bias to the two divergence terms in (6) (that is, $P_i \partial V_i / \partial K_i < R$ may more often go together with $\dot{k}_i \geq 0$, and similarly for labour). It is also very likely that the overall correction introduced to take account of rising import prices does not properly capture the effect of individual sector input price shifts. (Regression of the measurement bias on $\dot{p}_m - \dot{p}_v$ gives nonsignificant results.) It is perhaps no accident that when we multiply the estimated input price effect in manufacturing [column (2), Table 3] by the average share of the sector in the business economy (1/3, say) we get figures that are for several of the countries quite close to the estimated role of import prices in the aggregate business sector [column (2), Table 8]. It is as if a *ceteris paribus* assumption applied in equation (5) or (6) and $\Delta V = \Delta V_i = (\partial V_i / \partial T_i) \Delta T_i$, where i would stand for the manufacturing sector. But this may, of course, be stretching the argument too far.

Finally we may note that while the intercountry variance of labour-productivity growth stayed as high in the second as in the first period in manufacturing (1.79 compared with 1.77) in the service sector it fell (from 1.36 to 1.11). For the business sector the intercountry variance fell even more (from 1.97 to 1.34). This too may be evidence that manufacturing was hit more directly by the real supply shocks which worked differentially in the industrial countries. The absolute demand squeeze, with one or two exceptions, was more uniform across countries.

III. CONCLUDING REMARKS

Can one try to attach a consistent story to these international comparisons of productivity slowdown? While for some countries there may already have been signs of deceleration in productivity growth by the end of the 1960s (a point made for the United States by Denison, 1979, Nordhaus, 1982, and others), it seems that the dominant role was played by the commodity-price shock of the early 1970s. Until then raw-material and energy prices were falling in real terms. There was a turning point in 1971-72, the price rise culminating in the great shock of 1973-74. In spite of subsequent fluctuations the earlier low levels were never recovered even for raw materials (at least not by the end of 1981). This price shock affected the material (and energy) input intensive sectors directly. As we have seen, more than half of the slowdown in manufacturing can be ascribed to this direct effect. Two secondary effects played a role on the demand side. The terms-of-trade effect on the income of net importers, the investment squeeze, and the induced contractionary fiscal (and monetary) measures have generally kept economic activity growing much more slowly since 1973. The major industrial countries, in particular the United States, the United Kingdom, and Japan, adopted contractionary policies for fear of excessive inflation and current-account deficits. The depressed domestic demand (which, in turn, interacts with export demand) has impeded the internal relative price and factor adjustment process necessitated by these supply shocks. When seen in this light, the observed productivity slowdown is thus directly linked to the choice of short-term and medium-term macro-economic response strategy.

In this context one may refer to another structural factor that is sometimes proposed as a possible culprit--the import and export competition from the newly industrialized countries (NICs). The rapid development of the NICs is not a new phenomenon of the 1970s--it started in the 1960s and even before that--yet it was not a special issue during the rapid growth phase. Why would it cause more problems in the 1970s? The answer, which is related to our earlier discussion, seems to be that in a rapidly growing economy it is much easier to adjust to external competitive shocks because there is excess demand and factors will easily move into more productive activities with less risk of unemployment. At a time of general slack, on the other hand, the system tends to freeze into old modes of operation and fear of unemployment causes retrenchment, excessive subsidization of ailing industries, and the like. This links up with our present topic only in the sense that it would probably be wrong to ascribe a separate role to external competition as an explanatory factor in the productivity story. Rather, it is the generally depressed internal economic conditions that tend to impede adjustment to both types of external shock and thus show up in the form of reduced productivity growth.

The NICs and the much broader group of middle-income developing countries (MICs) can be brought into the story to play another role. They provide an exception to the characterization of OECD response which may at the same time strengthen the argument. Faced with the same exogenous input price shocks these economies, and in particular their manufacturing sectors, performed quite well in the 1970s in terms of output and general economic activity, while most OECD countries did miserably in this respect. Part of the answer, which is not directly relevant here, has to do with the emergence of an international private capital market to which many of the NICs had access and for a time could borrow heavily at zero or negative real interest rates (I discuss this in another paper, 1982). The other side, more relevant to our present discussion, is that these countries have by and large been pursuing highly expansionary domestic policies. As the recent World Development Report (1981; p. 140, Table 4) shows, domestic absorption in the group of 60 middle-income countries grew at least as fast in the 1970s as in the previous decade. The cost of choosing the expansionary option was much higher inflation and larger current-account deficits (which were themselves required to effect the resource transfer from OPEC). But it showed up in continued rapid growth in both output and labour productivity. (There are unfortunately no data on total factor productivity.) The data show a more expansionary response of the MICs after 1973, yet a close association between output and labour productivity in all countries. There is little doubt that the more expansionary internal policies (and smaller output variability) of the MICs have a lot do so with the difference in economic performance. Paradoxically, it is likely that the relative success of the MICs would not have been possible if the OECD countries had also followed a more expansionary policy, since competition for the OPEC surplus would have made this a much more costly option to pursue (by 1980-81 real interest rates had indeed risen). But for the present purpose this example illustrates that productivity and macro-economic response are closely linked.

Finally, if the view of the sources of the productivity slowdown in the OECD countries advocated here is correct, it also follows that this phenomenon is only as transitory or as permanent as the macro-economic climate of the world economy. If input price shocks continue to hit the world economy frequently, but at uncertain intervals, and if cost-induced inflationary waves are going to be followed by contractionary demand policies in the leading industrial countries, then there is no reason to consider the slowdown as transitory. If, on the other hand, the system were to find an efficient way of smoothing the fluctuations in real input prices (e.g., by commodity agreements, buffer stocks, or the break-up of cartels) and of better co-ordinating economic activity and monetary policies across national frontiers, then one of the major sources of the slowdown will be removed. The best bet probably lies with neither of the two extremes. There may be some learning and adaptation to the new environment which would allow pursuit of reasonable inflation rates without the enormous cost in unemployment that has been paid in recent years. The upshot of the present discussion is that in this case aggregate productivity growth in the industrial countries might improve along with the hoped-for improvement in overall macro-economic performance.

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