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## Rising oil prices and industrial production in some developing countries in the seventies

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# Kieler Arbeitspapiere

# Kiel Working Papers

Working Paper No. 190

Rising Oil Prices and Industrial Production  
in Some Developing Countries  
in the Seventies\*

by

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## Introduction\*

According to a widespread view, industrialization prospects of non-oil developing countries (NOPECs)<sup>1</sup> have been seriously affected by the drastic rise in oil prices during the last decade<sup>2</sup>. It is pointed out that the share of fuels in total imports doubled within two years to more than 17 percent (1974) and that higher oil import bills contributed considerably to enlarged balance of payments deficits. Apart from some already advanced NOPECs, whose favourable credit standing in international capital markets allowed them to finance their deficits, many Third World countries were faced with the situation where equilibrium in external trade had to be restored by cutting imports. This seemed all the more necessary as the demand of developed countries for NOPEC-exports slackened because of a cyclical slow-down and intensified protectionist pressures<sup>3</sup>. Especially those NOPECs which traditionally had restricted imports of consumer goods were now forced to reduce the foreign supply of intermediates and capital goods, actually urgently needed for carrying out their industrialization programs.

Nonetheless, although NOPECs were confronted with quadrupling oil prices and other external shocks, the average annual growth rate after the oil shock of 1973/74 remained at about 5 percent for the group as a whole; this was hardly 1 percentage point less the increase in real gross domestic product experienced in the late sixties and early seventies<sup>4</sup>. Given this constella-

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\*Juergen B. Donges und Dean Spinanger provided helpful comments on an earlier draft.

<sup>1</sup> The group of NOPECs includes all net oil importing developing countries and those Third World economies whose oil exports constitute only a minor share in their external trade.

<sup>2</sup> Following the first oil price shock of 1973/74, which is the topic of this paper, NOPECs have been hit once again by the second rise in oil prices in 1979/80. Since the period to analyse the second oil shock is still rather short and because of data limitations, we confine ourselves to a short qualification in the concluding remarks.

<sup>3</sup> See Balassa (1981a); Agarwal, Glismann, Nunnenkamp (1983).

<sup>4</sup> By contrast, the average GDP increase of 2.5 percent for industrial countries after 1973 was only half the growth rate in 1967-73.

tion, an empirical evaluation of the hypothesis that the oil price rise has had a significantly negative impact on industrial production of NOPECs in the seventies would seem to be fitting. In the following it is attempted to separate longer-term effects from an oil price induced once-and-for-all loss in industrial production applying time series analysis for 7 NOPECs. Different production functions are estimated for the industrial sectors of Brazil, Chile, Colombia, the Philippines, Singapore, South Korea and Tunisia. Compared with many other NOPECs this sample mainly consists of countries characterized by relatively high levels of industrialization and overall development; their economies thus might be especially sensitive to the oil price shock. On the other hand, quite different economies are analysed, for example with respect to the degree of dependency on energy imports (ranging from net energy exporters like Colombia and Tunisia to fully import dependent economies) and trade policies pursued (Table 1); this may allow us to identify some factors which may determine the effects of the oil price rise on industrial production.

#### Measuring oil price effects

Similar to other studies concerned with the economic situation of developed countries after the oil shock of 1973/74 this paper applies production function analysis and isolates the oil price effect on industrial production in the above mentioned 7 NOPECs<sup>1</sup>. Using time series data generally ranging from 1962 to 1979 the basic regression (I) run reads as:

$$\ln V = A + \alpha \ln L + \beta \ln C + \delta \ln EP$$

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<sup>1</sup> See for example Tatom (1981); Rasche, Tatom (1981); Cooper (1980).

Table 1 - Some Economic Indicators of 7 Developing Countries

	Brazil	Chile	Colombia	Philippines	Singapore	South Korea	Tunisia
Degree of dependency on energy imports (percent) <sup>a</sup>	81.0	46.0	-31.6	100.0	100.0	65.3	-154.9
Share of oil imports in total exports (percent) <sup>b</sup>	15.9	5.5	0.4 <sup>c</sup>	12.7	18.1	9.2	10.1
Increase in the share of oil imports in total exports (percent) <sup>d</sup>	186.7	195.1	1421.6	150.3	72.5	145.9	90.0
Per-capita-income (US-\$) <sup>e</sup>	1030	990	580	380	2450	560	730
Share of mining and manufacturing in gross domestic product (percent) <sup>b</sup>	29.8	35.1	20.7	27.3	23.5	22.5	16.0
Share of exports in gross domestic product (percent) <sup>b</sup>	8.1	12.8	14.9	22.2	117.3	29.9	25.8
Share of manufactured exports in total exports (percent) <sup>b,f</sup>	19.6	3.6	26.1	12.1	44.3	84.3	21.8

<sup>a</sup> Share of net imports of commercial energy in total domestic consumption of commercial energy in 1973. A negative sign indicates net energy exporting countries. - <sup>b</sup> In 1973. - <sup>c</sup> Imports of SITC 332 (petroleum products) only. - <sup>d</sup> In the period 1973-79. - <sup>e</sup> In 1975. - <sup>f</sup> Share of exports of SITC 5-8 (minus SITC 68) in total exports.

Sources: UN, World Energy Supplies, New York, var. iss. - UN, Yearbook of International Trade Statistics, New York, var. iss. - World Bank, World Bank Atlas 1977, Washington, D.C., 1977. - World Bank, World Tables, The Second Edition (1980), Washington, D.C., 1980.

where

- V = Value added of manufacturing industry at constant prices;
- L = Average number of persons engaged in manufacturing industry;
- C = Quantity of electricity consumed in manufacturing industry as a proxy for capital inputs<sup>1</sup>;
- EP = Relative price of oil (1973 = 100)<sup>2</sup>.

The coefficients  $\alpha$  and  $\beta$  represent partial output elasticities of labour and capital respectively;  $\delta$  denotes the percentage change in V if the relative price of oil changes by one percent. According to the above stated hypothesis a significantly negative value of  $\delta$  is to be expected because of rising oil prices in the seventies.

Supplementary equation types II, III and IV are estimated:

- In type II, a time trend (T) is added to the production function of type I allowing for long-term developments in industrial production.
- Equation type III reads as:

$$\ln V = A + \gamma D + \alpha \ln L + \beta \ln C + \delta \ln EP;$$

D stands for a dummy-variable which takes the value "0" for the period 1962-73 and "1" for the years after the oil price shock; by this it is attempted to separate the effect the oil price rise had on the growth rate of industrial production from an once-and-for-all reduction in industry's value added which might have been caused by the sudden increase in oil import bills in 1974; if the last mentioned effect is neglected - as in equation types I and II - the longer-term impact of the oil

<sup>1</sup>This, for sure, is not the best way of measuring capital inputs: It may be that the amount of electricity consumed per unit of capital declined with rising oil prices; in this case the actual input of capital will be higher than reported by C. Nevertheless, lacking time series data on capital stocks and assuming that electricity and capital are rather complementary inputs, it seemed to be a second-best approach.

<sup>2</sup>Nominal prices of oil in national currencies were deflated by overall consumer price indices.

price variable on industrial performance will probably be overestimated.

- Type IV combines both modifications, the inclusion of a time trend and the dummy-variable.

Two problems of this approach of measuring oil price effects on industrial production are evident. Firstly, it has to be considered that elasticities estimated in equations I -IV reflect the impact of marginal changes in independent variables on industrial production.

In case of drastic changes coefficients may differ from estimated values and can no longer be used for calculating exactly the quantitative impact on value-added in the country's industry. For the oil price variable such a drastic jump took place in 1973/74 when relative oil prices on an average nearly tripled. So the coefficient  $\delta$  should be regarded as indicating the tendency of oil price induced influences on industrial production rather than the exact quantitative impact of the oil price shock of 1973/74. This does not exclude comparing the effects rising oil prices have had on industrial performance in different countries, especially in cases of equation types III and IV where the inclusion of the dummy-variable will reduce distortions in elasticities at least to a great extent.

Secondly, only the direct impact will be assessed by production function analysis (indicated by  $\delta$ ). Additionally, energy prices might have caused indirect effects, for example, if they have given rise to an intensified substitution between different factors of production. Energy and capital being rather complementary inputs, industrial production might have been affected by a slackening capital formation. On the other hand, this effect could have been offset by an extended use of labour.



In the following, the impact of this kind of oil price induced adjustment process on industrial production is left out of account. To what extent results will be affected by this depends not only on the degree of indirect effects but also on the space of time they need to become effective. If adjustment will take a rather long time, results won't be distorted significantly. To check this, the following two regressions are run for each of the seven developing countries regarded:

$$\ln C = a_0 + a_1 \ln V + a_2 \ln EP$$

$$\ln L = b_0 + b_1 \ln V + b_2 \ln EP$$

Negative indirect effects of rising oil prices on industrial production in the seventies are most likely to expect if coefficients  $a_2$  and  $b_2$  are significantly negative; offsetting influences will be indicated by positive-signed coefficients  $a_2$  or  $b_2$ .

### Empirical results

Examining first regression type I, results vary widely between the 7 NOPECs analysed (Table 2): For only two countries, Brazil and the Philippines, the hypothesis of a significantly negative impact of rising oil prices on industrial production is supported at the 5 percent level of confidence. Both economies are characterized by a high degree of dependency on energy imports going along with high shares of oil imports in total exports and sharp increases in these shares after the oil price shock of 1973/74 (see Table 1). In addition, world market orientation was rather weak<sup>1</sup>. The

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<sup>1</sup>In addition to indicators of Table 1 see Balassa (1981b).

Table 2 - Production Function Estimates for 7 Developing Countries

Country	Period of estimation	Type of equation	A	D	lnL	lnC	lnEP	T	R <sup>2</sup>	Number of observations
Brazil	1962 - 1979	I	1.08		0.175 <sup>+</sup> (1.47)	0.901 <sup>****</sup> (15.96)	-0.065 <sup>*</sup> (-1.93)		0.99	18
		II	0.84		0.193 <sup>+</sup> (1.40)	0.862 <sup>****</sup> (5.73)	-0.067 <sup>**</sup> (-1.89)	-0.003 (0.29)	0.99	18
		III	1.02	-0.110 <sup>+</sup> (-1.27)	0.121 (0.97)	0.927 <sup>****</sup> (15.77)	0.031 (0.38)		0.99	18
		IV	1.01	-0.110 (-1.19)	0.122 (0.82)	0.925 <sup>****</sup> (5.88)	0.031 (0.34)	0.000 (0.00)	0.99	18
Chile	1962 - 1978	I	-2.93		0.871 <sup>+</sup> (1.47)	0.423 <sup>****</sup> (2.14)	-0.043 <sup>+</sup> (-1.27)		0.35	17
		II	-2.11		0.823 <sup>***</sup> (2.20)	0.114 (0.80)	-0.170 <sup>****</sup> (-4.85)	0.035 <sup>****</sup> (4.56)	0.74	17
		III	-2.54	-0.383 <sup>+</sup> (-1.32)	0.702 (1.19)	0.399 <sup>**</sup> (2.06)	0.133 (0.97)		0.38	17
		IV	-2.16	0.101 (0.44)	0.864 <sup>****</sup> (2.17)	0.102 (0.68)	-0.224 <sup>**</sup> (-1.74)	0.037 <sup>****</sup> (3.96)	0.72	17
Colombia	1962 - 1978	I	-4.29		0.714 <sup>**</sup> (1.74)	0.669 <sup>****</sup> (6.05)	-0.028 (-0.68)		0.99	17
		II	-2.59		0.693 <sup>****</sup> (3.66)	0.080 (0.81)	-0.039 <sup>**</sup> (-2.06)	0.045 <sup>****</sup> (6.98)	0.99	17
		III	-4.34	-0.146 <sup>+</sup> (-1.62)	0.701 <sup>**</sup> (1.82)	0.616 <sup>****</sup> (5.64)	0.098 (1.13)		0.99	17
		IV	-2.70	-0.110 <sup>****</sup> (-3.41)	0.684 <sup>****</sup> (4.95)	0.066 (0.91)	0.056 <sup>**</sup> (1.81)	0.043 <sup>****</sup> (9.10)	0.99	17
Philippines	1962 - 1979	I	-0.87		0.705 <sup>****</sup> (3.52)	0.367 <sup>****</sup> (3.60)	-0.215 <sup>****</sup> (-2.93)		0.95	18
		II	0.19		0.006 (0.00)	0.242 <sup>**</sup> (1.92)	-0.164 <sup>***</sup> (-2.13)	0.042 <sup>+</sup> (1.56)	0.96	18
		III	-1.71	-0.354 <sup>****</sup> (-2.23)	0.803 <sup>****</sup> (4.41)	0.225 <sup>**</sup> (2.04)	0.145 (0.83)		0.96	18
		IV	-0.87	-0.303 <sup>**</sup> (-1.85)	0.312 (0.65)	0.160 <sup>+</sup> (1.29)	0.128 (0.74)	0.029 (1.11)	0.96	18
Singapore	1962 - 1979	I	-2.29		0.435 <sup>***</sup> (2.81)	0.280 <sup>***</sup> (2.70)	0.104 <sup>****</sup> (2.94)		0.99	18
		II	-3.02		0.392 <sup>****</sup> (2.73)	0.199 <sup>**</sup> (1.92)	-0.034 (-0.70)	0.028 <sup>**</sup> (1.91)	0.99	18
		III	-2.97	-0.236 <sup>+</sup> (-1.41)	0.377 <sup>****</sup> (2.43)	0.309 <sup>****</sup> (3.01)	0.329 <sup>**</sup> (2.01)		0.99	18
		IV	-3.15	-0.088 (-0.43)	0.378 <sup>****</sup> (2.49)	0.224 <sup>**</sup> (1.85)	0.130 (0.57)	0.023 <sup>+</sup> (1.24)	0.99	18
South Korea	1962 - 1979	I	-6.51		1.338 <sup>****</sup> (2.42)	0.139 (0.39)	0.187 <sup>**</sup> (1.75)		0.98	18
		II	-8.63		0.194 (1.15)	0.088 (0.33)	0.115 <sup>+</sup> (1.38)	0.146 <sup>****</sup> (3.45)	0.99	18
		III	-6.44	0.237 (0.69)	1.473 <sup>****</sup> (2.47)	0.043 (0.11)	-0.004 (-0.00)		0.98	18
		IV	-8.73	0.440 <sup>**</sup> (1.85)	0.324 (0.66)	-0.095 (-0.36)	-0.248 (-1.18)	0.162 <sup>****</sup> (4.07)	0.99	18
Tunisia	1963 - 1978	I	2.47		0.350 <sup>****</sup> (3.25)	0.257 <sup>****</sup> (4.80)	-0.053 <sup>+</sup> (-1.32)		0.97	16
		II	2.96		-0.065 (-0.54)	-0.001 (-0.00)	0.005 (0.18)	0.060 <sup>****</sup> (4.28)	0.99	16
		III	2.50	0.012 (0.04)	0.352 <sup>****</sup> (3.03)	0.258 <sup>****</sup> (4.59)	-0.063 (-0.29)		0.97	16
		IV	2.68	-0.106 (-0.66)	-0.089 (-0.69)	-0.009 (-0.13)	0.098 (0.68)	0.062 <sup>****</sup> (4.22)	0.99	16

For specification of variables see the text. The numbers in parentheses beneath the regression coefficients are the t-values: \*\*\*\* indicates significance at the 0.5 percent level; \*\*\* 2.5 percent level; \*\* 5 percent level; + 12.5 percent level (one-tailed t-test).

adjustment process of national industries to higher energy costs might have been hampered because of a relatively bad export performance for manufactured goods; although both economies were already well advanced in terms of industrialization levels reached, neither Brazil nor the Philippines were able to enlarge their world export market shares after the oil price shock compared to the early seventies.

In a second country group the oil price induced effects were either weak (Chile, Tunisia) - both in terms of the value of the oil price coefficient and its level of significance - or even insignificant (Colombia). For Colombia and Tunisia this may largely be the consequence of both countries being net energy exporters. Although exported shares of domestically produced commercial energy declined in both cases after 1973<sup>1</sup>, self-sufficiency in energy protected them from being hit by OPEC-caused external shocks; on the other hand, Colombian and Tunisian oil exports were too low to participate themselves in the oil price boom to a considerable extent<sup>2</sup>. Among the 5 net importers of energy Chile was the only country where domestic supply contributed to more than 50 percent to national consumption of commercial energy throughout the seventies. Merely a small part of exports was necessary to pay for oil import bills. Furthermore, the adjustment process to higher energy prices might have been supported by an intensified world market orientation of the Chilean economy as indicated by rising shares of exports in gross domestic product which had been achieved although copper prices declined drastically<sup>3</sup>. Starting from an extremely low level (3.6 percent in 1973) the share of manufactured goods in total exports tripled within 3-4 years.

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<sup>1</sup>In 1979, Colombia has become a net importer of commercial energy.

<sup>2</sup>Tunisia, to some extent, could take advantage of the rise in export prices for phosphates which largely was a consequence of the oil price shock.

<sup>3</sup>However, the disadvantageous development in copper prices was the principal factor which caused average world export market shares to decline from 0.3 percent (1970-73) to 0.2 percent (1974-79). In Colombia market shares remained nearly stable comparing averages before and after the oil price shock of 1973/74 whereas Tunisia was successful in strengthening its world market position from 0.07 to 0.1 percent.

While the only small impact of rising oil prices on industrial production could be easily explained in cases of Chile, Colombia and Tunisia by their favourable domestic energy endowments, it is surprising that estimates for Singapore and South Korea point to a rather positive impact. Similar to Brazil and the Philippines, both economies were highly (South Korea) or even fully (Singapore) dependent on energy imports; although considerable differences with respect to per-capita-incomes and shares of industry in gross domestic product existed in the early seventies, at least industrialization levels were roughly comparable for all 4 economies later on<sup>1</sup>. The problem thus remains as to how to explain the contrast in oil price effects on industrial performance in Brazil and the Philippines on the one hand and South Korea and Singapore on the other? Emphasis should be laid on marked differences in economic orientation: Whereas the two first mentioned countries performed an inward-looking development strategy at least in large parts of the period under consideration, both South Korea and Singapore are to be characterized as outward-looking economies, with high shares of exports in gross domestic product and manufactured goods in total exports. Furthermore, South Korea and Singapore were the only countries out of the 7 economies analysed which were successful in raising world market shares considerably<sup>2</sup>. Estimation results of equation type I thus indicate that export orientation provided the most promising adjustment pattern in coping with the external oil price shock, even on the background of a slackening world market demand and increasing protectionist pressures in industrial countries.

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<sup>1</sup> In 1979, the share of industry in gross domestic product reached 38 and 35 percent in Brazil and the Philippines, 39 and 36 percent in South Korea and Singapore; differences in per-capita-income remained somewhat more pronounced (1780 and 600 US-\$ in Brazil and the Philippines; 1480 and 3830 US-\$ in South Korea and Singapore respectively).

<sup>2</sup> On an average, exports of South Korea and Singapore accounted for 0.4 and 0.6 percent in world exports in the period 1970-73; market shares climbed to an average of 0.9 and 0.8 percent respectively in the period 1974-79.

Table 3 - Rank Correlation between Selected Economic Indicators of 7 Developing Countries and the Impact of Rising Oil Prices on Industrial Production<sup>a</sup>

Characteristics	Type of equation:					
	I	II	III	IV		
	Regression coefficient of variable:					
	lnEP	lnEP	lnEP	D	lnEP	D
Degree of dependency on energy imports	-0.12	-0.22	(0.71 <sup>***</sup> )	-0.33	(0.38)	(-0.18)
Share of oil imports in total exports	-0.25	0.07	(0.32)	0.00	(0.57 <sup>**</sup> )	(-0.19)
Increase in the share of oil imports in total exports	-0.21	-0.61 <sup>**</sup>	(0.00)	-0.32	(-0.46)	(-0.28)
Per-capita-income	0.14	-0.07	(0.21)	-0.14	(0.18)	(0.24)
Share of mining and manufacturing in gross domestic product	-0.32	-0.79 <sup>****</sup>	(0.50)	-0.64 <sup>**</sup>	(-0.21)	(0.01)
Share of exports in gross domestic product	0.57 <sup>**</sup>	0.71 <sup>****</sup>	(0.11)	0.29	(0.39)	(0.40)
Share of manufactured exports in total exports	0.79 <sup>****</sup>	0.89 <sup>****</sup>	(-0.21)	0.68 <sup>****</sup>	(0.00)	(0.40)

<sup>a</sup> The Spearman coefficient of rank correlation is significant at the 2.5 percent level if marked by \*\*\*\*; \*\*\* indicates significance at the 5 percent level; \*\* 10 percent level. A negative sign indicates that the value of parameters declines (i.e. a weaker positive impact of the oil price rise and a smaller positive shift dummy or a stronger negative impact of rising oil prices and a greater negative shift dummy) if, for example, the degree of dependency on energy imports increases. The rank correlation coefficients are put in parentheses if regression coefficients of the corresponding equation are insignificant to a great part.

This contention is further substantiated if rank correlations between the value of the oil price coefficient on the one hand and economic indicators of Table 1 on the other are compared (Table 3). Only for both criteria concerned with export performance is the Spearman coefficient significant, indicating a lower negative impact of the oil price rise if the export share in gross domestic product and, especially, if the share of manufactured goods in total exports is high.

Differences in results for Brazil and the Philippines on the one hand and South Korea and Singapore on the other persist if allowance is made for long-term developments in industrial production (see Table 2 for equation type II). However, the positive impact of rising oil prices for the two outward-looking countries is reduced (South Korea) or even disappears (Singapore); world market orientation seems to exert its influence in the long run rather than to be used as a short-term adjustment mechanism to external shocks. Nevertheless, the Spearman coefficients of rank correlation again stress the importance of export orientation in limiting negative oil price induced effects on industrial production. On the other hand, the negative impact of rising oil prices seems to increase if industrialization levels are high and in case of sharp increases in the share of oil imports in total exports (Table 3).

For Chile, Table 2 reports a considerably stronger negative coefficient of EP for equation type II than for the first estimation. Yet, it has to be considered that adding a time trend to the production function may be least adequate in the case of Chile since a dramatic change in economic policy took place during the period of estimation: Efforts in the mid-seventies to liberalize the trading system fundamentally, obviously leading to a far greater world-market-oriented industrialization strategy, may not yet be fully reflected in parameters of equation II, especially in case of the time trend.

Accounting for an once-and-for-all reduction in industrial production caused by the sudden and drastic rise in oil import bills in 1974 (equations III and IV), the hypothesis according to which industrialization efforts of NOPECs would have been seriously affected in the seventies by considerably higher oil prices has to be completely rejected: With the exception of

Chile in case of equation IV - which, according to the above reasoning, is of only minor importance - there is no longer any significantly negative oil price coefficient for the seven NOPECs analysed. Even for Brazil and the Philippines, where estimates of types I and II pointed to especially strong negative influences of the oil price variable, growth of industrial production was not reduced in the longer run; as in most other countries the oil price shock of 1973/74 rather caused an once-and-for-all loss in industry's value added.

The degree of the - usually negative - shift in industrial production, again, seems to depend primarily on the performance of the export sector and the level of industrialization of the economy: If ranks are correlated between coefficients of the dummy-variable in type III and country specific characteristics, the once-and-for-all reduction in industrial production increase with rising shares of mining and manufacturing in gross domestic product and with an increasing concentration on raw material exports; in other words, it is stressed once more that a high share of manufactured goods in total exports seems to have helped adjustment to external disturbances.

Generally speaking the above results also hold if it is considered that higher oil prices - in addition to the direct impact on industrial production - might have caused indirect effects, for example, by giving rise to an intensified substitution between different factors of production. Estimates presented in Table 4 indicate that for 5 out of 7 NOPECs neither the input of capital nor that of labour was negatively affected by rising oil prices; if industrial production is reduced at all in these countries by oil price induced adjustment effects, this process seems to take a rather long time and has not become effective within the seventies. Only in South Korea and -

Table 4 - The Impact of Relative Oil Prices on Capital and Labour Inputs in 7 Developing Countries

Country	Period of estimation	Dependent variable: lnC				Dependent variable: lnL			
		a <sub>0</sub>	ln V	lnEP	R <sup>2</sup>	b <sub>0</sub>	ln V	lnEP	R <sup>2</sup>
Brazil	1962-79	-2.15	1.014**** (36.45)	0.034 <sup>+</sup> (1.61)	0.99	4.94	0.435**** (8.11)	0.231**** (5.62)	0.97
Chile	1962-78	4.05	0.677** (2.83)	0.096**** (3.05)	0.45	4.46	0.191** (2.22)	-0.010 (-0.92)	0.22
Colombia	1962-78	3.12	1.115**** (13.64)	0.013 (0.33)	0.98	3.27	0.276**** (7.12)	0.060**** (3.31)	0.97
Philippines	1962-79	0.47	1.197**** (6.71)	0.532**** (6.70)	0.97	1.49	0.607**** (6.62)	0.098** (2.40)	0.94
Singapore	1962-79	-0.09	1.728**** (28.86)	-0.101 <sup>+</sup> (-1.36)	0.99	5.31	1.161**** (29.30)	-0.147**** (-2.99)	0.99
South Korea	1962-79	-0.57	0.946**** (14.38)	-0.244*** (-2.14)	0.97	4.81	0.613**** (17.22)	-0.063 (-1.02)	0.98
Tunisia	1963-78	-9.97	2.186**** (8.98)	0.188 <sup>+</sup> (1.71)	0.96	1.30	1.038**** (6.87)	0.092 <sup>+</sup> (1.34)	0.93

For specification of variables see the text. The numbers in parentheses beneath the regression coefficients are the t-values: \*\*\*\* indicates significance at the 0.5 percent level; \*\*\* 2.5 percent level; \*\* 5 percent level; + 12.5 percent level (one-tailed t-test).



to a lesser degree - in Singapore is a slow-down in capital formation to be observed because of higher oil prices; in both cases this was not offset by an extended use of labour. Probably, the somewhat surprising results pointing to a positive impact of the oil price rise on industrial production resulted at least to some extent from the neglect of indirect effects. As a whole, however, Table 4 supports the view that negative effects on industrial production are not systematically underestimated by exclusively dealing with the direct effects of rising oil prices.

#### Concluding remarks

Concerned with the seventies, our results indicate that the hypothesis according to which industrialization prospects of non-oil developing countries have been seriously affected by the drastic rise in oil prices of 1973/74 has to be rejected. The growth of industrial production was not reduced significantly for any of the 7 NOPECs analysed; the oil price shock rather caused an once-and-for-all loss in industrial production. Especially the outward looking economies characterized by an already diversified export pattern were successful in limiting the direct negative effects on industrial production; on the other hand, they were the only ones for which industrial production was affected indirectly by oil price induced adjustment patterns. Finally, there are some indications that the impact of rising oil prices increases with the level of industrialization already reached. As the importance of industry in NOPEC-economies will further increase, the influence of relative oil prices may become more distinct in the future, though heavily depending on the patterns of industrialization and, above all, factor intensities chosen.

The relevance of these considerations for the NOPECs is perhaps already becoming evident after the second oil price shock of 1979/80. It seems to be even more difficult than in the last decade to reduce seriously enlarged balance of payments deficits without affecting economic growth: Prospects for expanding exports remain rather gloomy in light of persistently low economic growth rates in developed countries and protectionist pressures gaining further ground. On top of this, a growing number of NOPECs may face balance of payments constraints as they are already heavily indebted in international financial markets and creditors are reluctant to provide new loans. Already in 1981 any number of NOPECs (such as Argentina, Brazil, Ivory Coast and Morocco) experienced a drastic decline in economic growth rates, perhaps indicating that it has become increasingly difficult for non-oil developing countries to adjust their economies to rising oil prices without affecting growth and further industrialization prospects.

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