ABSORPTIVE CAPACITY OF THE PREREVOLUTIONARY IRANIAN ECONOMY

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The impact of oil revenues on the Iranian economy during a given time period can be broken down into several independent elements. The first is the response of the government to changes in oil revenues from the administrative side in identifying and implementing areas for expenditure. The second is the production-inducing effect of these expenditures through linkage and spread effects. A third aspect concerns the production of government oil-derived expenditures as measured by the economy's ability or absorptive capacity to utilize them effectively. In Iran's case, because economic development was the principal vehicle for converting oil resources into a continuing stream of real benefits to the country, the estimation of realistic spending levels or the absorptive capacity for oil revenues was undoubtedly the most important decision undertaken by the government.

It is important to remember the context of the problem. By the 1970s the Iranian government to a large extent was controlling both the rate at which oil was produced (subject to technical constraints) and the price charged for its export. All revenues from the export of oil accrued to the government in the form of foreign exchange. Production from the petroleum reserves was desirable only to the extent that benefits, either monetary or nonmonetary, occurred and were valued by the government. Since the oil reserves were fixed, production and pricing decisions by the government determined a stream of benefits or revenues over a finite period of time. Increased output in the near term implied a decision to forego some oil revenues in the future.

An analysis of Iran's absorptive capacity and the government's role in attempting to alter it throws additional light on several important factors leading up to the economic crisis that preceded the revolution.

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Conceptual Issues

Absorptive capacity has been characterized as an ill-defined concept.[1] To this extent it is like the concept of economic development in that there have been a wide range of definitions. It is possible, however, to compose a definition that is broad enough to accommodate most of the interpretations applied to the concept: prior to the revolution, Iran's absorptive capacity was the ability of the domestic economy to absorb resources at an acceptable rate of return within a given period.

In applying the concept, therefore, two issues must be addressed: (1) the nature of resources to be absorbed and (2) what constitutes an acceptable rate of return.

In the first issue, a distinction is often made between investable funds or savings and the total financial resources in the economy, between supply of financial resources and its translation into physical goods, between foreign exchange components and the total financial resources, and so on. Ultimately, given such a variety of alternative definitions of financial resources, the choice of which one to use for analysis must depend on the use for the concept of absorptive capacity selected.[2]

For the second issue, absorptive capacity must ultimately be defined[3] in terms of the magnitude of oil revenues that would yield a minimum acceptable rate of return to the country, i.e., both economic and social returns would be included. In Iran's case, there was a finite limit on the total magnitude of investment during any period that yielded a positive rate of return. This limit was set by the decline in the return on investment and reflected the scarcity of projects with high expected rates of return.

The scarcity of high-return projects during any finite time period was due in turn to limitations on the supply of domestic resources to combine with the oil revenues, including: (1) the availability of labor with the needed skills; (2) knowledge of available natural resources and technology; (3) management and entrepreneurial experience; (4) adequate financial and planning institutions to initiate and implement projects; and (5) a reduced

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[1]Ragaei El Mallakh and Jacob Atta, *The Absorptive Capacity of Kuwait* (Lexington, Massachusetts: Lexington Books, D.C. Heath and Company, 1981), p. 1.

[2]Ibid., p. 2.

[3]The classic work is John Adler, *Absorptive Capacity: The Concept and Its Determinants* (Washington, D.C.: Brookings Institution, 1965). See also Richard Eckaus, "Absorptive Capcity as a Constraint Due to Maturation Processes," in *Development and Planning,* eds. J.N. Bhagwati and R.S. Eckaus (Cambridge, Massachusetts: Massachusetts Institute of Technology Press, 1973), and Taher El Jehaimi, "The Absorptive Capacity of Libya: A Constrained Expenditure Approach," *The Journal of Energy and Development,* spring 1976, pp. 326-47.

level of social or cultural constraints on development. The existence of such limitations restricted the Iranian economy's level of absorptive capacity.

In this regard it must be stressed that to be useful the concept of absorptive capacity must explicitly take the time element into account. The factors hindering improvements in efficient capital utilization do not generally lend themselves to quick changes. In Iran's case shortages of skilled manpower would have required, for example, that the educational system be extensively reformed. Changing sociocultural attitudes and building new growth-oriented political institutions was also a necessary element but one that, if approached correctly, would have been a protracted process involving practically every significant aspect of society. Thus, the abandoning of a controlled spending policy in favor of the immediate expenditure of oil revenues as they accrued appears to have been a major mistake on the part of the government.[4]

In more specific terms, during 1974 oil revenues increased to $20 billion from just $5 billion a year earlier. As a result, the goverment faced two alternatives: either to spend these revenues as they accrued (the one they chose) or to pace its spending in line with the economy's ability to efficiently utilize the funds. The latter approach obviously was superior because it would have permitted a smooth intertemporal allocation of oil resources in step with the needs of the economy. Thus, initial inflationary pressures would have been relieved as well as the balance-of-payments difficulties in later years.[5]

Iran's novel condition of an elastic supply of financial resources dictated that planners change their perspective. As Vakil noted:

> Indeed these (oil) revenues are on the one hand, like the blood of the economy, carrying badly needed investment resources to particular areas for purposes of expanding productive capacity; and on the other hand, they are capable of producing an excessive liquidity situation, if capital resources become suddenly out of line with other complementary factors of production (such as skilled labor, technology, organizational skills, natural resources or general infrastructure services). This duality renders the planning task all the more difficult under conditions of financial surplus, since it requires a shift of emphasis in the planning circles, from an allocation of resources according to the new abundant factor to an allocation of resources according to the real scarce factor.[6]

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[4]Ahmad Shahshahani and Mihssen Kadhim, "Development Problems of an Energy-Based Economy: Iran," *Journal of South Asia and Middle East Studies,* February 1979, p. 70.

[5]Ahmad Shahshahani and Mihssen Kadhim, op. cit., p. 68.

[6]Firouz Vakil, "Iran's Basic Macroeconomic Problems: A Twenty-Year Horizon," *Economic Development and Cultural Change,* July 1977, p. 716.

It follows that absorptive capacity concepts should have been utilized by the government in implementing the nation's development strategy and that the best definition of absorptive capacity from a conceptual point of view for Iran would have been the maximum level of foreign exchange spending by the government that yielded positive returns, given constraints on factors prerequisite and complementary to such spending.[7]

Unfortunately, it is difficult to make this definition operational because the process of evaluating the present value of both monetary and non-monetary returns from all possible domestic spending opportunities for oil revenues over time in Iran would be exceedingly complex, if not impossible. In view of this fact, it would have been best for the government to have chosen an indirect and more macroeconomic approach.

In terms of the factors associated with the Iranian revolution, it appears that financial resources were neither allocated exclusively to economic projects nor were they spent efficiently when economic projects were involved. The abundance of financial capital in fact contributed to waste and inefficiency. In this context the best operational definition of absorptive capacity is one that explicitly takes into account the productivity of government expenditures in contributing to real nonoil gross domestic product (GDP).

This approach would allow, from an operational perspective, not only the productivity of expenditures to be monitored but also would facilitate rational discussions as to the possible limits to be placed on real nonoil GDP growth, irrespective of productivity trends.

For instance, the revenues from oil after 1973-1974 temporarily transformed Iran into a capital-surplus, skilled-labor-deficient, unskilled-labor-abundant country with skilled manpower undoubtedly acting as the growth inhibiting factor. To alleviate this constraint and expand absorptive capacity, the government resorted to importing a large number of foreign technicians. The efficiency of such measures ultimately depends on what skills were transferred to the Iranian population and at what social cost.[8] Although this problem requires thorough research and analysis, the picture that has emerged so far is mixed at best. Reports of friction, discord, and distrust as well as some violence between the Iranians and foreign nationals have been documented.[9] A cursory analysis seems to confirm Griffin's

[7]Christopher Gebelein, "Forecasting Absorptive Capacity for Oil Revenues: Practical Techniques for Policy Analysis," in *U.S. and World Energy Resources: Prospects and Priorities,* eds. Ragaei El Mallakh and Carl McGuire (Boulder, Colorado: International Research Center for Energy and Economic Development, 1977), p. 107.

[8]M.A. Fekrat, "Growth of OPEC-Type Economies: A Preliminary Theoretical Inquiry," *Economia Internazionale,* February 1979, p. 82.

[9]"The Shah's Americans: In Iran for Beaucoup Bucks," *The Washington Post,* May 12, 1977, p. A-10. Quoted in Farkat, op. cit., p. 82.

observation[10] that large-scale expatriate participation in an economy is likely to frustrate the growth of an entrepreneurial class, disrupt national cohesion, and delay the appearance of a development ideology.

The analysis which follows is concerned with estimating the absorptive capacity of prerevolutionary Iran as it related to the country's domestic constraints on efficient investment. Emphasizing the impact on domestic income has the advantage of avoiding the calculation of separate estimates for the trade account; i.e., the approach assumes that if oil revenues were insufficient to meet the government's desired level of expenditure, the nation would be able to easily raise the shortfall in the international financial markets.[11]

The Incremental Capital-Output Ratio

All things considered, the incremental capital-output ratio (ICOR) appears to be the best measure of Iranian absorptive capacity.[12] This approach assumes that increases in national output are a fairly stable function of increments in real capital stock. The numerator of the ratio comprises the value increase in stock of all produced means of production (including working capital). The denominator represents the increment in real nonoil GDP. Because the precise time lag between initiation of the investment process and the eventual increase in output is not known (and in any case probably varies from year to year), two formulations of the ICOR were examined. The first one sets both the numerator and denominator to cover the same increment of time — the change in output and investment during a given year. The second measure assumes that incremental output is related to prior investment, that is, there is a one-year lag between the implementation of the investment decision and the time at which output is forthcoming.

For investment, nonoil GDP ratios are calculated for a number of measures of investments in order to derive a number of specific policy conclusions.

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[10]Keith Griffin, *Underdevelopment in Spanish America* (Cambridge, Massachusetts: Massachusetts Institute of Technology Press, 1969), p. 132.

[11]An approach somewhat similar to that developed in Taher El Jehaimi, op. cit.

[12]The limitations of the capital-output ratio as a measure of productivity are well known. Cf. W.B. Reddaway, *The Development of the Indian Economy* (Homewood, Illinois: Richard D. Irwin, 1962), pp. 207-08, and especially Willy J. Stevens, *Capital Absorptive Capacity in Developing Countries* (Leiden: A.W. Sijthoff, 1971).

The ICORs examined included:

ICOR = total investment (t)/ nonoil GDP(t).

ICORL = total investment (t-1)/ nonoil GDP(t).

Similarly,

ICORPM = ICOR for private investment in machinery

ICORPC = ICOR for private investment in construction

ICORGM = ICOR for government investment in machinery

ICORC = ICOR for total (government plus private) investment in construction

ICORM = ICOR for total investment in machinery

ICORGC = ICOR for government investment in construction

ICORPT = ICOR for total private investment (construction plus machinery)

ICORGT = ICOR for total government investment.

In each case an L at the end of the symbol refers to the previous year's investment divided by the increment in this year's nonoil GDP. All variables are in real terms.

Historically (table 1), the ICORs have been relatively stable (by international standards); however, they do show several distinctive patterns. (1) Relatively high ICORs were obtained in the early 1960s, undoubtedly a reflection of excess capacity resulting from the government's stabilization program. (2) In general, ICORs declined until the late 1960s, then began to increase, reaching very high values in 1977. (3) In general, these conclusions hold for all of the various ICOR measures.

While admittedly a very crude measure, one advantage of the capital-output ratio in the present context is that its movements provide some substantiation for several hypotheses that would seem to explain fluctuations in private-sector investment in the 1960s. Given the lack of relevant data, these hypotheses would be pure conjecture in the absence of something like a capital-output ratio.

Most importantly the incremental capital-output ratio lends itself to econometric analysis, thus providing a method whereby the impact of government expenditures and the rate of economic growth can be determined.

Capital-Output Patterns

Capital-output patterns suggest a number of possible forces at work during this period (1960-1977). Several mechanisms can be outlined that are consistent with the observed trends and also in agreement with events taking place at the time. This discussion is a prelude to and provides the rationale for the econometric analysis that follows.

Table 1

IRAN: CAPITAL-OUTPUT MEASURES

Year	ICOR[a]	ICORL[a]	ICORPM[a]	ICORPML[a]	ICORPL[a]	ICORPCL[a]	ICORGM[a]	ICORGML[a]	ICORL[a]
1960	0.347	0.183	1.15	1.04	1.28	1.02	0.26	0.34	1.40
1961	1.656	0.195	3.99	5.69	6.54	6.38	1.81	1.28	5.81
1962	0.408	0.180	0.89	1.04	1.51	1.71	0.28	0.47	1.17
1963	0.273	0.159	0.60	0.60	1.05	1.01	0.13	0.19	0.73
1964	0.263	0.149	0.67	0.49	1.01	0.86	0.17	0.11	0.84
1965	0.230	0.158	0.44	0.45	0.77	0.68	0.26	0.11	0.71
1966	0.226	0.189	0.51	0.41	0.76	0.71	0.30	0.24	0.81
1967	0.284	0.184	0.71	0.48	0.70	0.72	0.41	0.29	1.12
1968	0.178	0.210	0.34	0.38	0.45	0.42	0.33	0.22	0.67
1969	0.427	0.225	0.68	0.74	1.00	0.96	0.89	0.70	1.58
1970	0.278	0.230	0.49	0.43	0.62	0.63	0.55	0.56	1.03
1971	0.292	0.217	0.59	0.42	0.66	0.53	0.52	0.47	1.11
1972	0.211	0.229	0.51	0.34	0.49	0.38	0.26	0.30	0.83
1973	0.217	0.249	0.50	0.52	0.46	0.44	0.34	0.23	0.84
1974	0.271	0.249	0.54	0.47	0.55	0.44	0.52	0.32	1.06
1975	0.408	0.289	1.27	0.46	0.73	0.47	0.50	0.45	1.78
1976	0.289	0.415	0.69	0.71	0.60	0.41	0.43	0.28	1.13
1977	0.687	0.488	1.32	1.56	1.59	1.35	1.06	0.90	2.40

Year	ICORCL[a]	ICORM[a]	ICORML[a]	ICORGC[b]	ICORPT[b]	ICORPTL[b]	ICORGT[b]	ICORGTL[b]
1960	1.38	2.62	2.03	0.93	2.43	2.06	1.19	1.35
1961	6.97	10.88	13.01	4.33	10.54	12.08	6.15	5.91
1962	1.52	2.58	2.84	1.08	2.39	2.75	1.36	1.61
1963	0.79	2.00	1.73	0.95	1.65	1.60	1.08	0.91
1964	0.60	1.78	1.64	0.77	1.69	1.35	0.94	0.89
1965	0.57	1.60	1.20	0.83	1.23	1.13	1.09	0.63

Table 1

IRAN: CAPITAL-OUTPUT MEASURES (continued)

Year	ICORCL[a]	ICORM[a]	ICROML[a]	ICORGC[b]	ICORPT[b]	ICORPTL[b]	ICORGT[b]	ICORGTL[b]
1966	0.65	1.45	1.47	0.69	1.26	1.13	0.99	1.00
1967	0.77	1.72	1.37	0.96	1.47	1.20	1.37	0.94
1968	0.62	1.11	0.95	0.67	0.79	0.81	0.99	0.76
1969	1.43	2.69	2.39	1.70	1.68	1.69	2.59	2.13
1970	0.99	1.75	1.69	1.13	1.11	1.05	1.67	1.62
1971	0.89	1.81	1.50	1.15	1.25	0.95	1.66	1.44
1972	0.64	1.28	1.04	0.80	1.05	0.72	1.05	0.96
1973	0.75	1.34	1.16	0.87	0.96	0.96	1.21	0.95
1974	0.79	1.64	1.26	1.10	1.09	0.90	1.62	1.14
1975	0.91	2.34	1.41	1.57	2.00	0.93	2.08	1.39
1976	0.99	1.77	1.30	1.17	1.30	1.11	1.60	1.16
1977	2.53	4.47	3.97	2.88	2.91	2.91	3.95	1.37

Source: Computed from data in Bank Markazi Iran, *Annual Report* (Teheran), various issues.

[a]ICOR =TINP/ΔNOXNP; ICORL = TINPL/ΔNOXNP; ICORPM = PIMP/ΔNOXND; ICORPML = PIMP/ΔNOXNP; ICORPCP = PICP/ΔNOXNP; ICORPCL = PICPL/ΔNOXNP; ICORGM = GIMP/ΔNOXNP; ICORGML = GIMPL/ΔNOXNP; ICORC = CITP/ΔNOXNP; ICORCL = CITPL/ΔNOXNPL; ICORM = MITP/ΔNOXNP; and ICORML = MITPL/ΔNOXNP. Where TINP = total real investment, TINPL = total real investment in previous period, PIMP = real private investment in machinery with Δ and L versus same with the TINP. PICPL = private investment in construction; GIMP = government investment in machinery, and CITP = total investment in construction.

[b]ICORGC = GICP/ΔNOXNP; ICORGCL = GICPL/ΔNOXNP; ICORPT = PITP/ΔNOXNP; ICORPTL = PITPL/ΔNOXNP; ICORGT = GITP/ΔNOXNP; ICORGTL = GITPL/ΔNOXNPL. Where GITLP = total government investment in construction (real); PITP = total private real investment; GITP = total real government investment.

In terms of the revolution, the underlying causes of the rising capital-output ratio in the mid- to latter 1970s should be the main focus of attention. Events during this period suggest several causes for the observed decline in investment productivity: (1) diminishing returns to investment stemming from high rates of growth; (2) infrastructural bottlenecks; (3) the presence of easy profits, promoting waste; (4) problems in implementing aspects of agrarian reform; and (5) the destructive effects of inflation and price control on labor motivation.

Decreasing Returns to Investment

The returns on capital decreased in the 1970s apparently because financial resources were applied in greater quantities during a given time period. As noted earlier, this pattern could have resulted from the fact that other factor inputs, such as labor, could not increase as rapidly as investment. It could also have reflected that, as growth accelerated during the boom period, the most productive technologies and investments were undoubtedly chosen initially but that inferior technologies (because of their availability) and marginal projects weighed more heavily in total investment over time.

It seems safe to postulate, therefore, a negative correlation between the productivity of capital (as measured by the capital-output ratio) and the rate of gross domestic capital formation; i.e., that investment opportunties with high returns are limited during any period of time and that, from a certian point onward, further capital formation would be possible only if companies and the government were willing to undertake projects with lower prospective returns.

A more formal explantion for the observed patterns of change in the various capital-output ratios is that sometime in the late 1960s to early 1970s increases in the quantity of combined factors of production started generating a smaller output increment due to the supply pattern of the factors themselves.[13]Most economic entities can be identified as having one or more required production factors in relatively fixed supply. From a certain level onward, additional output will be possible only if other economic resources are combined in ever greater quantities with the scarce factor. This generally amounts to a rise in input costs and a tantamount reduction in productivity and the rate of return.

Along somewhat different lines, it is now a well-established fact that the investment process involves an important element of learning. The high

[13]A similar approach has been proposed by Ragaei El Mallakh and Mihssen Kadim, "Absorptive Capacity, Surplus Funds, and Regional Capital Mobility in the Middle East," *Rivista Internazionale di Scienze Economiche e Commerciali,* April 1974, pp. 310-11.

capital-output ratios after 1973 might be attributed at least in part to the relatively low rate of prior investment. The relationship between the past rate of investment and prospective rates is intricate and complex because a higher historical rate not only implies greater familiarity and practice in the investment field, but also a larger economic system, which would be able to utilize considerably greater amounts of capital.

Finally, recent theories of economic growth have increasingly emphasized that the structure of capital formation is as relevant as its volume.[14] This hints at a final causative factor. It may be that the number of indirectly productive investments (infrastructure, educational facilities, residential housing, etc.) increased in the 1970s with the overall volume of capital formation. Since this type of investment has a relatively long gestation period, an increase in its importance could account for the rise in the overall ICOR. Unfortunately, reliable estimates for the indirectly productive investments as distinguished from directly productive capital formation are very difficult to distinguish in the case of Iran and any arbitrary allocation would be quite hazardous.

Clearly, both decreasing and increasing returns are logically possible. Acceptance of the decreasing returns hypothesis for the 1970s does not imply that instances of increasing returns were not also forthcoming. Both hypotheses need not necessarily be incompatible.[15]

The possibility of increasing returns may have been the real rationale for the government's development strategy. As derived from microeconomic analysis, productivity increases can take place because as the market increases, the greater the differentiation and specialization of labor possible. The argument that may have been most convincing to the government was Kenneth Arrow's contention that (in general), the faster the rate of growth of investment and output, the faster the growth rate of productivity owing to the process of learning by doing.[16]

To sum up, both the observed patterns of the ICORs in Iran and economic theory suggest that at any time there are certain forces working to increase the productivity of capital which at other times cause it to fall.

Based on the available evidence, it is impossible to say that diminishing returns was a major contributing factor to the decline in productivity during the period.

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[14]Cf. T.Y. Shen, "Technological Diffusion, Substitution and Efficiency," *Econometrica,* March 1973.

[15]A theme developed by N. Kaldor, *Strategic Factors in Economic Development* (Ithaca, New York: Cornell University Press, 1967).

[16]Kenneth Arrow, "The Economic Implications of Learning by Doing," *Review of Economic Studies,* June 1962, pp. 155-73.

Bottlenecks

The problem of infrastructure bottlenecks, such as ports, power, and transportation, has been noted at length in the popular press. On a general level, shortages in these areas can be thought of as developing simply as a result of a sudden increase in demand together with a relatively long period required for the construction of additional facilities.

Bottlenecks then appear in the production chain so that firms relying on inputs such as electric power are forced to operate at less than full capacity as overall growth accelerates. This occurred at times after 1973 in Teheran because the area's power-generating capacity was not sufficient to supply all users simultaneously. The result was a series of scheduled brownouts and an average complete loss of power of up to four working hours a day.

The fairly dramatic drop in productivity probably required more than limited supplies of service. A reading of accounts[17] at the time indicates that the manner in which the government allowed excess demand in these areas to develop contributed in large measure to the subsequent reduction in productivity.[18]

As will be discussed in detail later, the government's response to the inflationary pressures that built up after 1973-1974 was a comprehensive price-control schedule.

Difficulties in the power industry are of particular interest since they were dramatic demonstrations of the failures of the government's price-control schemes. Unlike many of the government's other mistakes, power failures could not be hidden behind a bureaucratic curtain of silence, and hence it is instructive to examine the problems of this sector in some detail.

The problem of an "empty" economy can be directly attributable to the workings of excess demand induced by price controls. In general, when price controls are in effect but no attempt is made to force demand and supply to balance at a fairly realistic price (as was the case in many instances between 1975-1977), resources will be rapidly drawn out of the industrial stream into final output and final consumption. The result, as with power, will be to threaten the continuity and efficiency of production and distribution.

In fact, by the middle of 1977 an acute countrywide energy shortage was the most pressing concern for the government. Power blackouts, power failures, and insufficient generating capacity disrupted production schedules in industry and business as well as complicated the everyday lives of urban workers.

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[17]Cf. Edwin Luck, "Port Congestion," *The Financial Times* (London), July 28, 1975, p. 26, and Robert Graham, "Power Shortage Plays Havoc with Industry," *The Financial Times,* July 25, 1977, p. 15.

[18]Robert Graham, "State A Barrier to Investment," *The Financial Times,* July 25, 1977, p. 17.

The problem was not a new one in Iran, but in the summer of 1977 the combination of factors associated with the lack of proper price signals to stimulate both public and private investment, together with the low rainfall, contractual difficulties, and poor planning, exacerbated the situation.

One of the most devastating effects of the power shortage was documented in a report from the Imperial Commission's Committee on Industry (the commission was a watchdog body responsible directly to the Shah).

According to the commission's findings,[19] the country's sole aluminum plant, Arak Aluminum, had experienced interruptions in its supply of electricity 760 times for a total of 33,000 minutes between March 1976 and March 1977. The plant (whose main factor input was electricity) had access to a maximum 35 megawatts (MW) instead of the promised 115 MW. As a result, production had declined by 43 percent during the industrial boom year of 1974 — a year when the demand for aluminum was increasing at an unprecedented rate. Arak Aluminum not only lost millions but disrupted the production schedules of its major buyers. During the same period, the report found that power failures were the major cause of a 45 percent decline in output at the country's principal machine tools factory, also located at Arak.

The problems at Arak were not isolated instances. Rather, they reflected a generalized situation throughout the country, especially where firms had believed official assurances that power could always be supplied at low rates from the national power grid and therefore did not go ahead with construction of their own private generators.

It is clear that if power prices had been allowed to increase somewhat during the post-1973-1974 period, not only would total demand (much of it for nonessential uses) have been much lower, but a number of firms would have found it profitable to install their own systems, thus releasing public resources for other projects.

The government blamed most of the nation's power difficulties on the failure of foreign firms to complete work on schedule on the 750 MW generating plant at Reza Shah Dam in Khuzestan. The project was originally planned to be operational in 1977; however, indications were that it might be some time before any elecricity actually would be generated from the facility. The government blamed the delay on the American contractors and the French turbine suppliers for their alleged failure to carry out their obligations. But the story appears much more complex, involving problems over the site of the dam, tremendous pressure for quick completion of preliminary studies, and, finally, delay in implementation that left the turbines on site for a year before their installation.

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[19]Cited in Robert Graham, "Power Shortage Plays Havoc with Industry."

These are the kinds of inevitable problems that appeared everywhere in the economy as projects were initiated in a hurried response to, but not in anticipation of, scarcities and shortages. In short, though the failure of the Reza Shah Dam to come onstream was clearly a contributing factor to Iran's power shortages, it was not the real reason. The basic cause was largely one of miscalculation of the degree to which industrial and domestic electricity consumption was increasing under the revised Fifth Five-Year Plan. Even if the Reza Shah project had been fully operational, electricity supply would still have fallen short of demand.

Electricity consumption was rising at a rate of between 18 and 20 percent a year. By 1977 official figures placed Iran's power shortfall at 600 MW. Foreign specialists connected with the power business, however, believed the shortfall was nearer to 1,000 MW, perhaps beyond, given the tremendous expansion of electrification throughout the country as well as growing industrialization.

In addition to the ill-wisdom of importing nuclear technology for electricity generation, the Iranian nuclear program was extremely ill-conceived from the start. There were serious questions about the risk involved since many of the nuclear plants were to be situated in the earthquake-prone western area of the country. Costly long-distance power transmission would be necessary as local use was minimal. The country was also incurring massive nuclear program expenses — several billion dollars alone for West German nuclear power plants at Bushehr.

In terms of planning failures, it is possible to criticize the government's whole approach to power. About 71 percent of Iran's total energy generated in the mid-1970s was derived from petroleum, 18 percent from gas, 5 percent from hydroelectricity, and the remainder from coal and noncommercial sources. The basic strategy evolved in 1974 was that alternative sources of energy must be developed to replace both oil and gas (regarded as too important to waste), especially as production of oil was expected to begin to decline in the mid-1980s. Gas, too, was regarded as more important to conserve for use in secondary recovery industrial use (steel, direct reduction, and aluminum) and as a feedstock for the petrochemical industry. This strategy was fashioned despite the fact that in 1976 Iran's proven reserves were the second largest in the world.

Many of the issues raised by such considerations were never answered convincingly, leading one observer to comment that Iran had no energy policy at all but rather a number of contending bureaucracies.[20]

Waste

Rising capital-output ratios also suggest inefficient use of expenditures. Although documentation is difficult to obtain, one recent study of Iranian

[20]Ibid.

import patterns reveals several startling facts about the extent of mismanagement taking place during this period.

An examination[21] of imports from 1972 to 1974 found that overpayments (in terms of the lowest potential price which could have been paid at the time) amounted to $539 million or 37.8 percent. This sample of imports represented about 60 percent of Iran's total imports. For 1973 and 1974 the overall results are similar but with one interesting difference: following the oil price increases, overpayments rose to 49.4 percent in 1973 and were 46.2 percent in 1974.[22]

A number of reasons not related to overpayments have been suggested for this loss of exchange earnings.

1. There may have been variations in unit export prices for an exporter due to qualitative differences, price discrimination between purchasers, tarriffs, and the overvalued rial that could have led to fake invoices (and thus to apparent variations in export unit values).

2. Imports may not have been purchased by buyers with perfect information. In reality, imports were likely to have been contracted for by many companies or individuals with fragmentary knowledge of world markets.

3. Existing trade patterns were in large part determined by historical ties and may not have accurately reflected current prices.

4. Some current trade was based on past contracts and thus sold at prices differing from the spot figure.

5. Contracts were made in many currencies and thus fluctuations in exchange rates could have affected the dollar price from one source to another.

6. Quality differences could have been reflected in the price.

7. Quick delivery may have required a higher price.

8. A large portion of imports was from multiproduct firms which placed restrictions on their importing agents. Major importers in the country contracted to multinational firms were committed to import all the products of that firm and therefore could not import a competitive product from a different but low-cost producer.

9. Differential credit terms or contract or transport costs could contribute to variations in import prices.

A detailed analysis of each of these factors revealed that none, either alone or in various combinations, could come close to accounting for the calculated degree of overpayment.

Overpayments on imports were only one dimension of the economic waste that resulted from the oil price increases of 1973-1974. In addition,

[21]H. Askari, J.T. Cummings, and G. Richter, "Efficiency of LDC Trading Patterns: The Case of Iran," *American Economic Review*, May 1979, pp. 191-95.

[22]Ibid.

industrialization proceeded with little or no consideration given to comparative advantage and domestic factor endowments. The structure of tariffs was not based on rational economic factors. The results were factories without workers, in many instances output produced at about twice the world price, and negative value added in several industries.

Inefficiency in Agriculture

One of the objectives in the prerevolutionary government's anti-inflation program was to eliminate the middleman (because of their excessive profits) between the farmer and the retailer. Presumably this would mean more profits for the farmers. However, in eliminating many of the traders and bazaar merchants from the system the authorities did not replace them with a viable alternative network. For example, a large number of cold storage plants were being established as a key element of the Fifth Five-Year Plan, but their construction was far behind schedule. Plans were made as well for the government to spend around $475 million to construct 27 silos in urban areas; again, the program was also considerably behind schedule as a result of the acute nationwide shortage of cement, in addition to the usual bureaucratic delays. In any case, given its other commitments, the country's trucking fleet could not come close to handling the scheduled 2 million ton capacity planned.[23]

As a result of distribution problems of the type outlined above and despite the price controls and subsidies, such as on imports at stable prices, rice cost the Iranian consumer about twice as much as it did his counterpart in Western Europe.

Such were the realities that by 1977 the main complaint seemed to be the commonplace nature of shortages in many food items. Numerous complaints were made by distributors that the government's procurement agency was often late or negligent in meeting orders.

What was clearly antagonizing the agricultural sector was the low profitability of investment in farming activities, and it was the government's pricing policies that were particularly troublesome for the farming community. Specifically, the contrast between the price for home goods and that for imported commodities was a major source of irritation in rural areas. For example, in late 1976 farmers received around 10 rials a kilogram for wheat, an amount widely regarded as barely adequate to cover the costs of cultivation, let alone provide a reasonable living. At the same time the government was paying 18 rials a kilogram for imported wheat. Policies of this type were apparently the source of so much anger that they drove tea farmers in some parts of the country to burn their crops

[23]"Farming Lags Behind," *The Financial Times*, July 25, 1977, p. 19.

while forcing a number of poultry farms to close. It became clear that the agricultural community could continue to carry its burdens only at the cost of lower productivity. Quality began slipping noticeably in the fruit and vegetable markets and an increasing number of farmers began to vocally criticize what they considered to be outrageous government pricing programs.

In part, one of the government's major problems was its haste; the country's planners were moving too fast for the majority of the farmers who were largely illiterate. Many potentially proficient plans failed simply because the agricultural ministry lacked the qualified personnel to explain them adequately. As a result, some "impact programs had no impact at all."[24]

Disincentives for Labor

Under repressed inflation the value of money depends on what is available for purchase opportunities. Whether the purchase of substitute goods will give the consumer as much satisfaction as the goods made artificially scarce by price controls becomes the crucial issue. If substitute goods do, the marginal utility of money income will be maintained. If they do not, then it is simply a matter of time until workers will refuse to accept money in exchange for additional effort.

Clearly, the price controls imposed by the government after 1973-1974 did increase social investment. However, to assure the success of the tremendously expanded public investment it was soon apparent that controls alone were insufficient due to such factors as skilled labor shortages. Successful implementation of the government's investment program meant a further restraint of consumption by workers, i.e., for increasing amounts of savings out of wage income.

The government's strategy to increase its investment while avoiding inflation therefore depended on: (1) the willingness of individuals to accept substitute goods; (2) the presence of a plentiful supply of such goods; and (3) the belief that the government's action is the only possible solution and that the solution is in the hands of just and capable men.

The theory was that if money had value and thrift was honored by the community, then savings would be viewed with respect by most individuals. Labor effort would not be withheld from the market, and producers would be able to obtain the necessary labor force and reach their optimum levels of output.

It is difficult to speculate as to the precise timing but it is clear that by 1975 Iranian producers were encountering absenteeism. Moreover, there

[24]Ibid.

were difficulties in getting labor to shift to geographic areas and industrial sectors where it was most urgently needed.

Inasmuch as under repressed inflation high wages mean little more than larger amounts of savings, nonmonetary advantages like living in a large city with its many amenities or the chance to work at a position higher on the social scale began to assume importance. Under the repressed inflation labor was becoming inelastic with respect to money but elastic with respect to nonmonetary advantages.

Where employers tried to impose wage restraint, they frequently found a well-organized labor force capable of slowdowns and/or strikes (even though illegal) which by and large won further wage increases. Most employers recognized that despite these increases workers still had problems simply in meeting their basic needs. Rentals and land prices had risen so rapidly that by 1976 as much as 60 percnt or more of take-home pay went for housing. Labor problems also had the effect of frightening potential investors away from labor-intensive projects. This tended to reduce the productivity of capital as capital was substituted for labor.

In sum, the decline in productivity or the absorptive capacity in the mid-1970s was brought on by a number of government expenditure policy actions which resulted in: (1) the increasing reluctance of labor to offer effort in exchange for savings (reducing labor's productivity and increasing rigidities in the economy); (2) the declining productivity of investment due to skilled labor shortages; (3) the appearance of bottlenecks because of capital shortages — skilled government administrators and the like; (4) the presence of huge profits that promoted waste; and (5) the continuation of the high cost of marginal producers in production (because of tariffs and price controls that form an umbrella of protection under which high-cost producers can continue to operate).

Empirical Results

Based on the previous discussion, a number of macroeconomic variables were selected as independent variables to be regressed on the various measures of the incremental capital-output ratio.

For the increasing economies of scale effect:

GNOXNP = the growth of real nonoil GDP;
GNOXNPL = the growth of real nonoil GDP lagged one year;
GGDPNP = the growth of real domestic product;
GGDPNPL = the growth of real domestic product lagged one year;
GNOXNPL2 or GGDPNPL2 = the growth of aggregate income measures lagged two years.

Presumably the greater these rates of growth, the more productive

capital would be. It should be noted that a bias occurs in the current period figures since the higher the growth of the income variable, the larger the denominator (DNOXNP) in the ICOR. This is not a problem, of course, in the lagged formulations.

The government impact is depicted by:

GENANP = the level of real government expenditures;
GGP = the growth of real government expenditures;
GPRAT = the ratio of total real government to total real private expenditures;
GPRATL = GPRAT lagged one year.

Presumably the greater the value of these variables, the more they divert scarce labor/management from private sector activities and thus reduce the productivity of investment.

There is no a priori presumption as to the sign these values will take. Government investment in economic overhead capital could reduce the costs of private production or the government's expenditures could divert scarce resources away from the private sector. The net effect could go in either direction.

The diminishing return effect is measured by:

GTINP = the growth of total real investment;
GTINPL = the growth of total real investment lagged one year;
GTINPL2 = the growth of total real investment lagged two years;
ICORL = the respective incremental capital-output ratio lagged one year.

The expected sign is negative; i.e., the faster investment occurs, the greater the chance capital will outpace the suppliers of complementary factors of production.

The ICORs selected were: (1) total investment (ICOR); (2) private sector investment in machinery (ICORPM); (3) private sector investment in construction (ICORPC); (4) government investment in machinery (ICORGM); (5) total (government plus private sector) investment in construction (ICORC); and (6) total investment in machinery (ICORM).

The most complete analysis was made on ICOR (total investment capital-output ratio) and ICORL (lagged total investment capital-output ratio). Only selective analysis was attempted with the other capital-output ratios.

It should be noted that the results were insensitive to the measure of the incremental capital used, hence only those for ICOR are presented here.

The results for 1959-1977 for ICOR (table 2) indicate that government expenditures had a strong negative impact on the productivity of capital, that is, no positive economies or cost-reducing linkages were created by government expenditures. The negative signs for GNOXNP and GNOXNPL must be interpreted as reflecting the output effect (ΔNOXNP) in light of the strong positive signs for their lagged values. Thus it is unlikely

Table 2

IRAN: DETERMINANTS OF THE INCREMENTAL OUTPUT RATIO, 1959-1973
(Current period formula)

Equation	Dependent Variable[a]	Independent Variables[a] GENANP	GGDPNP	GNOXNPL	GGP	GNOXNP	GPRAT	GTINPL	Intercept	r^2	F
(1)	ICOR	-0.0006							2.71		
		(-0.26)							(6.17)	0.007	0.06
(2)	ICOR		-5.62						3.20		
			(-0.59)						(3.17)	0.037	0.35
(3)	ICOR	0.0005	-6.97						3.25		
		(0.16)	(-0.52)						2.58	0.040	0.17
(4)	ICOR			5.84					2.12		
				(6.82)					(3.12)	0.07	0.67
(5)	ICOR	0.0006			-1.25				2.92		
		(-0.24)			(-0.33)				(3.80)	0.020	0.08
(6)	ICOR			12.91		-21.09			3.48		
				(3.58)		(-5.66)			(8.99)	0.814	17.49
(7)	ICOR	0.002		8.51		-25.75			3.81		
		(1.81)		(2.12)		(-6.16)			(9.84)	0.873	16.05
(8)	ICOR					-27.33	4.79		3.44		
						(-7.36)	(4.71)		(10.76)	0.872	27.14
(9)	ICOR			6.71		-26.49	3.36		3.31		
				(2.08)		(-8.42)	(3.07)		(11.95)	0.921	27.04
(10)	ICOR					-30.62	4.81	1.29	3.59		
						(-6.37)	(4.76)	(1.06)	(10.33)	0.889	18.77
(11)	ICOR					-19.51		1.21	4.30		
						(-2.41)		(0.52)	(7.08)	0.531	4.53

[a]See text for classification of symbols.

that economies of scale were present.

The strong positive value for the ratio of government to private expenditure is another indication of the effect of the government's bidding away of resources from the productive private sector when the public sector expanded at a relatively rapid pace.

The positive sign for total investment (GTIMPL) indicates the effect of diminishing returns to investment. Of particular interest is the fact that when the regressions (table 3) are run for the preoil boom (1959-1973), several different patterns emerge. Apparently, preemption of resources by the public sector was largely a postoil boom phenomena. Government expenditure (GENANP) was not statistically significant in any of the regressions for 1959-1973.

Diminishing returns on increased investment do not appear to have been present, with the growth in total investment not significant in the 1959-1973 regressions, in contrast with those for 1959-1977.

Conclusions

Whatever merit the government's programs in the post-1973 boom might have had, they clearly achieved limited impact due to the declining productivity of capital. Analysis of the pre-1973 period, however, indicates that many of these problems might easily have been overlooked or at least statistical analysis along the lines used here would not have forewarned the authorities of this difficulty.

This should not be interpreted as condoning the government's strategy so much as simply pointing out the problems any government would face in an environment characterized by considerable structural change.

On the other hand, the authorities should have realized that even though oil revenues transformed the economy into a capital-surplus position, this was only a temporary and transient state. The government received ample warning at the time that Iran was not a true capital-surplus economy as was Saudi Arabia. Given the transient nature of capital inflow, it follows that the country should not have followed a growth strategy based on the premise of relatively abundant capital and using capital-intensive techniques to increase the national product.

It appears, however, that the post-1973 growth strategy was based on the premise of capital abundance and therefore economized on labor by increasing the capital-intensive investment projects. The strategy was further predicated on the notion that labor, both in quantity and quality, would soon catch up so that by the time capital inflows from the oil sector began to diminish, the process of capital generation would have become internalized and the country's growth momentum self-sustaining. Yet there is

Table 3

IRAN: DETERMINANTS OF THE INCREMENTAL CAPITAL-OUTPUT RATIO, 1959-1977

Equation	Dependent Variable[a]	Independent Variables[a] GENANP	GGDPNP	GNOXNPL	GGP	GNOXNP	GPRAT	GTINPL	Intercept	r^2	F
(1)	ICOR	0.003							2.17		
		(8.99)							(5.23)	0.357	7.20
(2)	ICOR		-21.79						5.01		
			(-4.19)						(9.60)	0.575	12.60
(3)	ICOR	0.002	-17.84						4.14		
		(2.06)	(-3.54)						(6.56)	0.686	13.10
(4)	ICOR			22.30					0.80		
				(3.24)					(1.10)	0.448	10.53
(5)	ICOR	0.003			-6.19				3.23		
		(3.04)			(-2.19)				(5.34)	0.540	7.05
(6)	ICOR			27.39		-19.54			2.29		
				(5.14)		(-3.40)			(3.28)	0.718	15.30
(7)	ICOR	0.004		7.81		-30.37			4.11		
		(6.19)		(1.90)		(-9.11)			(9.09)	0.937	54.24
(8)	ICOR					-36.06	6.85		3.52		
						(-6.37)	(6.97)		(7.32)	0.821	27.57
(9)	ICOR			10.55		-5.52	4.91		2.98		
				(1.61)		(-32.22)	(3.23)		(5.28)	0.855	21.67
(10)	ICOR					-46.19	6.08	4.77	4.18		
						(-7.81)	(7.20)	(2.71)	(9.09)	0.893	30.52
(11)	ICOR					-35.76		9.06	5.29		
						(-2.73)		(2.38)	(5.33)	0.387	3.79

[a]See text for classification of symbols.

little historical precedent or empirical evidence for accepting the momentum thesis. The economic solution instead would have been to base the strategy on long-term scarcities rather than short-term abundancies. In short, the government's strategy should have aimed at maximizing the long-run return per unit of capital.[25]

[25]M.A. Fekrat, op. cit., p. 83.