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AN EMPIRICAL TEST OF THE RISK AVERSION HYPOTHESIS

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In this paper we develop a framework for the empirical analysis of production theory under uncertainty. Applying duality theory and using a flexible functional form for technology, we provide a model for production decisions under uncertainty that can be easily estimated and used to identify attitudes towards risk. Furthermore, we provide a measure of degree of risk aversion and a direct test for the risk aversion hypothesis.

I. Introduction

The effects of uncertainty on producers' behaviour have been recently the subject of several studies.[1] These studies show that producers will change their behaviour under uncertainty and moreover the nature of the change in their behaviour will depend on their attitudes towards risk.[2]

The most common assumption about individuals' attitudes towards risk has been that individuals are risk averse. Theoretical support for this assumption, which is related to the boundedness of the Von-Neuman-Morgenstern utility function, is suggested by Arrow (1971). Empirical support is given by observed phenomena such as purchase of insurance, portfolio diversification and other risk-sharing contracts. On the other hand, it has been also argued that since many firms are owned by a large number of shareholders whose portfolios are diversified, risk neutrality of the firm may be appropriate.

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[1] See Sandmo (1971), Batra and Ullah (1974), and Hartman (1976).

[2] See references in footnote 1.

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CAPACITY UTILISATION IN SELECTED INDUSTRIES OF PAKISTAN

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This paper quantifies the rate of capacity utilisation in twenty-three selected industries of Pakistan for the period, 1971–76. Variation in the number of shifts worked and in intensity of operations of machinery among the industries is also determined. The impact of factors operating from the demand and from the supply side respectively is analysed by use of econometric techniques and by studying industrial managers/owners own perceptions of constraints to full utilisation of available capacity. The basic conclusions are that in the '70s approximately half the capacity was lying idle in the sample industries and that supply related factors are primarily responsible for creating this excess capacity.

I. Introduction

The decade of the '70s has witnessed relative stagnation in the industrial sector of Pakistan. From an annual growth rate in industrial production of about 10 per cent in the '60s, it has declined to only 5 per cent between 1970 and 1980. One of the primary reasons given for the slowdown is the shyness of private sector investment caused by prevailing economic and political uncertainties resulting from the many structural changes brought about through direct government intervention in the economy. Successive waves of nationalisation, in particular, are alleged to have sapped private entrepreneurs of their confidence. The implicit assumption behind this argument is that industry is already operating at the limits of capacity and that further increases in production can only come about through investment in the expansion of capacity. However, if it can be shown that substantial excess capacity does exist still in the industrial sector then an alternative strategy of reviving the sector in the short run could be to raise the level of production from plants already in operation.

Earlier research in the '60s had, in fact, demonstrated the existence of substantial excess capacity in the industrial sector of Pakistan. Winston (1971), Hogan (1967), Kemal and Allauddin (1974), for example, had shown that rates of capacity utilisation were generally low, particularly if capacity is measured in terms of multiple-shift operation. Hogan had taken capacity on a three-shift basis and found utilisation to be around 25 per cent only in Pakistan while the corresponding estimates of Winston (1971) and Kemal and Allauddin (1974) were 40 per cent and 50 per cent respectively. Reasons given for the margin of unutilised capacity were the substantial overvaluation of the rupee in the '60s, low interest rates, high effective protection and the linking of import licences of raw materials to existing capacity all of which gave firms a strong incentive to build capacity ahead of demand. In addition, Hogan (1967) had argued that in periods of fast growth of investment and movement towards industries with longer run-off periods a certain amount of excess capacity was built into the system. Not only did Pakistan witness fast growth of industrial investment in the '60s but also towards the end of the decade a diversion of investment was beginning to take place away from simple consumer goods towards intermediate and capital goods as the scope for import substitution in the former was getting exhausted. The switch towards investment in capital-intensive industries had, inevitably, led to an increase in gestation periods.

Therefore, it seems likely that by the end of the sixties considerable excess capacity had been created in the industrial sector of Pakistan. The substantial devaluation of the rupee in 1972[1] removed one of the basic economic incentives for further anticipatory investment by the private sector. A policy of rationalisation of the industrial sector, can, therefore, now focus on utilisation of capacity already created. As such, the emphasis of research in the short run is less on identification of suitable measures to revitalise private sector investment and more on ways to stimulate production from existing plants through a judicious mix of fiscal, commercial, credit, labour, pricing and other policies. This paper is the product of such an emphasis. An effort is made to explicitly quantify the impact of different government policies on capacity utilisation in the industrial sector.

There are two features of this paper which have perhaps generally not been studied in the capacity utilisation literature. Firstly, research is undertaken at the individual firm level whereas most of the studies, for example, by Winston (1971), have been carried out at the industry level. This approach

[1] The Pakistani rupee was devalued in May 1972, when the exchange rate changed from Rs.4.76 =$1 to Rs.11.00 = $1. However, following the dollar devaluation in February 1973, the exchange rate became Rs.9.90 = $1.

avoids aggregation problems and has the theoretical justification that decisions regarding target level of production and expansion of capacity are taken at the individual firm level and not at the industry level. In this way, it is possible, for example, to study the consistency between firms' perceptions of their problems in utilisation of available capacity and the results of the econometric analysis carried out in the paper to explain the variation in the rate of capacity utilisation among firms. It is felt, as such, that research at the firm level can give a sharper focus on the mix of policy measures for more efficient utilisation of capacity.

Secondly, the paper seeks to determine separately factors which influence the number of shifts operated by a firm and the intensity with which firms operate their shifts. This disaggregation of the capacity utilisation question helps to highlight which factors have greater impact on time utilisation and which affect intensity of operations.

The paper is organised as follows: Section II describes the coverage of industries in the study and outlines the process of primary data collection. Section III reviews the various measures of capacity that have been developed in the literature, and defines the particular approach used in the paper for quantification of capacity and the extent of its utilisation. Section IV presents the estimates of the rates of capacity utilisation among the industries (included in the sample) during the period, 1971-1976. Section V lists factors which are likely to affect the utilisation of capacity. Section VI gives the results of econometric analysis undertaken to determine the extent to which these factors explain the variation in the rate of capacity utilisation. Section VII presents the findings on industry's own perception of factors limiting the utilisation of capacity. A comparison is made between the results of the econometric analysis and industry's subjective perceptions. Finally, in section VIII are given some of the policy recommendations which follow from the analysis for raising the rate of capacity utilisation in Pakistan.

II. Data Collection

Twenty-three industries, essentially at the four-digit level of Standard Industrial Classification, were chosen for study. This group consists primarily of industries producing intermediate goods although some consumer goods industries, primarily export-oriented in character, have also been included. Many of the industries in the sample like fertilizer, industrial and petro-chemicals, cement, pharmaceuticals, etc., enjoy high priority in national planning and are likely to feature more in the industry mix in coming years. Altogether, these twenty-three industries accounted for over 25 per cent of the value of fixed assets in the industrial sector in 1976.

There is a wide variation in the characteristics of the sample industries. Some industries, viz., industrial chemicals (soda ash, caustic soda, sulphuric acid), plastics, synthetic fibres, fertilizer, cement, sheet glass, are continuous process industries while others are of the batch-making type. In some industries like fertilizer, cement, and industrial chemicals, production is very capital-intensive while others like starch, sports goods, surgical instruments, etc., are essentially based on labour-intensive technology and organisation at the small-scale level. Cement and industrial chemicals are primarily in the public sector while elsewhere the private sector dominates. Few industries, like sports goods, marble goods, and surgical instruments, are highly export-oriented while others are of the import-substituting type. Altogether, the heterogeneity among the industries chosen for study provides rich prospects for the analysis of the impact of a large number of factors on capacity utilisation.

The population of units in the selected industries was taken from the Directory of Establishments, based on the Census of Manufacturing Industries of 1970-71. This Census covers only those establishments which are engaged in manufacturing activities for the whole or part of a year and are registered under Section 2(j) and 5(i) of the Factories Act, 1934. Section 2(j) refers to plants which employ 20 or more workers on any day during the year and use power in their manufacturing operation. Section 5(i) pertains to factories wherein a manufacturing process is carried on with or without use of power whenever ten or more workers are working there or have worked there on any of the twelve months immediately preceding. Therefore, the population of units excludes very small-scale plants employing less than ten workers.

The number of sample units in each industry is given in Table 1. The total population of units was 451 out of which it was possible to sample 127. In the case of industries with few units a census was carried out.

Numerous problems were encountered in the process of primary data collection. The overall response rate was 81 per cent. All large units (employing more than 50 workers)[2] in the sample co-operated,[3] but the response rate from medium (employing 20 to 49 workers) and small-scale (employing less than 20 workers) units was relatively low, at about 50 per cent. The basic reasons for the latter are, firstly, the industrial directory was not entirely accurate in the case of relatively small units. Some units had closed, wrong addresses were given for others and in a few cases units listed did not

[2] This size classification by level of employment corresponds to that used by the Planning Division, Government of Pakistan.

[3] One of the basic reasons for the high rate of response from large firms is that they are public quoted companies and they are legally obliged to make information available to shareholders and the general public.

exist or were carrying out only trading operations. Secondly, some units were apprehensive about tax assessments or nationalisation or the dissemination of confidential data to competitors and, therefore, did not wish to co-operate. Thirdly, small units did not have the tradition of maintaining past records for a number of years. Also, some units which had been nationalised in 1973 did not have data prior to this when ownership was in private hands.

TABLE 1

Rate of capacity utilisation by industry, 1971 and 1976

(%)

Industry	Number of Units in Sample	U_{it} 1971	U_{it} 1976	Average Value,[a] 1971-76 U_t	Average Value,[a] 1971-76 U_i
Batch-making					
Scooter tyres and tubes	3	30.6	52.8	57.2	92.4
Cycle tyres and tubes	3	41.2	30.8	31.2	94.6
Rubber belting	3	33.9	52.3	46.8	98.2
Miscellaneous rubber products	11	29.4	26.2	55.2	61.1
Starch	4	12.1	6.2	38.2	34.4
Pharmaceuticals	21	46.0	44.4	48.4	82.1
Plastic goods	9	27.4	46.9	43.1	99.1
Asbestos cement	2	27.1	37.3	45.4	78.3
Refractories	3	19.6	12.8	32.2	63.1
Hollow glass	10	44.2	62.3	58.7	98.9
Pottery and ceramics	5	68.4	70.2	64.3	99.3
Surgical instruments	11	32.7	47.2	37.2	99.8
Sports goods	5	34.0	35.7	36.1	97.8
Poultry feed	3	27.2	54.5	44.1	81.3
Marble goods	4	64.8	31.2	44.7	99.8
Continuous process					
Caustic soda	5	83.4	80.4	96.4	76.2
Soda ash	2	74.3	72.2	80.1	90.2
Sulphuric acid	4	83.4	94.4	81.8	94.3
Plastics	3	25.2	13.6	56.9	28.7
Synthetic fibres	4	64.3	80.1	91.9	77.2
Fertilizer	6	71.1	84.7	99.1	77.4
Cement	4	64.4	73.0	96.2	65.3
Sheet glass	2	58.1	76.2	86.6	81.3

[a]The averages by type of process are as follows:

	U_t	U_i
Continuous process	86.2	73.8
Batch-making	45.5	86.0

III. Measures of Capacity

A number of measures of capacity have been developed in the literature. In the context of an individual firm or industry, David Lim (1975) refers to the shift measure, U_t, as one of the earliest capacity utilisation measures. In this approach, the actual number of shifts worked in a year is compared with the available number of shifts, on the assumption that a certain number of shifts can be operated daily. Lim (1975) also refers to the electricity measure, U_E, of capacity utilisation in which the actual consumption of electricity in kilowatt-hours by electric motors in a plant is compared with their rated capacity after allowing for some dissipation of power in the form of heat. Kim and Kwon (1971) have applied the electricity measure to industries of South Korea and find the average rate of capacity utilisation as only 25 per cent. However, Lim (1975) argues that this measure has a strong built-in downward bias for a number of reasons. Morawetz (1976) determines the extent of this bias for industries in Israel and Philippines. He finds that it gives rates of capacity utilisation on the average three times lower than other measures. Therefore, the electricity measure has not been applied to the quantification of capacity in this paper as it is likely to overstate substantially the extent of excess capacity in the sample of industries.

The shift measure also tends to overestimate capacity. It suffers from the defect that it does not allow for compulsory holidays and planned shutdowns of plant for annual repairs and maintenance. Also, further adjustment has to be made to U_t to allow for variation in the intensity of usage of machinery in relation to the design intensity. The need, therefore, for a time-and-intensity measure, U_{it}, of capacity utilisation is clear. This measure is likely to be the nearest approximation to the actual rate of capacity utilisation of a plant.

In Pakistan, a number of different measures of capacity are in common use. The term *sanctioned capacity* is used by investment authorising agencies like the Department of Investment Promotion and Supplies and the Pakistan Industrial Credit and Investment Corporation. This capacity measure is based on single-shift operation for 330 working days or as specified by the applicant. Only in the case of continuous process industries is the concept of three-shift operation used. *Assessed capacity* is relevant in industries where excise duty in the form of a capacity tax is levied. It is estimated by the Central Board of Revenue and is generally below even the sanctioned capacity. *Licenced capacity* is determined by the Provincial Departments of Industries. It is defined as capacity for which licences are issued for imported raw materials. Firms have a tendency to get their licenced capacity assessed as high as possible to get a large quota of imported raw materials which frequently command a premium in local markets.

Two other measures related to the sanctioned capacity are *installed* and *rated* capacity. Installed capacity is derived on 365 days operation at maximum efficiency. Rated capacity is installed capacity less allowance for holidays and maintenance or parts replacement time. If estimated on a three-shift basis for both continuous process and batch-making industries it is identical to U_{it}. The approach of deriving rated capacity has, therefore, been used in the paper.[4] A further downward adjustment has been made to capacity in the case of batch-making industries of up to 1½ hours per 8-hour shift to allow for time losses between changes of shifts. Therefore, the approach adopted in the paper has consciously been chosen to minimise the extent of reported excess capacity in the study industries.

There is a perception in the context of batch-making industries that three-shift operation is seldom attained and, therefore, capacity estimated on this assumption is only a theoretical measure. However, out of the sample of 97 firms from batch-making industries in the study, 23 were already working three shifts implying that this level of utilisation is attainable in such industries.

The approach adopted in this paper is to disaggregate U_{it} into two components: the time utilisation measure, U_t, and the intensity of operations measure, U_i, such that:

$$U_{it} = U_t U_i \tag{1}$$

U_t and U_i are derived for batch-making and continuous process industries respectively in the following manner:

Batch-Making Industries

We designate the following symbols: DA = Days available, HA = Hours available per shift, DW = Days worked, HW = Hours worked per shift, S = Number of shifts worked, Q = Output, C_R = Rated capacity. Then,

$$U_t = \frac{DW \times HW \times S}{300 \times HA \times 3} \tag{2}$$

[4] The concept of rated capacity was somewhat difficult to apply in the context of some industries like sports goods, surgical instruments, etc., which are highly labour-intensive and production is being carried out primarily by small units. For such industries capacity was defined as the peak output per shift attained during the period, 1971 to 1976. This was then multiplied by three to give the capacity on a three-shift basis. It is likely that this measure tends, in fact, to overstate the extent of capacity utilisation.

and $$U_i = \frac{Q/(DW \times HW \times S)}{C_R/(300 \times HA \times 3)} \quad (3)$$

and, $$U_{it} = Q/C_R .$$

It can be shown that $U_{it} = U_t U_i$.

Continuous Process Industries

We define the following: DA = Days available, DPS = Days plant shut down for planned repairs and maintenance, DUF = Days lost due to unanticipated factors, DW = Days worked, Q = Output, C_R = Rated capacity. Then,

$$DA = 365 - DPS$$

$$DW = 365 - DPS - DUF$$

therefore, $$U_t = \frac{365 - DPS - DUF}{365 - DPS} \quad (4)$$

and, $$U_i = \frac{Q/DW}{C_R/DA} \quad (5)$$

and, $$U_{it} = Q/C_R$$

As before, it can be shown that $U_{it} = U_t U_i$.

It may be noticed that in the case of continuous process industries U_t is directly reduced by the proportion of days lost due to unanticipated factors.

IV. Trends in Capacity Utilisation

Following the derivation of the rated capacity for each firm in the sample it is possible to derive the rate of capacity utilisation for firms within each industry in the sample.[5] This is given in Table 1 for the years 1971 and 1976.

[5] The methodology used for deriving estimates of capacity utilisation at the industry level from the sample of units is as follows:

Overall, there appears to have been some improvement in the rate of capacity utilisation over the five year period although the pattern is not entirely clear. Twelve industries have witnessed significant increases and five declines, while in six, it has remained more or less unchanged. Major increases in the rate of capacity utilisation have taken place in industries producing scooter tyres and tubes, rubber belting, synthetic fibres, plastic goods, fertilizer, sheet glass, hollow glass, surgical instruments and poultry feed. Large declines have occurred in cycle tyres and tubes, plastics and marble goods.

There also appears to be substantial variation in the rate of capacity utilisation among industries. In some industries like caustic soda, sulphuric acid, synthetic fibres and fertilizer it exceeded 80 per cent in 1976. At the other extreme, there are industries like starch, plastics and refractories where it was even less than 20 per cent. The median rate of capacity utilisation among the industries in the sample in 1976 was about 52 per cent. Therefore, it seems that almost half of the capacity in the industries in the sample was lying idle in 1976, implying that the margin of excess capacity is still quite substantial.

The results also indicate that large firms are relatively more efficient in utilisation of capacity. This evidence is particularly strong in the case of pharmaceuticals and pottery and ceramics, two industries which have large variation in size of firms.[6] Possible reasons for this difference are discussed in the next section.

The average values of U_i and U_t for firms within an industry over the period, 1971 to 1976, have also been derived and are presented in Table 1.

C_j = Rated capacity of the jth unit in the industry.

Q_j = Output of the jth unit in the industry.

n = Number of units in the sample from the industry.

Then, $$U_{it} = \sum_{j=1}^{n} Q_j / \sum_{j=1}^{n} C_j .$$

[6] Industries which had a significant presence of relatively small units were pharmaceuticals, plastic goods, miscellaneous rubber products, hollow glass, pottery and ceramics, surgical instruments and sports goods. The variation in U_{it} by size of unit in these industries was as follows:

	U_{it} (in 1976)		
	Large (Employing more than 50 workers)	Medium (Employing between 20 and 49 workers)	Small (Employing less than 20 workers)
Pharmaceuticals	50.9	13.9	12.7
Plastic goods	26.5	23.2	22.0
Miscellaneous rubber products	23.6	30.8	15.9
Hollow glass	64.8	58.2	45.9
Pottery and ceramics	17.9	33.9	32.7
Surgical instruments	48.6	38.0	45.0
Sports goods	36.3	38.0	24.9

A clear pattern is visible in these values. In continuous process industries bulk of the variation in the rate of capacity utilisation appears to be caused by changes in the intensity of operations, U_i. The high start-up costs associated with process operations provide a strong incentive for 24-hour operations with variations in throughput to allow for demand, raw material constraints, etc. The pattern is reversed in the case of batch-making industries. Almost the entire variation is in the time utilisation factor, U_t, and firms in such industries try and work fewer shifts but maintain, more or less, full intensity of operations during the shifts. Reasons for this are the high costs of operating additional shifts due to time losses between shifts which could be even higher if the product mix is also being changed simultaneously and because of indivisibility in labour payments within shifts.

V. Factors Affecting Capacity Utilisation

A large number of factors have been adduced in the literature to explain the variation in the rate of capacity utilisation. In addition, we have generated a few of our own hypotheses. These factors have been grouped into two broad categories, those operating from the supply side and those *via* demand, as follows:

SUPPLY FACTORS

Effective Rate of Taxation of Output (ERTO): In some industries in the sample, excise duties are levied on an *ad valorem* basis and in others they are specific in character. Sales taxes, ST, however, are *ad valorem.* The effective rate of excise duty, EET, has been derived by finding the excise duty as a proportion of the price of output less sales tax. The overall effective rate of taxation of output, ERTO, has then been calculated in the following manner:

$$\text{ERTO} = 100[(1+\text{EET})(1+\text{ST})] - 100$$

A negative association is expected between ERTO and U_{it} as the former raises marginal costs and leads to a reduction in output levels under profit maximizing behaviour.

The range of values of ERTO between 1971 and 1976 in each industry are given in Table 2. Industries in the sample that have a relatively high burden of domestic taxes on output are synthetic fibres, scooter tyres and tubes, rubber belting, miscellaneous rubber products, sheet glass and plastic goods.

Year of Commencement of Production (YEARPROD): This factor takes the value of the particular year in which production commenced.

TABLE 2

Government fiscal and commercial policies by industry, 1971 to 1976

Industry	Fiscal Policy							Commercial Policy[a]	
	Taxation of Products			Taxation of Imported Raw Materials[b]		Taxation of Competing Imports		Import Policy on imported Raw Materials[b]	Import Policy on Competing Imports
	EED(%)	ST(%)	ERTO(%)	ID(%)	ST(%)	ID(%)	ST(%)		
Batch-making									
Scooter tyres and tubes	37½	20	65	20-25	0	40-60	10-20	2	2
Cycle tyres and tubes	5-7½	20	26-29	20-25	0	B	B	2	2
Rubber belting	12½	20	35	20-25	0	40-60	10-20	1	1
Miscellaneous rubber products	12½	20	35	20-25	0	B	B	2	B
Starch	0	20	20	N	N	B	B	N	B
Pharmaceuticals	0	0	0	0	0	0	0	1	1
Plastic goods	12½	20	35	92½-125	10-20	B	B	2	B
Asbestos cement	0	20	20	20-25	0-20	20	7½-10	2	2
Refractories	0	20	20	N	N	30-50	10-20	N	1
Hollow glass	12½	20	35	N	N	40-50	20	N	1
Pottery and ceramics	0	30	30	N	N	75-135	10-20	N	2
Surgical instruments	0	0	0	20-50	7½-20	B	B	3	B
Sports goods	0	0	0	0	0	B	B	2	B
Poultry feed	0	0	0	0	0	B	B	1	B
Marble goods	0	0	0	N	N	B	B	N	B
Continuous process									
Caustic soda	0	20	20	N	N	50-62½	10-20	N	1-2
Soda ash	8-18	0	8-18	N	N	52-62½	10-20	N	2
Sulphuric acid	0	0	0	12½-25	0	B	B	3	B
Plastics	0	20	20	25-50	0-20	92½-125	10-20	1	2
Synthetic fibres	42½-86¼	20	71-123½	20-25	0-20	37½-30	0-20	2	2-3
Fertilizer	17½	0	17½	0	0	0	0	2	3
Cement	15-27	0	15-27	0	0	13-28	10-20	2	2
Sheet glases	12½	20	35	N	N	60-75	10-20	N	2

EED=Effective Excise Duty; ST=Sales Tax; ERTO=Effective Rate of Taxation on Output; ID=Import Duty; N=Negligible; B=Banned. [a]Code Numbers for Import Policy: 1=Free/Cash Imports; 2=Tied/Barter Imports; 3=Imports through the Trading Corporation of Pakistan. [b]For only the Principal Raw Material Imported.

It is hypothesised that the older a firm's plant is the lower is likely to be the rate of capacity utilisation because of the greater probability of machine breakdown due to wear and tear. In other words, there is a direct correlation between YEARPROD and U_{it}. However, there is the contrary hypothesis that YEARPROD catches the 'learning by doing' phenomenon in a firm. The longer a firm has been in production the greater the experience of management and labour about production bottlenecks [See LeCraw (1978)]. If this hypothesis is valid then there could be an inverse correlation between YEARPROD and U_{it}.

Public or Private Sector Ownership (DPUBPRI): It is argued that public sector firms may have a greater production orientation and tend to operate at higher levels of capacity utilisation than private sector units where maximisation of profits rather than production is likely to be the principal objective. Also, public sector units may have greater access to import licences, credit, etc., than private firms. DPUBPRI is defined as a dummy variable which takes a value of one when the unit is in the public sector and zero if it is privately owned.

Days Lost due to Unanticipated Factors[7] (DAYSLOST): Plant shut downs are likely to occur for a number of reasons, namely, labour strike, lockout, machinery breakdown, electricity failure, gas/fuel shutdown, unanticipated holidays (due to lack of demand, input supply bottlenecks, non-gazetted holidays, etc.,) or random factors like war, floods, etc. Days lost in this manner can affect the rate of capacity utilisation. Therefore, there is likely to be an inverse correlation between DAYSLOST and U_{it}. In practice, however, it is possible for batch-making firms to recover part or all of such losses by raising U_t or U_i subsequently and in the case of continuous process firms by increasing U_i.

In view of the importance of this factor, a separate table, Table 3, has been constructed which gives the magnitude of days lost in each industry and the relative frequency of different types of shutdowns during the period, 1971 and 1976. DAYSLOST has been measured as number of days lost as percentage of days available.

It may be noticed from Table 3 that there are large differences among the sample industries in terms of days lost due to unanticipated factors. In some industries like plastics, starch and asbestos cement, time losses

[7] DAYSLOST is really not only a supply variable but is also affected by demand factors. For example, the component of days lost due to unanticipated holidays could be caused by either supply or demand factors. However, in view of the fact that unanticipated holidays on the average accounted for 22.8 per cent of days lost in the selected industries as shown in Table 3, it was decided in the analysis to classify DAYSLOST as a supply variable. The remainder of days lost, i.e., 77.2 per cent, were due to labour strikes, plant lockouts, breakdown of machinery, electricity failure, gas or fuel shutdown, etc.,which are clearly supply related factors.

TBALE 3

Days lost due to unanticipated factors[a] by industry, 1971 to 1976

Industry	Days lost as percentage of days Available	Causes (Percentage of Total)							
		Labour Strike/ Unrest	Plant Lockout	Break-down of Machinery	Electricity failure	Gas, Fuel, shut down	Unanti-cipated holidays	Others (War, Floods etc.)	Total
Batch-making									
Scooter tyres and tubes	4.3	30.1	0.0	14.7	6.4	0.0	44.9	3.8	100
Cycle tyres and tubes	6.8	11.0	0.0	26.4	15.8	5.2	41.6	0.0	100
Rubber belting	4.9	69.1	0.0	17.2	3.8	0.0	4.2	5.7	100
Miscellaneous rubber products	8.8	20.9	52.7	3.7	8.8	0.0	6.1	7.8	100
Starch	24.2	18.9	48.2	1.2	12.2	0.0	19.5	0.0	100
Pharmaceuticals	5.5	40.8	2.3	21.9	14.9	0.0	19.3	0.7	100
Plastic goods	13.4	20.2	24.1	7.0	38.1	0.0	10.6	0.0	100
Asbestos cement	18.3	13.1	0.0	14.9	68.5	0.0	3.5	0.0	100
Refractories	2.5	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100
Hollow glass	3.4	22.8	0.0	11.3	45.6	2.4	4.9	13.0	100
Pottery and ceramics	4.8	14.6	0.0	16.2	38.4	20.1	5.3	5.4	100
Surgical instruments	3.0	9.6	0.0	0.0	60.3	0.0	5.9	24.2	100
Sports goods	1.4	0.0	0.0	0.0	17.1	0.0	59.7	23.2	100
Poultry feed	10.5	0.0	0.0	0.0	15.7	0.0	84.3	0.0	100
Marble goods	3.9	0.0	8.2	9.3	33.3	0.0	32.9	16.3	100
Continuous process									
Castic soda	5.1	36.4	0.0	22.3	21.3	4.2	4.5	11.3	100
Soda ash	2.9	30.7	0.0	43.0	22.8	0.0	3.5	0.0	100
Sulphuric acid	1.2	0.0	0.0	14.3	56.1	17.3	12.2	0.0	100
Plastic	53.0	2.3	31.6	44.2	6.6	0.0	0.0	15.2	100
Synthetic fibres	6.2	20.5	0.0	0.0	29.9	0.0	47.6	2.0	100
Fertilizer	1.1	0.0	0.0	23.1	31.4	16.5	9.0	20.0	100
Cement	6.2	0.8	0.0	35.2	42.7	10.0	5.1	6.2	100
Sheet glass	2.5	3.1	0.0	66.3	30.6	0.0	0.0	0.0	100
Average for above industries	8.4	15.9	7.3	17.1	27.0	3.3	22.8	6.7	100

[a]The percentages are derived for the six year period for all units combined within an industry in the sample.

were substantial. Altogether, in the selected industries, the average number of days lost as a percentage of days available between 1971 and 1976 was 8.4 per cent. The most important factor leading to time losses was power failure accounting for 27 per cent of total days lost. Next in importance were labour strikes, plant lockouts and unplanned holidays. Machinery breakdowns also tended to cause relatively frequent interruptions in the production process. This factor was of particular importance in capital-intensive industries like caustic soda, soda ash, plastics, fertilizer, cement and sheet glass.

Percentage of Skilled Workers in Production Staff (SKILLED): This factor quantifies the skill component in the labour force. As argued by Winston (1971) such skills are generally in critical shortage. Therefore, there is likely to be a positive association between SKILLED and U_{it}.

Percentage of Managers and Executives in Total Employment (MANAGER): Similar to the SKILLED hypothesis, there could be a direct correlation between MANAGER and U_{it}. On the other hand, in line with Marris (1964), managers and executives may have a strong disutility associated with night shifts which would restrict the rate of capacity utilisation. If this is true, then there could, in fact, be an inverse correlation between MANAGER and U_{it}.

Plant Balancing (DBALANCED): Balancing of plant is essential to debottlenecking the production process. Firms which report the need for balancing are probably experiencing difficulties in achieving higher production due to lack of investment at a particular stage in the production line. Capacity attainable in such firms can only be as high as the capacity at the stage which constitutes the bottleneck [See Afroz and Roy (1976)]. DBALANCED is defined as dummy variable. It takes the value of one when the firm reports itself as being balanced, and zero otherwise.

Employment (SIZE): Winston (1971), Kemal and Allauddin (1974), LeCraw (1978), and Islam (1978), all imply a positive relationship between the size, measured in terms of employment or fixed assets, of the firm and its rate of capacity utilisation. Of particular significance in this context is the indivisibility of management over a 24-hour day which afflicts, especially, the small firm with a Jack-of-all-trades management. This argument is supported by the organisation theorists, Willmore and Acheson (1974).

It is also possible that SIZE may be positively associated with U_{it} as a reflection of the greater political and economic power of larger units to obtain favourable allocations of import licences, credit, etc.

Fixed Assets to Value Added Ratio[8] (ASSETVAL): This measure corresponds to the capital-output ratio for a firm. Marris' (1964) argu-

[8] It is measured as the capital-output ratio at full utilisation of capacity.

ment of disutility of night-time work and the need therefore to give a night-time differential in wages which tends to raise labour costs of extending the number of shifts is likely to be less important in the case of capital-intensive plants where the share of labour costs may be low. Therefore, there is likely to be a positive correlation between ASSETVAL and U_{it} as tested by Winston (1971), Kim (1982), Betancourt and Clague (1978) and others. Willmore and Acheson (1974) produce a different argument in support of this hypothesis. According to them, labour productivity is more variable, and hence more dependent upon the performance of the manager in operator-based than machine-based activities.

However, an aspect of the relationship between the capital-output ratio and rate of capacity utilisation which is seldom emphasised is that capital-intensive undertakings are perhaps characterised more by plant indivisibilities, implying concave costs of adjustment of capacity as defined by Malcolmson (1973). In such cases there will be a greater tendency to create capacity ahead of demand. This implies that, at least in the initial years of a plant's life, there may be some built-in excess capacity. Also, capital-intensive investments frequently embody transfer of complex technology, and it takes a longer time for managements in developing countries to master the operations of such plants. These arguments point to the possibility of perhaps even a negative association between ASSETVAL and U_{it}.[9]

Working Capital (WORKCAP): The liquidity position of a firm may clearly affect its ability to produce due to the lack of finance for current purchases of raw materials, wage payments to labour or for giving credit to buyers. Therefore, there is likely to be a positive correlation between WORKCAP and U_{it}.

WORKCAP is measured as current assets less current liabilities as percentage of production cost.

Import Policy on Raw Materials (DIMPRAWM1 and DIMPRAWM2) *and Imported Raw Materials as Percentage of the Value of All Raw Materials* (IMPTOT): Dependence upon imported raw materials is one of the most frequently emphasised factors limiting capacity utilisation in the literature [See Winston (1971), Hogan (1967), Kemal and Allauddin (1974),

[9] A correlation was carried out between the average capital-output ratio of an industry and the frequency with which technical problems were mentioned by managers/owners as affecting their operations. The results are as follows:

Let,

T = Percentage of responses on factors restricting capacity utilisation relating to technical problems,

K/Y = Capital-output ratio.

Then, $T = 0.79 + 2.17\,(K/Y)$

(5.91^{*})

$r = 0.79$

*Significant at 1 per cent level.

Kim (1972), Islam (1978) and Wangwe (1977)]. It is our contention, however, that dependence on imported raw materials is not what is important *per se*. What is perhaps more critical is the nature of import policy on raw materials, viz., whether it is liberal or not and if there are any restrictions either on the quantity or on the source. To capture these hypotheses, three variables are defined. The first variable is IMPTOT, value of non-competing imported raw materials in total raw materials, which is the conventional measure of dependence on imports. The other two variables are DIMPRAWM1 and DIMPRAWM2. Both are dummy variables. DIMPRAWM1 takes the value of one when imports are tied by source and DIMPRAWM2 has the value of one when imports can be made only through the Trading Corporation of Pakistan. Both dummy variables have the value of zero when the imports are free and not restricted in any way by the Chief Controller of Exports and Imports. The coefficients of DIMPRAWM1 and DIMPRAWM2 can, therefore, both be expected to be negative.

The type of import policy on raw materials in each industry is given in Table 2. Imports of raw materials for rubber belting, pharmaceuticals, plastics and poultry feed industries are not restricted. In the case of other industries, raw material imports are either source-specific or can be made only through the Trading Corporation of Pakistan.

We turn now to the demand factors.

DEMAND FACTORS

Exports as Percentage of Sales (EXPSALE): Exports can have an influence on capacity utilisation through demand expansion. Therefore, there is likely to be a positive correlation between EXPSALE and U_{it}. The importance of export markets has been emphasised by Winston (1971), Kim (1982), Islam (1978) and others.

Number of Firms in the Industry (NOFIRMS): Winston uses this measure as an index of competition within an industry. He argues that market power can affect capacity utilisation. In oligopolistic industries, firms can substitute either inventory accumulation or excess capacity for price adjustments when faced with demand fluctuations. LeCraw (1978) asserts that the presence of more firms in an industry facilitates greater flow of information about the production process and thereby generates higher efficiency. Therefore, NOFIRMS could be positively correlated with U_{it}. On the other hand, developing countries are confronted with limited markets, and if too many firms enter an industry excess capacity is likely to be created. If so, NOFIRMS and U_{it} may be negatively correlated.

Import Policy on Competing Imports (DIMPCOMP1 and DIMPCOMP2): A restrictive import policy on competing imports implies a high degree of protection to domestic industries. In the short run, this could stimulate output. However, as emphasised by Winston (1974), if such a policy is maintained for a number of years, the artificially high levels of profitability could lead to over-investment in the industry, resulting in a general fall in the rate of capacity utilisation.

The import policy on competing imports has been depicted in the form of two dummy variables, DIMPCOMP1 and DIMPCOMP2. The latter takes the value of one when the imports are tried by source or can be made only through the Trading Corporation of Pakistan. The former has the value of one when imports are banned. Both dummy variables are zero when imports are free on cash resources. Table 2 gives the import policy on competing imports in the sample industries.

The impact of a number of other factors on capacity utilisation rates was also studied in the initial regressions. For example, the effect of changes in domestic demand conditions was tested by defining an index of real Gross National Product for each year of the study. However, this variable did not emerge as significant in the regressions. Other indicators of the stage of the business cycle were also tried without success.

The OWNER variable was defined to see if there was any significant difference in capacity utilisation between Pakistan-owned and foreign-owned firms. It was felt that the latter could do better because of potentially greater access to technology and credit. However, only twelve units in the sample were either wholly or partly foreign-owned. Therefore, there was perhaps not enough variation in OWNER for it to show any significance.

Quality of labour-management relations is another factor which could affect the rate of capacity utilisation. Firms were asked to rank such relations as excellent, good, fair or poor. It appears that there was a generally upward bias in the response as indicated, for example, by the lack of consistency between this ranking and the number of days lost due to strikes and unrest. It is not surprising, therefore, that the variable, DLABMGR, defined to capture the quality of labour-management relations did not do well in the regressions. The DAYSLOST variable, to the extent that shutdowns are caused by trade union behaviour, is a better indicator of the impact of industrial relations on U_{it}.

Winston (1971) had also hypothesised that intermediate and capital goods industries are likely to experience higher rates of capacity utilisation than consumer goods industries, because of the greater diversity in the use of the former. A dummy variable, DINTMGD, was defined to test this hypothesis. However, this variable was virtually insignificant. A similar conclusion was reached by Islam (1978).

DISTRRKA was defined to measure the impact of the distance from Karachi of the plant on U_{it}. It has been argued by Wangwe (1977) that distance makes a difference because of the problems in access to the import licencing authority and banks. In the context of Pakistan, Karachi is the city where not only the head offices of commercial and development banks, stock exchange and the Chief Controller of Imports & Exports are located but it is also the only sea port and greater distance from the port could imply significant transport cost disadvantage for firms that are export-oriented or rely heavily on imported raw materials. However, DISTRRKA did not emerge as significant in the regressions.

A number of other location variables were also included. It was hypothesised that firms located in the backward areas of Pakistan, like Baluchistan and the N.W.F.P., may have greater difficulties in capacity utilisation because of poorer access to infrastructure and shortages of skills. Here again the problem was that there were only 15 units in the total sample located in such areas. The lack of variation in the location variables, therefore, may have rendered them insignificant in explaining U_{it}.

It was not possible to include explicitly the extent of night-time wage differential, a popular variable in the capacity utilisation literature, due to serious measurement problems. Firms which operated only one shift clearly did not have any conception of the magnitude of this differential. Even firms which operated multiple shifts had difficulty in indicating what this differential was, as they generally had a policy of rotating labour among shifts. Measurement problems in this variable have also been emphasised in a recent paper by Farooq and Winston (1973). In their sample, 87 per cent of the workers either worked a normal 8-hour day time shift or were rotated over three shifts. It is likely, however, as discussed earlier that other factors included in the analysis are capturing indirectly the impact of night-time shift differentials in wages on the rate of capacity utilisation.

VI. Results of Regression Analysis

Separate regressions using the above mentioned variables were run for U_i, U_t and U_{it} for batch-making and continuous process industries respectively. The objective of running the separate regressions for each type of industry was to determine respectively the factors which influence the number of shifts operated by a firm, the intensity with which these shifts are operated and the overall rate of capacity utilisation.

A stepwise regression procedure was adopted. Initially, only demand variables like share of exports in total sales (EXPSALE), extent of competition within the industry (NOFIRMS) and import policy on competing imports (DIMPCOMP1, DIMPCOMP2), were included in the regression. These variables were able to explain about 16 per cent and 9 per cent respectively of the variation in the rate of capacity utilisation among units in the two types of industries. The F-test of the significance of this group of variables revealed that they were not significant for units in continuous process industries.

Another regression was run incorporating only supply variables like effective rate of taxation of output (ERTO), year of commencement of production (YEARPROD), type of ownership (DPUBPRI), extent of days lost due to unplanned factors (DAYSLOST), total employment and its composition (SIZE, SKILLED, MANAGER), capital-intensity and plant balancing (ASSETVAL, DBALANCED), extent of dependence on imports and nature of import policy on raw materials (IMPTOT, DIMPRAWM1, DIMPRAWM2) and availability of working capital (WORKCAP). These variables are listed in Table 4 and 5. Altogether, the supply variables were

TABLE 4

Results of regressions[a] for sample units in batch-making industries
(All variables, except dummy variables, are in logarithmic form)

	U_t		U_i		U_{it}	
	β	t-ratio	β	t-ratio	β	t-ratio
Demand Variables						
LEXPSALE	0.085	3.488*	0.146	5.103*	0.231	6.652*
LNOFIRMS	0.030	0.795	0.125	2.799*	0.155	2.982*
DIMPCOMP1	−0.024	−0.308	0.143	1.574	0.119	1.023
DIMPCOMP2	0.338	2.946*	0.473	3.534*	0.811	4.863*
Supply Variables						
LERTO	−0.045	−8.325*	−0.012	−1.878	−0.057	−8.972*
YEARPROD	−0.083	−1.140	0.188	2.209**	0.105	0.863
DPUBPRI	0.578	4.655*	−0.117	−0.806	0.461	2.998*
LDAYSLOST	−0.062	−2.265**	−0.064	−2.015**	−0.126	−3.532*
LSKILLED	0.184	2.428**	0.182	2.056**	0.366	3.689*
LMANAGER	−0.190	−4.380*	0.156	3.072*	−0.034	−0.828
DBALANCED	0.055	0.788	−0.121	−1.482	−0.066	−0.546
LSIZE	−0.048	−0.595	0.119	3.918*	0.071	2.672*
LASSETVAL	0.090	2.331**	0.058	1.308	0.148	2.723*
DIMPRAWMI	−0.226	−2.346**	−0.136	−1.201	−0.362	−2.496**
DIMPRAWM2	−0.465	−2.805*	−0.087	−0.452	−0.552	−2.198**
LIMPTOT	0.029	1.238	0.012	0.456	0.041	1.322
LWORKCAP	−0.011	−0.105	0.517	3.904*	0.506	2.878*
CONSTANT	4.296		1.181		5.477	
$\bar{R}^2$	0.387		0.487		0.428	
Degrees of Freedom	313		313		313	
F-ratio	10.431		15.323		12.378	

*Significant at the 1 per cent level. ** Significant at the 5 per cent level.

[a] In view of the substantial non-response in 1970 and 1971, particularly on the part of small-scale units and units that were nationalised in 1973, regression analysis has only been carried out for the period, 1972 to 1976,

able to explain about 27 per cent and 34 per cent respectively of the variation in U_{it} in the two types of industries. F-tests demonstrated the overall significance of this group of variables in both cases.

The pooling together of demand and supply variables increased the overall explanatory power to about 42 per cent for both types of industries. However, based on the above results it seems fair to conclude that supply factors have played a more important role than demand factors in influencing the rate of capacity utilisation in the industries covered by the study.

TABLE 5

Results of regressions[a] for sample units in continuous process industries
(All variables, except dummy variables, are in logarithmic form)

	U_t		U_i		U_{it}	
	β	t-ratio	β	t-ratio	β	t-ratio
Demand Variables						
LEXPSALE	0.031	0.992	0.086	2.072**	0.117	2.223**
LNOFIRMS	0.039	0.346	0.006	0.051	0.045	0.372
DIMPCOMP1	−0.111	−0.636	−0.143	−1.040	−0.254	−1.582
DIMPCOMP2	−0.097	−0.793	−0.267	−2.616*	−0.364	−2.782*
Supply Variables						
LERTO	−0.006	−0.710	0.030	0.810	0.024	0.086
YEARPROD	0.104	0.517	0.326	2.012**	0.430	2.108**
DPUBPRI	0.246	2.923*	−0.151	−1.550	0.095	1.118
LDAYSLOST[b]	—	—	0.042	0.020	0.042	0.012
LSKILLED	0.186	1.278	0.230	1.526	0.416	2.064**
LMANAGER	0.085	1.369	0.034	0.510	0.119	1.683
DBALANCED	0.244	2.381**	0.287	3.034*	0.531	3.982*
LSIZE	0.080	2.338**	0.043	1.601	0.123	2.756*
LASSETVAL	−0.094	−1.100	0.048	0.970	−0.046	−0.068
DIMPRAWM1	0.104	0.907	0.021	0.005	0.125	0.738
DIMPRAWM2	0.007	0.055	0.062	0.182	0.069	0.206
LIMPTOT	0.055	1.387	−0.031	−0.720	−0.024	−0.613
LWORKCAP	0.273	5.512*	−0.071	−0.872	0.202	3.433*
CONSTANT	1.426		3.682		5.108	
$\bar{R}^2$	0.743		0.263		0.417	
Degrees of Freedom	105		105		105	
F-ratio	16.897		7.856		11.123	

* Significant at the 1 per cent level. ** Significant at the 5 per cent level.

[a] In view of the substantial non-response in 1970 and 1971, particularly on the part of small-scale units and units that were nationalised in 1973, regression analysis has only been carried out for the period, 1972-76.

[b] In the case of continuous process industries, variations in U_t are due to variations in the number of days lost due to unplanned factors, DAYSLOST. Therefore, the regression on U_t is run essentially to determine factors influencing the magnitude of DAYSLOST. As such, since DAYSLOST is the dependent variable, it has, by definition, to be excluded from the set of explanatory variables.

Analysis of individual variables indicates that six variables – EXPSALE, DIMPCOMP, SKILLED, DAYSLOST, SIZE, WORKCAP – were significant in both types of industries. Critical inputs to production appear to be availability of skilled labour and working capital while the major factors contributing to days lost by firms are labour strikes, plant lockouts, power shortages, unplanned holidays and breakdown of machinery. On the demand side, access to export markets and competition from imports are the major factors influencing the rate of capacity utilisation. It is interesting to note that in the case of continuous process industries there are indications that restrictions on competing imports have led to some over-investment, a factor highlighted by Winston (1971). Another important finding of the analysis is that capacity utilisation tends to increase with the size of the unit measured in terms of employment per shift.

There are a number of variables which are significant only in one type of industry. In batch-making industries, extent of competition, measured in terms of NOFIRMS, seems to increase efficiency in utilisation of capacity. It is of interest to note that in such industries units in the public sector appear to be able to achieve higher rates of capacity utilisation than their counterparts in the private sector. This is some vindication of the performance of the public sector in Pakistan although it could be due to preferential access to inputs. Other variables which have affected the extent of capacity utilisation in batch-making industries but were insignificant in the context of continuous process industries are ERTO, ASSETVAL and DIMPRAWM1 and DIMPRAWM2. As hypothesised, the latter two variables relating to the nature of import policy on industrial raw materials were significant whereas the variable, IMPTOT, measuring the extent of dependence on imported raw materials, was not.

Machinery-related factors, as expected, appear to have a greater impact on U_{it} in continuous process industries. For example, the year of commencement of production, YEARPROD, was directly correlated with U_{it} for such industries. In particular, firms with more recent vintages of capital were able to achieve higher intensity of operations, U_i. Also, plant balancing was an important factor in continuous process industries. Plants which were reported as being balanced appeared on the average to be able to achieve significantly higher rates of capacity utilisation.

Turning to an examination of the impact of different variables on U_t and U_i separately in the two types of industries we have that two factors were significant in both types of industries in explaining variation in the former. These are DPUBPRI and DAYSLOST. Firms in the public sector generally operated more shifts than those in the private sector. The impact of DAYSLOST was proportional in the case of continuous-process industries whereas in the case of batch-making industries the results indicate that some of the time losses were recovered subsequently. This is indicated by the low magnitude of the regression coefficient of 0.062 of the DAYSLOST variable which is significantly less than the average proportion of days available in batch-making units in the sample that were lost due to unanticipated factors.

It is also of interest to note that besides the two factors mentioned above there were a large number of other variables affecting U_t in batch-making industries. EXPSALE, ERTO, SKILLED, ASSETVAL tend to raise U_t while MANAGER depressed it. The last result, in particular, is consistent with the statement of Marris (1964) that managers experience a strong disutility from night-time work and, therefore, management-intensive plants, other things being equal, are likely to operate fewer shifts.

In the case of units in continuous process industries other variables, besides DPUBPRI and DAYSLOST, affecting U_t were DBALANCED, SIZE and WORKCAP. All these variables were directly correlated with U_t. There is some evidence, therefore, in the case of such industries that larger plants are able to work more shifts.

With regard to factors influencing the intensity of operations, U_i, three variables, viz., EXPSALE, DIMCOMP2 and YEARPROD, were significant in both types of industries. Increase in the share of exports in sales probably raises U_i as firms attempt to execute their orders in time. Also, as mentioned earlier, the YEARPROD variable indicates that plants with more recent vintages of machinery are generally able to achieve higher intensity of operations without experiencing interruptions due to breakdowns.

Other variables significantly influencing U_i were SKILLED, MANAGER, SIZE and WORKCAP in batch-making industries. There is some evidence here that in such industries larger plants are able to achieve higher intensity of operations. In the case of continuous process industries, DBALANCED had some impact on the magnitude of U_i.

It is of interest to note that disaggregation of U_{it} into U_t and U_i highlights the role of factors which are passive in terms of their impact on U_{it} but are, in fact, playing a significant role in influencing U_t and U_i in opposite directions such that the separate effects, more or less, cancel each other out. The analysis carried out in this paper does reveal the existence of such variables. Perhaps the most vivid example is that of MANAGER. The results indicate that in both batch-making and continuous process industries, this variable is insignificant in explaining variations in U_{it}. However, in the case of former group of industries, it significantly reduces U_t but simultaneously raises U_i, such that the overall impact on U_{it} is negligible. Other variables which appear to possess this property are YEARPROD in batch-making industries and DPUBPRI, ASSETVAL and IMPTOT in continuous process industries.

VII. Industry's Perception of Problems in Capacity Utilisation

As mentioned earlier the questionnaire administered on the sample units also elicited information from the owners/management about problems confronted by them in full utilisation of their plant capacities. It was hoped that the quantitative impact or the ranking of importance of different factors could be obtained. However, in most cases respondants were only able to list the factors each year which they perceived had affected capacity utilisation. An analysis has been carried out of the importance of different factors in Table 6. Factors were grouped into two categories, viz., supply and demand factors.

The supply factors relate to problems with raw material availability, labour (industrial relations, absenteeism, low productivity, availability of skills), machinery (technical problems, breakdown), infrastructure (shortages of electricity, transport, gas, etc.,) and finance for working capital. The demand factors are international recession (restricting exports), presence of competing imports, domestic competition and recession (limiting internal demand). Random factors have also been incorporated in the analysis to capture the impact of the war between India and Pakistan in late 1971 and the severe floods of 1973.

As indicated in Table 6, supply factors clearly appear to dominate the perceptions about problems in capacity utilisation. 69 per cent of the responses from the total sample of units related to supply factors. Within supply factors, the most frequently mentioned problems were with respect to availability of raw materials, labour-management problems, low labour productivity and absenteeism, shortages of skilled labour and breakdown of machinery. In some industries like cement and fertilizer, infrastructural bottlenecks, particularly relating to availability of gas and transport, were highlighted.

Approximately 26 per cent of the responses related to demand factors. The most commonly mentioned problem in this category related to the slack in domestic economy due to the recession that the country has witnessed since 1971, a factor which did not emerge as very significant in the econometric analysis. Next in importance was competing imports, although this factor accounted for only about 5 per cent of the total response.

Industries which appeared to be particularly vulnerable to supply factors were scooter tyres and tubes, cycle tyres and tubes, sulphuric acid, soda ash, plastic goods, asbestos cement, sheet and hollow glass, surgical instruments and marble goods. It is interesting to note that even though the last two industries are export-oriented, it is not demand but supply factors which had a greater impact on their rate of capacity utilisation.

Industries which were relatively more susceptible to demand conditions

TABLE 6

Perception of firms of importance of different factors in affecting capacity utilisation

Industry	Supply Factors								Demand Factors						Random Factors			
	Raw Materials	Labour[a]	Skills	Technical[b]	Infrastructure[c]	Finance	Others	Total	International Recession	Competing Imports	Domestic Competition	Domestic Recession	Others	Total	War	Natural Calamities	Total	Overall Total
Batch-making																		
Scooter tyres and tubes	41.2	23.4	–	–	–	10.8	–	75.4	–	26.4	–	–	–	24.6	–	–	–	100
Cycle tyres and tubes	66.7	–	–	–	–	33.3	–	100.0	–	–	–	–	–	–	–	–	–	100
Rubber belting	14.3	28.6	–	–	–	–	–	42.9	–	14.3	–	28.6	–	42.9	14.2	–	14.2	100
Miscellaneous rubber products	22.6	12.9	3.2	6.4	12.9	6.4	–	64.4	16.1	–	13.0	6.5	–	35.6	–	–	–	100
Starch	8.7	26.1	–	4.3	13.0	17.4	8.7	78.2	–	–	8.7	13.1	–	21.8	–	–	–	100
Pharmaceuticals	15.7	11.1	–	1.9	0.9	2.8	29.7[d]	62.0	–	24.0	3.8	10.2	–	38.0	–	–	–	100
Plastic goods	35.7	17.9	1.8	7.1	10.6	8.9	–	82.1	–	–	7.2	5.4	5.3	17.9	–	–	–	100
Asbestos cement	28.2	11.3	–	8.6	19.2	8.4	–	75.7	–	–	–	24.3	–	24.3	–	–	–	100
Refractories	25.0	8.3	16.7	–	–	16.7	–	66.7	–	–	8.3	16.7	–	25.0	–	8.3	8.3	100
Hollow glass	25.0	15.0	19.0	1.8	8.9	3.6	–	73.3	–	5.4	7.1	12.4	–	24.9	1.8	–	1.8	100
Pottery and ceramics	23.5	14.7	5.9	–	10.2	–	4.2	58.5	–	5.9	17.6	5.9	5.9	35.3	–	6.2	6.2	100
Surgical instruments	21.7	22.9	3.6	6.1	9.7	2.4	5.4	71.7	16.9	–	–	5.9	–	22.8	5.5	–	5.5	100
Sports goods	20.8	16.7	5.6	–	–	11.1	–	54.2	27.7	–	–	11.1	–	38.8	7.0	–	7.0	100
Poultry feed	55.6	11.1	–	–	–	–	–	66.7	–	–	–	33.3	–	33.3	–	–	–	100
Marble goods	20.0	8.0	20.0	10.0	4.0	8.0	–	70.0	20.0	–	–	8.0	–	28.0	–	2.0	2.0	100
Continuous process																		
Caustic soda	11.7	16.4	13.9	17.4	10.0	–	–	69.5	–	17.4	–	–	4.4	21.8	8.7	–	8.7	100
Soda ash	–	20.0	–	13.3	16.7	–	–	50.0	–	–	–	50.0	–	50.0	–	–	–	100
Sulphuric acid	11.1	11.1	–	22.2	11.1	11.1	11.1	77.7	–	–	–	22.3	–	22.3	–	–	–	100
Plastics	12.5	12.5	–	25.0	–	–	–	50.0	–	10.0	–	30.0	–	40.0	5.0	5.0	10.0	100
Synthetic fibres	17.2	20.3	–	17.2	7.3	–	3.5	65.5	–	20.7	–	6.9	–	27.6	3.5	3.4	6.9	100
Fertilizer	4.4	8.7	4.4	17.1	26.1	4.4	–	65.1	–	9.0	–	–	–	9.0	13.0	12.9	25.9	100
Cement	26.9	7.7	–	11.5	23.1	–	–	69.2	–	–	–	19.2	–	19.2	7.4	4.2	11.6	100
Sheet glass	–	–	50.0	30.0	20.0	–	–	100.0	–	–	–	–	–	–	–	–	–	100
Average for above industries	22.0	14.2	6.2	8.7	8.9	6.3	2.8	69.0	3.5	5.7	2.9	13.5	0.7	26.3	2.9	1.8	4.7	100

[a] Strikes, plant lockouts, absenteeism, low productivity, etc.
[b] Machinery breakdown, imbalanced plants complexity of technology, etc.
[c] Gas and power supply, availability of rail and road transport, etc.
[d] Impact on production resulting from the introduction of the Generics Scheme.

were rubber belting, soda ash, plastics and pharmaceuticals. It is interesting to note that, except for the last industry, these industries are manufacturing intermediate and not consumer goods. Therefore, there is no apparent correlation between the type of industry and the importance of demand factors.

In summary, it can be said that both approaches come up with consistent conclusions about the impact of different factors on capacity utilisation. Both highlight the importance of supply factors in relation to demand factors in restricting the rate of capacity utilisation achieved. Within the former the importance of raw material, labour, technical and infrastructure related factors has been emphasised by both approaches.

VIII. Policy Implications

The analysis carried out above has given an indication of the principal factors which have influenced the rate of industrial capacity utilisation in Pakistan in the '70s. Given the recommended shift from investment planning to production planning, so as to revive the industrial sector in the short run, it is now possible to spell out the key components of the latter. It is essential, however, to emphasise that the policy package ought to be applied on a selective basis. Higher capacity utilisation should only be encouraged in those industries which are generally perceived to be socially desirable. Indiscriminate across-the-board application of production incentives could also stimulate industries which are low in national priorities and lead to a wasteful diversion of capital, foreign exchange and human resources.

The principal findings of the research are that almost half the capacity in the study industries is lying idle and that supply factors are primarily responsible for creating this excess capacity. These findings demonstrate that there exists substantial scope for domestic policies for bringing about industrial revival. The relative lack of importance of demand factors, particularly international, even in export-oriented industries, indicates that national planning need not wait for the recovery of the international economy from recession. Since supply factors are mostly domestic in origin the implication is that if a determined effort is made to remove some of the bottlenecks then rapid progress can be made in bringing about the process of industrial revival in the country.

The key supply factors which appear to be constraining utilisation of capacity relate to raw materials and labour. It has been pointed out that it is not dependence *per se* on imported raw materials which seems to matter but rather it is the nature of the import policy which influences the availability of raw material. The case for making more favourable allocations of foreign exchange to existing plants for importing raw materials is clear. In this connection, depending upon inter-industry priorities, the import policy on some raw materials could be liberalised. Items previously importable on the barter or tied lists could be transferred to the category of cash imports.

Labour related problems are potentially more difficult to handle in the context of the climate of industrial relations in the country. During the '70s, there has been a decline in the quality of labour-management relations which has increased the frequency of strikes, lockouts and go-slows and increased the number of days lost due to these factors. Many of the sample firms have reported that absenteeism has increased and have generally complained about low labour productivity. Also, shortages appear to have emerged in a number of skills. The latter problem may have been exacerbated after 1975 when large-scale migration to the Middle East started.

There is need for a fundamental review of the labour legislation enacted in the '70s which may have altered the balance of power in industry to the extent that production orientation both on the part of management and labour has decreased. In addition, new incentive schemes of wage renumeration need to be tried whereby higher absenteeism is penalised and greater productivity at work adequately rewarded. It is also possible that the Government may offer special inducements in the form of tax rebates, etc., on expenditure by firms in training their labour.

It has been demonstrated that a sizeable proportion of days lost by industry are due to power and gas shutdowns and transport bottlenecks. While there has traditionally been some emphasis in planning on providing infrastructure and facilities to new plants this has frequently come at the expense of existing units. Such discrimination will have to be stopped and new investments sanctioned only if proper provision for the supply of power, gas, water, transport, etc., has been made for plants already in operation.

Also, high rates of effective taxation in some industries have been highlighted. An examination of fiscal policy in industry is warranted to determine the extent to which revenue expediency has created a trade-off with respect to production. Following such examination, the tax structure in some industries may be rationalised.

The study has indicated the technical problems associated with the operation of machinery particularly in capital-intensive plants embodying relatively complex technology. In such industries, import of spare parts and machinery for balancing and modernisation purposes should be liberalised and put under concessional terms. Financial institutions may be encouraged to allocate loans on a preferential basis for such investments which are likely anyway to yield high returns and possess strong commercial justification. For smaller firms, in particular, lacking adequate production management expertise, financial institutions may also be induced to offer subsidised management extension services.

Finally, the study has highlighted the difficulties which small firms experience in relation to large units in utilising their capacity. Part of the reason is the more privileged access of the latter to infrastructure, capital and licences for raw materials. Liberalisation of bank credit and import of raw materials are, therefore, likely to be two policy measures which could reduce the competitive disadvantage of small firms and make them more efficient in utilising capacity. The case for liberalisation of credit is justifiable not only on equity grounds but also because the results indicate that the availability of working capital is a major factor limiting the extent of capacity utilisation.

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