"UTILISATION OF INDUSTRIAL CAPACITY AND EMPLOYMENT PROMOTION IN KENYA'S MANUFACTURING SECTOR"

by

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This Research Paper is my original work and has not been presented for a degree in any other University.

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Abstract.

The need for faster rates of growth of both output and employment in Kenya strongly calls for a fuller utilisation of the existing capacity of the industrial sector. It is generally known that there is widespread underutilisation of capacity in the manufacturing sector of the economy.

The major aims of this study was to evaluate the feasibility and desirability of increasing capacity utilisation in the industrial sector in Kenya. The study attempted to do this by evaluating some of the methods and measurements used in estimating the level of capacity utilisation. It was expected that capacity utilisation would be significantly affected by the level of labour productivity, labour intensity, market concentration, competing imports, change in output stocks and the level of profitability.

The major findings of the study are that

(a) increase in labour productivity increases the level of capacity utilisation in beverages and tobacco, textile and clothing, leather and leather products industries.

(b) market concentration and labour intensity are insignificant factors in determining the level of capacity utilisation in Kenya's manufacturing industries over time.

(c) the effects of competing imports gives a mixture of results in different industrial groups over time.

(d) change in output stocks and the level of profitability have no significant impact on the level of capacity utilisation over time.

From our regression analysis using student's t-statistic values and the coefficient of determination, no clear case emerges for any policy bias towards capacity utilisation in Kenya's manufacturing sector. This inconclusiveness may be due to possible multicollinearity between some of the variables such as labour productivity and market concentration and also due to the type and quality of available data.

Nevertheless, the estimates made in this study suggest that employment and output could be expanded considerably if fuller capacity utilisation was achieved. The conclusion is drawn that capacity utilisation policy must be an integrated combination of measures including tax rates being linked to the number of production shifts and external trade taxes and subsidies to promote a greater substitution of local materials for presently foreign produced intermediate inputs.

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CHAPTER I

INTRODUCTION.

1:1. General Overview

The manufacturing sector in Kenya, and in a number of other less developing countries (LDCs), have displayed a high growth rate in output in the past. However, this has been accompanied by a relatively low rate in the absorption of labour in the sector. A coefficient used to measure the rate of labour absorption is the elasticity of employment with respect to output. All estimates of this elasticity coefficient for Kenya's manufacturing sector are less than unity, meaning that average rate of growth is lower for employment than for output.[1]

One reason which has been put forward in an attempt to explain the differential rates of growth between output and employment is that, firms adopt techniques of production that are in variance with relative factor endowments in LDCs. Crucial to this explanation is the assertion that wages are set at rates that are higher than the social cost of labour as well as the private opportunity cost in terms of the value of the marginal product of labour. This may be due to the influence of the government sector through its various laws and regulations that apply to the labour market, for instance, the minimum wage law. Secondly, there is the influence of the trade unions, whose objectives are to raise wages received by their members (workers) as much as possible and, thirdly, firms may pay wages that exceed labour productivity on their own without outside pressure if they have the ability to do so, and in order to ensure low turnover of labour and to achieve political good will.

Another reason which may contribute to factor distortions in production is that, capital is highly subsidized through low interest rates, investment allowances, low import duties for capital goods and other government incentives aimed at reducing the price of capital.

More recently, investigations in LDCs have revealed that while capital is scarce in these economies, a great proportion of it is being unutilised. Mouly and Costa's study reveals that the percentage of unutilised industrial capacity in developing countries is tremendous and ranges from 30 percent to 65 percent.[2] Their study argues that, with only a few exceptions like the textile industry and industries with technological process, a single shift system is the rule in Africa. In most cases estimates of capacity utilisation are on single shift basis. This argument is supported in Kenya's 1979-1983 Development Plan by the statement:

> "Much industrial capacity is presently used on a one shift basis when the potential is there for two or even three shift operation. The present style of operation in many cases could be more effectively organized and more efficiently managed."[3]

Both the Development Plan 1979-1983 and Mouly and Costa's study conclude that, increasing capacity utilisation of industrial capital will have an effect on the rate of growth of employment and of output in the industrial sector. This in effect may reduce the problems, facing most of the LDCs, of unemployment, poverty and economic growth. The prevailing expert opinion, agrees that, the scope for stimulating employment in the manufacturing sector in LDCs hinges on the use of existing productive capacity more fully, especially through shift working and choice of labour intensive production techniques, where the choice is available.[4]

1:2. Nature of the Problem

Increasing attention is being devoted to the serious unemployment problems in the less developing countries (LDCs) by a variety of institutions and individuals. In particular, the International Labour Office through its World Employment Programme (WEP), has been at the forefront of research efforts dealing with various aspects of these problems.[5] One of these efforts is the feasibility of emergency employment schemes that can alleviate the unemployment problems in the shortrun while more permanent solutions are formulated.[6] This study attempts to analyse the aspect of fuller utilisation of industrial capital as a method to generate more employment in Kenya.

The employment problem with all its subsequent social, political and economic problems, is becoming more serious in nearly all LDCs. And due to its multididimentional implications, the governments are putting much effort in an attempt to alleviate the problem. In Kenya, for example, the government has concluded several tripartite agreements with the employees and the trade unions. The purpose of these agreements is to increase labour absorption in all sectors by a certain percent.[7] The trade unions agree that there will be no demand for wage increase for a period of time. The first agreement signed in 1964 aimed to

> "alleviate the hardship being experienced by the unemployed and to provide the government with a breathing space in which to get its plans for economic development".[8]

Again the 1970 tripartite agreement recognised the need to take emergency measures to alleviate unemployment, it acknowledged that the measures to be taken were short-term and accepted that the ultimate solution lies in the implementation of the long-term plans to expand the economy.[9] The same view is at the core of the 1979 tripartite agreement.

It is argued that the growth of industrial production and employment is usually affected by the level of capital formation, labour itensity and effective utilisation of industrial equipment. In LDCs an increase in the rate of capital accumulation is expected to play a decisive part in the promotion of industrial development. Thus, generally speaking, with a given rate of capital accumulation, any additional increase in employment over and above that associated with this particular rate of capital accumulation is possible only if more labour-intensive production techniques are applied. But these have the effect of limiting the level of labour productivity in newly constructed plants.

The ILO report on Kenya concludes that, the six to seven percent growth in the economy's GDP is no protection to increasing unemployment problems due to inappropriate technologies used in production processes and rising wages, increasing productivity so rapidly that economic growth is robbed of its power to increase the number of jobs faster than the labour force growth. A study done by Rempel (1974) on Kenya's labour force indicates that the unemployment gap has been increasing and the trend is expected to continue unless something is done by the government.[10] Table 1:1 below shows the rates of growth in labour force, employment and in unemployment. The results show that the absorption rate is very much below the labour force growth, indicating more problems for the future.

Table 1:1

The Growth of Unemployment in Kenya

Year	Estimated growth in Labour force (%)	Growth in employment (%)	Growth in the unemployment gap
1965	4.64	1.16	5.52
1966	4.80	0.56	5.80
1967	4.77	2.06	5.39
1968	-4.27	1.49	-5.54
1969	14.8	3.3	17.49
1970	4.9	2.76	5.33
1971	4.93	7.24	4.45
1972	4.97	4.14	5.14
1973	5.01	5.78	4.85
1974	5.05	8.52	4.33
1975	5.09	-0.87	6.39
1976	4.73	4.65	4.75
1965-1976*	4.39	3.06	4.70

Note:

* For the whole period, a compound growth rate is estimated for the growth in labour force, employment and the unemployment gap, using the exponential growth rate equation $Ln = Lo\,e^{rt}$ for which 1965 is taken as the base period and 1976 as the current period.

Source Rempel, H., "An estimate of Kenya's labour force." Institute for Development Studies, University of Nairobi. Working Paper No. 159, 1974.

Kenya's Fourth Development Plan has estimated that the population of working age will be increasing by 266,000 a year over the plan period. And, of this number, only 50,000 can be absorbed or expected to find work in the recorded modern sector each year, leaving about 216,000 for the traditional sector.[11]

However, policies need to be adopted to reduce the future magnitude of the problem in two of its many dimensions. Policies, needing to be formulated, are those which would create employment for the unemployed group in rural and urban areas and those which would improve productivity of the already employed group. The latter arises when people work for fewer hours than they would want to, or their rewards are less than their marginal productivities. The above brief analysis of the employment problem calls for policies having the objective to increase capacity utilisation besides policies having the objective simply to increase the number of available jobs.

A major problem in LDCs is that capital (and even labour) is not fully utilised and one of the major bottlenecks to labour absorption especially in the manufacturing sector is not due to lack of capital but due to excess capacity in the production process. Firms are said to be producing less than the planned output which is even far much below the maximum attainable output that can be obtained by the firms. Studies have shown that there is widespread underutilisation of capital in LDCs.

In Kenya, the ILO mission study indicated that there is widespread underutilisation of capital in Kenya, measured in number of shifts worked as compared with those desired by the managements.[12] These findings were similar with those of the Special Survey,[13] though the ILO came out with the results that total gross product would have been 11% higher if all firms had been working at their own prefered levels and 100% to 135% higher if capacity utilisation had been pushed to a maximum.[14] The ILO report argued that the low levels of capacity utilisation had damaging consequences on economic growth and on labour absorptive capacity in the economy. Operating below capacity results in unnecessarily high costs of production, leading to high selling prices, which in turn means low domestic sales and loss of competitiveness in the foreign markets.

1:3. Significance of the Study

The subject of this study can be of great importance both to development economists as well as to economic planners and policy makers. It is a particularly important subject in Kenya in view of increasing employment problems and the socio-economic implications of the rural-urban drift which has caused major worries to economic planners in

Kenya. The results of this study may help to improve the overall policy making related to the industrial sector and to the whole economy.

Increasing productive employment is a major development objective in Kenya. Increasing capacity utilisation in the industrial production can be a useful policy target whereby employment can be increased without increasing the amount of capital required for production. This is mentioned in the current Development Plan 1979-1983, but without further explanation as to how employment can be increased through better or greater utilisation of industrial capacity. The Plan has this to say

> "There is substantial evidence that much of the nation's productive capacity is not now working at full capacity. And hence this could be a source of more rapid and widespread growth."[15]

The main objectives of the study is to evaluate the feasibility and desirability of increasing capacity utilisation in the industrial sector in Kenya. The study attempts to do this by investigating the major factors that influence the level of capacity utilisation in a particular period and over time and, secondly, to propose that employment creation can be increased if greater capacity utilisation can be induced by economic planning and the effects of policies.

1:4 Plan of the Remainder of the Paper

Having stated the problem, the significance of the study, and the main objectives, a brief outline of the remainder of the study is now presented.

Chapter II fulfils two main tasks. First, the theoretical background on capacity utilisation will be discussed. This will include the various definitions of capacity and the various measurements of capacity utilisation in the current economic literature. Secondly, the paper will analyse the empirical studies on capacity utilisation in some of the LDCs.

Chapter III is a presentation of the various hypotheses of this study, a discussion of the methodology and data sources. Finally, Chapter IV is a discussion of the results of the study, conclusions and limitations of the study.

FOOTNOTES

1. Estimates of the elasticity of employment with respect to output are 0.4 for the decade of the 1960s and 0.8 for 1967-71 as reported, respectively, in International Labour Office, Employment Incomes and Equality : A strategy for increasing productive employment in Kenya. Geneva, ILO, 1972, and World Bank, Kenya: Into the Second Decade, Baltimore and London, The John Hopkins Press, 1975, p.267. According to L.P. Mureithi in his "Employment, Technology and Industrialisation in Kenya : A study in development strategy,"PhD. Thesis, 1973,p.5, the average annual rate of growth of output from the manufacturing sector in Kenya for the years 1964-70 was 12.7% and the average annual rate of growth of employment in the same sector during the same period was only 3.6%, implying an elasticity coefficient of less than 0.3. The elasticity coefficient is even lower, however, in other productive sectors of the economy, according to these studies.

2. J. Mouly and E. Costa, Employment Policies in Developing Countries, George Allen and Unwin Ltd., London, 1974. p. 47.

3. Kenya Government, Development Plan 1979-1983 Part 1, Government Printer, Nairobi, 1979. p. 12.

4. More detailed analysis of the choice of product and choice of technique for manufacture is in E.O. Edward, Employment in Developing Nations. New York, Columbia University Press, 1974. pp. 103-104.

5. A description of these research efforts is available in International Labour Office, World Employment Programme, Research in Retrospect and Prospect, Geneva, 1976.

6. Ibid., pp. 70-75.

7. The first tripartite agreement was in 1964. And the government was to expand employment by 15% while private employers were to expand by 10%. The second agreement was in 1970, the government and the employers agreed to expand employment by 10%.

8. Kenya Government, Ministry of Labour, Manpower Branch, Report on the tripartite agreement on measures for the immediate relief of unemployment. 1970, p.94.

9. F. Stewart has tried to show that these agreements (1964 and 1970) had little or no long-term impact on the demand for labour or on the unemployment problem. See ILO, 1972, op.cit., pp.529-543.

10. See Henry Remple, "An estimate of Kenya's labour force." Institute for Development Studies, University of Nairobi, Working Paper No. 159, 1974.

11. Kenya Government: Fourth Development Plan, 1979-1983 op.cit., pp. 12 - 13.

12. ILO, Employment Incomes and Equality: A strategy for increasing productive employment in Kenya, 1972, op. cit., pp. 182-184.

13. This special survey was undertaken by the Central Bureau of Statistics, Ministry of Finance and Economic Planning, in Co-operation with research workers at the Institute for Development Studies, University of Nairobi, and the ILO mission. The survey was limited to firms employing 50 or more workers.

14. ILO., Employment, Incomes and Equality: A strategy for increasing productive employment in Kenya, 1972, op.cit., p. 182.

15. Kenya Government: Development Plan 1979-83, Part 1, op.cit., p.12.

CHAPTER II

SURVEY OF MEASUREMENTS OF CAPACITY UTILISATION

2:1. Theoretical Background.

The factors which cause fluctuations of industrial employment have been closely analysed in some of the less developing countries (LDCs).[1] The main reasons given are basically, the underutilisation of industrial equipment, the choice of production technique and the choice of products for manufacture.[2] This paper will pay considerable attention to the factors that affect underutilisation of industrial equipment. The choice of production technique and the choice of product for manufacture is beyond the scope of this paper.

However, the various capacity concepts and measurements suggest that different conclusions on the level of capacity utilisation can be made. Sometimes, capacity utilisation is measured by calculating the 'unemployment rate', so to speak, of tangible capital goods. Alternatively, it is measured by comparing current output with some hypothetical output that would be produced if conditions were different. These various measures of capacity utilisation are discussed in section 2:2 of this chapter.

Some authors of the existing literature have argued that, the failure of the industrial sector to absorb more of the labour force in the less developing countries (LDCs) has been due to lack of capital. The argument is that capital accumulation will lead to an increase in output which would consequently raise the level of employment.[3] Other people have argued that, although the investment funds are scarce, evidence shows that, there is tremendous excess capacity in capital-scarce economies.

> "If shortages of capital equipment is the major constraint to economic growth and industrialisation, then it is a paradox of no small significance that in the typical underdeveloped economy, the existing stock of industrial capital is left idle most of the time. If installation of capital equipment does not lead to its use, then it is clear that savings and investment in physical capital cannot be the most critical aspect of development."[4]

Using a simple Harrod-Domar model

$$g = {}^{S}/_{V}$$

where g = the growth in the economy (growth in output)

S = the average propensity to save

V = the capital-output ratio

then the higher the growth rate, the more productive capital is, and the higher is the rate of savings. That is, we can raise g by raising the savings ratio, S and by lowering the capital-output ratio, V.

If it happens that not all capital is used, or, all the capital is used only part of the time, the total amount of capital that must be installed to produce a unit of output is increased. If on the other hand capital is used only half of the time then (assuming no scale economies) twice as much capital stock is required to achieve a given level of production. Or putting it the other way round, half as much output will be produced from a given stock of capital. More generally, capital stock is used P proportion of the time where P is positive but less than unity.

And the utilisation adjusted output - capital ratio - the one that is actually required at the hypothesized level of utilisation of capital is:

$P\sigma$, (where σ = the Output-capital ratio) and the rate of growth[5] is given by:

$$g = P\sigma S.$$

Any underutilisation of capital must either force a reduction in the rate of growth of output or it must be off-set by an increase in the savings rate, or by an increase in capital productivity.

It is important to note that where underutilisation of capital exists, a rise in the value of P implies an increase in capital utilisation and this produces a greater proportionate increase in output. Taking a simple relationship and assuming that the level of potential output attainable in any given period t is

$$Y_t = \sigma K_t$$

where Y_t = potential output at time t.

σ = output-capital ratio.

K_t = the existing capital stock.

If capital stock is used less than fully, such that $P < 1$ then the actual output will be

$$Y_t^* = P\sigma K_t = PY_t$$

This implies that any increase in capacity utilisation will bring an immediate increase in the level of output since Y_t is greater than Y_t^* (this assumes no change in capital stock). But with a growing stock of capital one would expect an interdependence of current output, savings and investment with future stock of capital and output. So increasing utilisation of existing capacity will affect output in two ways, namely

(i) an immediate change in current output $Y'_t = P'\sigma K_t$ with the given stock of capital.

(ii) In all subsequent periods, increasing the rate of growth in output $g' = P'\sigma\delta$

An increase in utilisation, then, will act on growth as a substitute to permanent reduction in consumption rates (raising the savings ratio) and or increases in capital productivity.[6]

How then would one measure the level of utilisation of a given stock of capital and then relate this to the problem of employment which has reached a worriesome stage in the less developing countries? Robin Marris had this to say:

> "... capital accumulation is a necessary but not sufficient condition of the growth process. Some of the other factors may have direct effects on the rate of utilisation of capital which is accumulated."[7]

The relationship between output growth and growth in employment can give more insight into the nature of the problem and the link between the degree of under-utilisation and employment. Nevertheless, the variations in the rate of growth of output are sufficiently the dominant factors that affect the low rates of employment growth.

x_i = the average itensity of operation that is the percentage of the plant or section needed during the period of operation.

This method has its own limitations since the machine needs repairing (they usually break down and there should be time allowed for such). On the other hand, there are certain limitations on how much the plant should produce (demand restrictions), and even the problem of availability of skilled labour is taken for granted in this kind of estimation. This measure will, therefore tend to underestimate the degree of capacity utilisation in the industry.

Another concept based on maximum output expected is usually used. This is related to the output the firm would produce assuming no bottlenecks occuring in the course of production. That is, what the firm expects to produce in period t (Y_t) and what it actually produces in the same period (Y^*_t). Again, different firms have different ideas of what their expected maximum output could be. Some of them are sometimes very optimistic about what they expect to produce only to find that they actually produce less.

The concept of capacity output and the rate of capacity utilisation have been prominent in recent discussions in economic literature, and the major problems

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The concept of capacity output and the rate of capacity utilisation have been prominent in recent discussions in economic literature, and the major problems have been the extent to which these concepts are measured.[9] Capacity variables have been significant ingredients in the econometric models and a great deal of effort has been devoted to a development of a measure which would reliably serve a wide range of uses in an econometric estimation. It is on this basis we intend to highlight a few measures of productive capacity.

2:2:1. Review of Okun's Law

In his original article Okun used several statistical techniques to assess the relationship between unemployment and aggregate output in order to establish a measure of the output which could be produced under conditions of full-employment.[10] The technique used involved relating the growth of unemployment to that of real output, using various measures of the gap between potential and actual output and using a linear-logarithmic relationship between employment and output over time.

Okun came out with the following economic relationship

$$U = 4 + {}^{1}/_{3}GAP$$

where U = the overall unemployment rate

GAP = is the percentage excess of potential to actual output given by

$$\left(\frac{Y_t - Y_t^*}{Y_t^*}\right) \cdot 100$$

That is, each percentage increase in unemployment above the 4 per cent of the labour force implied a 3 per cent 'gap' of lost output.[11] This 'law' was not originally intended to explain the unemployment rate, but instead to provide a means of measuring potential output. And that there is a tolerable rate of unemployment beyond which policy measures need to be taken to check the excess capacity.

Tatom's study of the American economy indicated that if Okun had included a lagged value of the gap, the results would not have been biased upwards.[12] The results of Tatom's work were that unemployment is more sensitive to the rate of change of output than the original Okun's law suggests. Conversely, this means that the change in output gap associated with a given change in unemployment rate is less than what was implied by the original specification.

From Okun's law, Ott and others[13] have a similar relationship given by

$$Y - Y^* = z\,(u - u_o)Y^*$$

where Y = the potential output (real)

Y^* = the actual output produced

That is the gap between potential real output (supply) and actual real output (demand) is given by some constant z (Okun uses z = 3) times the difference between the actual unemployment rate u and some rate u_o that measures 'full employment' (assumed by Okun to be 0.04) times actual real output, Y^*.

That is

$$u = \left(\frac{Y - Y^*}{Y^*}\right)^1/z + u_o$$

We can therefore interpret u as reflecting relative excess supply in the market for real output rather than a proxy for relative excess supply in the labour market.

From the above relationship it is implicit that the responsiveness of unemployment growth to the growth in the gap is given by $^1/z$. The smaller is the gap, the lower will be the growth in unemployment and similarly the larger is the gap, the higher will be the growth in unemployment.

Before we go into details of these relationships we need first to look at various measures and concepts of capacity utilisation and in the process, try to give their limitations. This is because, different measures of capacity may give different implications on employment, which is our major concern.

2:2:2 The McGraw-Hill Capacity Measure

The McGraw-Hill Department of Economics took a survey on industrial output on a cross-section basis and included questions related to recent and planned additions of capacity in the industry. A few questions which helped the estimation of capacity utilisation included the two below:

(i) At the end of the past year, how did the capacity, measured in terms of physical volume, compared with what it was at the end of the previous year?

(ii) At what rate the company was actually operating at the end of the year compared with the rate the company would prefer to operate?

Thus in their measure, McGraw-Hill made no effort to to define capacity - since companies set their own definitions and followed what they termed as commonsense definitions of capacity such as maximum output under normal work schedules. Similarly no attempts were made to define physical volume or to indicate what is meant by preferred. The reports of individual companies were aggregated to industries figures through the use of employment weights. Then industries were aggregated to the whole manufacturing sector through the use of the value-added weights.[14]

This method has the advantage of knowing the level of capacity utilisation directly from the questions asked. But on the other hand, it has some biases, in that there are possible errors arising from incorrect industrial classifications. Another possible bias would be that the results depend primarily on the reports by the firm owners and they have, as we said, different interpretations of what they consider as the maximum or preferred output.

2:2:3 National Industrial Conference Board Measure

The capacity estimates of the Conference Board was an extension of the work by Daniel Creamer on capital-output ratios which was began as a study at the National Bureau of Economic Research in the United States for purposes of capacity measure.[15] The Conference Board took data on the value of fixed capital as reported on balanced sheet of corporate income tax returns for all firms. And they grouped manufacturing firms into 23 major classifications.

For each industry the value of fixed capital used was computed at original cost less straight line depreciation (deflated by an implicit price deflator based on the length of life and the price of capital goods).

The output measures used were the gross operating receipts of the same industrial classified corporation, each adjusted for inventories changes and deflated to constant prices with whole-sale price indexes. The capital-output ratios computed from these deflated values were then examined for the cyclical peaks and a benchmark year was selected for which independent evidence and the capital-output ratio indicated the full capacity utilisation.

This particular ratio was then taken as the capital (capacity) output ratio and was used to estimate the extent to which subsequent output rates depart from an imputed capacity output rates (C_o). For each industry the compilation were as follows

(i) . . . $FC_1 \div \frac{FC_o}{CO_o} = C_o$

(ii) . . . $\frac{O_1}{CO_1}$ = Percentage of capacity utilised at time t_1

where FC_1 = Fixed capital at time t_1.

FC_o = Fixed capital in benchmark period

CO_o = The capacity output in the benchmark period

CO_1 = Estimated capacity output at time t_1

The industries were aggregated by summing up the fixed capital in each industry and also summing up the actual output for each industry.

A major limitation of this method is that, due to unavoidable lag of nearly two years in obtaining statistics of income for corporate returns, reasonably current estimates using this method cannot be made. However, the data or the estimates can be extrapolated for the output data and the capital stock data. But since it is almost impossible to get capital stock data in less developing countries this method may not be used. Again unlike the McGraw-Hill measure, this method does not directly measure the level of capacity utilisation. Instead it assumes fixed or slowly changing relationships between capital stocks and real capacity outputs. Even when the changes in technology is ignored the ratios between capital stocks and capacity output are not uniquely determined by the rate of operation as this measure suggests. And in fact what is being measured is not capacity utilisation itself but something close to it.

2:2:4. The Wharton School Econometric Unit

The Wharton School Index of capacity utilisation is constructed by a simple procedure which enables us to provide quick and frequent estimates of capacity. This measure is the only one of the measures discussed above which has fairly recent theoretical piece underlying it.[16]

The method involves plotting quarterly output figures against time, and peaks in each series are selected by inspection. Each peak is defined as 'capacity' and a straight line from the peak to peak describes capacity during the intervening periods for the period after the peak but before the next is reached, the last straight line is extraporated with the same slope until production intersects the line. After such intersection, capacity is taken to be the line connecting the last peak and the most recent production figure until a new peak is reached. The individual industries are aggregated to total manufacturing sector using the value-added weights.

When the index of output is unchanged for two or more successive peaks, the first of the two is chosen as the capacity peak. The ratio of the actual output to the trend line (linear segments) fitted through peaks is called capacity utilisation. This method has been used in some industries in developing and developed countries.[17]

However, a major objection of this method of estimating capacity utilisation is that some capacity utilisation peaks when in fact there may have been considerable underutilisation of capacity. These objections have been summarised by Phillips. One interesting aspect of the failure to define capacity according to Phillips, is that

> ".... the type of reporting to be expected in the not unusual case is increased for the purpose of reducing or eliminating purchasing or subcontracting for materials or parts. In terms of the final output of the firm, capacity is not increased, yet in terms of value-added for the firm and industry, it is."[18]

2:2:5 <u>The Production Function Approach.</u>

Another approach to the problem of capacity estimation is by estimating the cost or production function by sector. In the case of cost function, it has often been suggested that the point of minimum average cost may represent full capacity output (in a complete environment). This method of estimation may be a fruitful step in capacity estimation but there is a problem in obtaining a sharply defined minimum point for emperical average cost function.

Klein and Preston have attempted to measure capacity utilisation through a production function approach.[19] For each sector they define actual output by the convectional production function relationship. That is

$$Q = f(L, K) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (i)$$

where technology is expected to vary.

The statistical relationship is given by

$$Q_t = Ae^{ut} \; L_{et}^{\alpha} \; K_{ut}^{\beta} \; V_t \quad \ldots\ldots\ldots\ldots\ldots \quad (ii)$$

where

Q_t = Actual output at time t

L_{et} = Man hours employed at time t

K_{ut} = Real capital stock utilized at time t

e^{ut} = Is a rough proxy for technical change

A = Is a constant expected to capture the influences of other variables not included in the function

V_t = The disturbance error term.

The full capacity output is defined as

$$Q_{ct} = \hat{A} \quad e^{\hat{u}t} \; L_t \; K_t^{\hat{\beta}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(iii)}$$

where

Q_{ct} = full capacity real output at time t

L_t = available manhours at time t

K_t = full utilized real capital at time t

Other variables are defined as equation (ii) above. The functions are the same except that the parameters in equation (ii) have been replaced by their estimates in the third equation and the error term is given its expected value of zero in the third equation.

The problems with this estimation is that errors in estimating capacity output can be caused by errors in measuring available manhours (L_t) or fully utilized real capital (K_t) or both. Secondly, errors may arise due to mis-specification of the estimating equations and finally, these errors may be brought by biased parameter estimates.

Other problems include the lack of information on the supply of manhours to each sector (labour force requirements for each industry). This will also lead to lack of estimates of capacity utilisation by industry. Different measures would tend to give different capacity results as Klein and Preston have argued.[20] However, this method is very close to the Wharton School and they have almost similar results of the capacity data.

2:3. Empirical Studies on Capacity Utilisation.

This section will attempt to analyse some empirical studies done by other people on the level of capacity utilisation mainly in Less Developing Countries. It would be difficult to compare utilisation levels in various countries since different measures of capacity utilisation are used, and, each has its own limitations. (as we have seen in the previous section).

Winston's study in industries in Pakistan aimed at examining the structure of excess industrial capacity and testing its comparability with the economic-rational analysis of capacity use. Also the study aimed at determining the importance of other industry's characteristics that influence excess capacity.[21]

He estimated capacity utilisation by the ratio of actual to full capacity output as reported by the firms and then adjusted the ratio to reflect capital scarcity. He disregarded the firm's idea of full utilisation by taking two and half shift operation as the standard (an approximation of about 140 hours a week), unless the sector reported operating rates higher than that, in which case actual operations were the standard.

The conclusions from his study were that excess capacity would be more explained by inefficiencies in planning and policies, and that only such errors could explain why a critically scarce resource needed for growth was allowed to sit idle most of the time. He argued that the prospects of creating policies specifically to increase utilisation rate holds great promise for increasing the level and the rate of growth of incomes in LDCs.

Winston ignored the fact that skilled labour is also scarce in LDCs and most of the skilled people are not willing to work at night shifts if they can get an equally paying job elsewhere during day time. He argued that

> "... there should not be any shift-differential in wage-rates, since an incentive to induce an adequate supply of night work is necessary only if the workers make a decision between day and night work. If there is wide-spread unemployment, in contrast, the workers decision is between night work and being unemployed. Competition to get any job at all should eliminate the need for payment of a shift differential regardless of underlying preferences between night work and day work."[22]

But he added that, there are instances where shift differences are paid by the manufacturers in LDCs and especially if the labour is skilled and has traditional preference on working day time.

However, his study came up with the following relationship:

$$Cu = 28.99 - \underset{(0.074)}{0.358M} + \underset{(0.08)}{0.251X} + \underset{(0.77)}{3.747K/Y} + \underset{(0.094)}{0.305S}$$

$$R^2 = 0.8152$$

$$F = 18.7$$

where Cu = capacity utilisation

M = competing imports measured as a percentage of total supply

X = export sales, measured as a proportion of total domestic production (at factor cost).

K/y = the capital to income ratio

S = Average firm size measured as average annual production by the reporting firms in each sector.

The figures in parentheses are standard errors of the regression coefficients. These results indicate that imports and capital -income ratio were significant at 99.9% while exports and average firm size were significant at 99% . And over 80% of the variations in capacity utilisation (between industries) is explained by variations in imports exports, capital-income ratio and firm size. Other variables like market power and labour productivity seemed not to contribute significantly to the level of capacity utilisation in manufacturing industries in West Pakistan.

A different approach in estimating capacity utilisation in British Manufacturing industries was used by National WestMinister Bank and data on production and capital stock was obtained from the index of industrial output in Britain.[23] The ratio of capital to output was calculated for each year. The highest ratio was then assumed to indicate the greatest degree of capital utilisation during the period analysed.

The highest, that is 'full capacity utilisation' ratio had to be adjusted for changes in the relationship between output and capital over-time. Differences from this trend relationship were assumed to be due to changes in capital utilisation. The second step was to calculate the linear trend. The trend line is then shifted upwards to pass through the highest ratio and from now on, each point on this curve was assumed to represent full capacity utilisation.

This method, however, presents few problems. First, capital utilisation of 100 percent refers therefore to the highest recorded capital-output ratio, which may or may not coincide with the maximum attainable. In fact as the available evidence suggest that most modern firms and industries normally operate well below their maximum, rated capacity, it is quite possible that the estimates understate the actual degree of capital underutilisation. Secondly, changes in the index of capital utilisation obtained by this method are closely correlated with changes in the proportion of firms working below capacity. And finally this method assumes no changes in technological progress.

Their estimates of capital stock data on the manufacturing industries seemed to overstate the volume of usable capital and consequently, the degree of capital underutilisation in a number of industries which have been in considerable difficulties during the last few years in their production processes. Nevertheless, estimates for individual industries using this method indicates that capital underutilisation in British Manufacturing industries was widespread.

On Malaysian manufacturing industries, David Lim used two different measures of capital utilisation.[24] The first, U_1, which was suggested by Winston, measures the number of hours the capital plant is utilised a year as a per centage of 8760 hours, the maximum number of hours available per year. U_1 therefore, associates 24 hours a day and 365 days a year with full capacity.[25]

The second measure, U_2, adjusts U_1 for the intensity of use. Since most machines can be operated at different speeds though there is probably only one optimal speed which corresponds to the least wear and tear. When the production managers tend to operate at such a rate and when their intentions are realised, the intensity of use may be said to be 100 per cent, and there is no need to adjust U_1. But if on the other hand, the actual rate of operation is only 50 per cent of the 'optimal' because the lack of demand does not warrant full operation, then the intensity of use is only 50% of U_1 and has to be adjusted downward by half.

This measure is different from the one used by the McGraw-Hill approach which measures actual utilisation as a percentage of desired capital utilisation.[26] Lim's data on U_1 and U_2 and of the other variables in his analysis were collected for 1972 for 350 establishments in the manufacturing sector of West Malaysian by interviewing the production managers.

The basic questions asked during the interview among otherswere based on the following:

(a) The number of hours the plant was operated on a typical day

(b) The number of days the plant was operated in 1972.

(c) The intensity of use when the plant was in operation. For those establishments which operated different schedules for different sections, total replacement value of the plant were used as weights in the calculation of U_1 and U_2.

Lim's conclusions were that foreign owned and controlled establishments in Malaysian manufacturing operated their plants and equipment longer and more intensively than their Malaysian counterparts. This was found to be mainly because foreign firms were large and more capital intensive. He pointed out that this high degree of capital utilisation is due to the size of operation and capital intensity of the production process and not due to X-efficiency as was postulated earlier.

Similar study done by Wangwe on Tanzanian manufacturing industry attempted to analyse the problems of underutilisation of productive capacity and to suggest how capacity utilisation might be increased.[27] He conducted a survey of 39 firms and analysed the causes of the underutilization of capacity, which were mainly of two characters: the supply and demand side of factors.

On the supply side, the shortage of raw materials was a major factor affecting the smooth operation of 80% of the firms sampled. This was mainly due to shortages of foreign exchange, especially where the firms mainly depended on imported inputs. The long time lags between applying for an import licence and actually obtaining it was a factor that affected many firms.

Credit facilities was,as reported, inadequate but this varied with the size of the firm and their pattern of ownership. Other factors on the supply side which affected the degree of capacity utilisation were based on electricity and water supply and largely on the availability of technical services.

On the demand side, most firms argued that there was defficiency of demand for industrial output. The average cost of production for unit of output in many small firms working at full capacity may be higher than corresponding average cost in a large enterprise, even when the latter works at least than full capacity. Wangwe argued that fluctuations in demand may also be responsible for excess capacity at times. If firms are to meet their orders during peak periods without undue delay in delivery, they will have to maintain underutilised capacity at other times.

He concluded that the capacity utilisation picture is a mixed one and there is no doubt that industrial output and employment can be increased through increased utilisation of existing capacity with very little additional investment or none at all. However, he did not indicate his measure of capacity utilisation in his paper though one may conclude that he took the ratio of actual operation to preferred operatic since his basic question is based on why firms operate below their preferred levels.

Baily's study on manufacturing industries in Kenya based its estimates of capacity utilisation on the ratio between planned and actual utilisation rates. Her research work basically aimed at determination of planned utilisation rates in manufacturing industries. She used quantitative data from a study of capital-labour, capital-output and labour-output ratios in the manufacturing sector in Kenya by Frank Thompson Department of Economics, Leeds University, and supplemented the data with information from a capacity survey of the manufacturing industry, undertaken by the Bureau of Statistics, Ministry of Finance and Planning, Government of Kenya, in 1971.[29]

In order to estimate the level of capacity utilisation, the survey of manufacturing industry had given data on preferred output, maximum output and actual output. Preferred output was based on what is optimal from the point of view of the firm, which maximizes its objectives in planning its levels of utilisation for the year or its normal working schedule. This was determined by the demand and and cost conditions which prevail in a particular economy as perceived by the firm when formulating its plans for the year.

The maximum output was based on the maximum the firm can produce assuming no constraints on the demand side as well as on the supply side of factors, giving allowances for wear and tear. And,finally, the actual output is the amount recorded in the firm's production accounts,

In estimation, Baily used the ratio of actual to preferred output or prefered utilisation. Her conclusions were that, very few firms had shift differential costs between day and night shifts.

Again most firms could not operate night shifts due to:

(1) High absenteeism on night shift compared to the day shift. This meant that the firms had to have extra workers on the night shift to be able to fill in for the absentees, leading to higher labour costs.

(2) There were difficulties in getting proper supervision on the night shift since skilled personnel were in short supply. She argued that even if the supervisors agreed to work on night shift, there may have to be extra search costs finding and keeping someone for the job. To make matters worse, firms often argued that the work permit system made it impossible for them (firms) to get additional supervisors and therefore to put on additional shifts.

(3) Finally she argued that productivity in those manufacturing firms operating night shifts dropped particularly on the graveyard shift in the very early morning hours. This was also mainly related to lack of proper supervision at night work.

The results of her interview suggested that Kenya firms sometimes have a choice between accepting a lower level of supervision on the night shift, and an attendant fall in productivity, and pay search costs, training costs and/or higher wages to secure the needed supervisory personnel.

The other major problem was the demand for products from the manufacturing firms. In the sixties, considerable investment in manufacturing took place behind the tariff barriers of the East African Community. But in the early 1970's the Community was in its downfall and the market has restricted even further. And therefore, Kenya's exports to neighbouring East African Countries was drastically reduced resulting to under-utilisation of existing capacity, as well as reduction in employment in these industries.

Baily's study concluded that

> "Utilisation rates and therefore the ratio of output and labour to capital stock are sensitive to the factor-price ratios even in the case where coefficients are fixed ex-ante and ex-post."[30]

She found that managers were sensitive to the shift differential costs and in most cases more capital intensive operations operated for longer hours than less capital intensive operations. Labour intensive industries such as furniture making, ratio assembly and clothing manufacture generally planned to work only one shift whereas in capital intensive industries such as flour milling, firms planned to run several shifts.

FOOTNOTES

1. See M.V. Raghvachori, "Excess capacity and production potential in selected industries in India." Reserve Bank of India Bulletin, April 1969, and D. Ghai and M. Godfrey, Essays on Employment in Kenya 1979. pp. 7 - 74.

2. Some of the people who have argued along these lines include W.H. Baer and E.A. Michael, "Employment and industrialisation in developing countries." Quarterly Journal of Economics, Vol. 80, February 1966, and D. Morawetz, "Employment implications of industrialisation in developing countries: A survey." Economic Journal Vol. 84, September 1974.

3. Among those who have been disturbed by the same misplaced emphasis are W.P. Hogan, "Capacity creation and utilisation in Pakistan manufacturing industry." Economic Development Report, September 1967, (mimeo) C.P. Kindleberger, Economic Development. (Second Edition), New York. McGraw-Hill Company, 1965, and R. Marris, The Economics of Capital Utilisation A report on multiple-shift work, Cambridge, 1964.

4. G.C. Winston, "Capital utilisation in economic development." Economic Journal, Vol. 81, No.321, May 1971, p. 36.

5. R. Marris, 1974, op.cit., p.14. He stresses the issue of employment absorption that is implicit in P - that a number of people can share the same equipment over time, even when they cannot, at any instant in time, so employment rises with P.

6. G.C. Winston, 1971. op. cit., p.37.

7. R. Marris, 1974, op.cit., p.11.

8. For various problems in the measurement of potential output, see A. Phillips, "Industrial capacity: An appraisal of measures of capacity." American Economic Review, Vol. 53, May 1963.

9. We are assuming that capacity utilisation is an output based measure and can be used as a rough proxy measure for capital utilisation.

10. Okun's Law is summarised by J.A. Tatom in "Economic growth and employment: A reappraisal of the conventional view." Federal Reserve Bank of St. Louis Review, October 1978, pp.16-22.

11. Okun points out that the 3 to 1 link between output growth and the unemployment rate is approximate. His 'own subjective weighted average of the relevant coefficient' implies a gap coefficient in the equation equal to 0.3125, slightly lower than the one-third figure used here.

12. J.A. Tatom, 1978, op.cit., p.16.

13. See D.J. Ott, A.F. Ott, and J.H. Yoo, Macroeconomic Theory. McGraw-Hill Company, 1975, pp. 257-258.

14. This measure of capacity is discussed in D.Lim, "Capital utilisation of local and foreign establishments in Malaysian manufacturing" Review of Economics and Statistics, Vol. 58, No. 2, May 1976.

15. This measure is best explained in D.Creamer, "Capital and output trends in manufacturing industries, (1880-1948)", Occassional Paper No. 41, National Bureau of Economic Research, United States, 1954.

16. Details of this measure can be obtained in L.R. Klein, "Some theoretical issues in the measurement of capacity." Econometrica, April 1960, and in A. Phillips, 1963, op.cit., pp. 282-292.

17. This method is used by P.D. Valle, "Productivity and employment in Copper and Aluminium industries" in A.S. Bhalla, Technology and Employment in Industry. I.L.O. Geneva 1975. pp. 273-303.

18. See A. Phillips, 1963, op.cit., p.286.

19. L.R. Klein and R.S. Preston, "Measurement of capacity utilisation: Some new results." American Economic Review, Vol. 57, March 1967, pp.34-57.

20. Details of their estimation procedure and various proxies used is in L.R. Klein and R.S. Preston, 1967, Ibid., pp.37-42.

21. G.C. Winston, 1971, op.cit., p. 36.

22. G.C. Winston, 1971, op.cit., p.54.

23. National Westminister Bank.,"Capital utilisation in the manufacturing industry." Quarterly Review, February 1972.

24. D.Lim, 1976, op.cit., pp.209-217.

25. G.C. Winston, "Theory of capital utilisation and idleness." Journal of Economic Literature, December 1974, p. 1301.

26. McGraw-Hill Publication Company. 25th Annual McGraw-Hill Survey, April 1972.

27. S.M. Wangwe, "Factors affecting capacity utilisation in Tanzanian manufacturing industries." International Labour Review, Jan-Feb 1977, pp.65-78.

28. M.A. Baily, "Capital utilisation in manufacturing industry in Kenya," Ph.D. Thesis, Massachusetts Institute of Technology, 1974.

29. This survey was not published but it has been summarised in Appendix I in this paper. Baily's other sources of data were from Phillips and Wasow study of "Effective rate of protection," and the Bureau of Statistics data on firms in three specific industries. That is beverages, garments and made-up textiles, rubber and rubber products.

30. M.A. Baily, 1974, op.cit., p. (iv).

CHAPTER III

HYPOTHESES, METHODOLOGY AND DATA SOURCES

3:1. Hypotheses

In an attempt to test the relationship between employment and capacity utilisation in Kenya's manufacturing industries, it is hypothesized that the level of capacity utilisation has no significant effect on the level of labour absorption capacity. In other words, capacity utilisation is not a significant variable in attempts to increase labour absorption in Kenya's manufacturing industries.

This hypothesis is decomposed into the following sub-hypotheses which will be tested in this study.

(a) It is hypothesized that, the level of labour productivity has a significant positive effect on the level of capacity utilisation in Kenya's manufacturing industries.

The argument advanced by Winston on this hypothesis is that, in measuring value-added per employee in less developing countries, we have inevitably measured labour skills.[1] These skills are in critical shortage in these countries, thus limiting capacity utilisation. This implies that, the lower or the higher the labour productivity, the lower or the higher is the level of capacity utilisation.

Baily's study showed that labour productivity fell as firms introduced night shifts in their operations in Kenya.[2] Her major reasons for this fall in productivity were based on the lack of supervision at night time and that night workers were generally either drunk or too tired to work. She concluded, though, that if supervision and technical expertise were there, then labour productivity would increase as capacity utilisation is increased.

The index for labour productivity is proxied by the ratio of output to labour for each group of industries.

(b) It is hypothesized that, the level of labour intensity has a significant positive effect on the level of capacity utilisation. This hypothesis is based on the premise that higher labour costs share of value added will induce the producers to make use of labour more extensively.

It is expected that, variations in capacity utilisation within industries may have an effect on labour intensity, though the level of the latter may also be influenced by the nature of technology and relative factor prices in the industries. A high price of labour relative to price of capital, would induce the entreprenuer to opt for capital intensive method of production where labour and capital are substitutable.

There are various measures of labour intensity and most of them require data on capital stock.[3] Bhalla argues that, some ambiguity in the concept of labour intensity may arise from a confusion between the elasticity of employment with respect to capital and the elasticity with respect to output. The two need not give identical results. An increase in the rate of capital utilisation (increase in number shifts) raises the labour absorption from a given amount of capital (that is, there is a decline in capital-labour ratio), but this will not necessarily raise the input of labour per unit of output.[4] Lary has used value-added per employee as an index of labour intensity.[5] A number of merits are claimed for this indicator, that is

(i) It reflects the flow of capital services rather than stock, and it is therefore more relevant to the theory of production functions.

(ii) It incorporates the contribution of human capital and of skill differences.

(iii) It bypasses the difficulty of measuring physical capital.

Although the share of labour costs to value-added suffers from the assumption of perfect competition in the product and factor market, it can be used as an estimate of labour intensity. In principle, this indicator is a true measure of labour intensity not only under the restrictive assumptions of perfect competition in factor and product markets, but also under those scale economies. And also under the assumption that the elasticity of substitution of labour for capital is greater or smaller than unity. When the elasticity is unity (as in the case of the Cobb-Douglas production function), the relative shares of wages and profits in value-added will always remain constant. If it is less than unity, then , as the capital intensity (ratio of capital to labour) increases, the share of wages rises. When it is greater than unity, as the capital-labour ratio rises, the wages share decreases.

Other indicators of the labour intensity index include the capital-value added ratio (or the capital coefficient) and the capital labour ratio. Both of these indicators require the use of capital stock data, which is difficult to get in Kenya. It is for this reason that, this study will utilise data on labour costs share in value-added as a proxy for the index of labour intensity.

(c) It is hypothesized that, the level of market concentration in manufacturing industries in Kenya has a significant positive effect on the level of capacity utilisation. The study will utilise data on annual output divided by the number of firms to measure firm size which is the proxy for market concentration. This measure may capture more of management-scale economies and less strictly technological plant-scale economies. It is assumed that the influence of management scale would be less variable between industries than technological scale effects, and would therefore show up more readily in a comparison across a number of industries.

If high utilisation of capacity indicates efficiency, then efficient firms would probably grow larger than the inefficient firms. If political power is greater for larger firms, they may influence political-economic decisions, such as licensing of imports. If capacity usage was constrained by import shortages then large firms would operate at higher rates of utilisation of capacity.

(d) It is hypothesized that, competing import goods have significant negative effect on the level of capacity utilisation in Kenya's manufacturing industries.

It is expected that large inflows of imports would tend to compete with locally produced goods, thereby reducing the demand for locally produced goods and the level of capacity utilisation. This impact of imports affected the textile and clothing industries in the mid-1970s when large quantities of imported textiles and clothes were dumped into Kenyan markets. The dumping resulted in the closure of some of the textile industries in Kenya while other industries were working at very low levels of capacity utilisation. Other industries which were similarly affected in the 1970s were the footwear and chemical industries, to name just a few.

Power argued that, less developing countries which have followed an import-substitution policy for a number of years, have biased investment toward those industries with significant competing imports.[5] And this would lead to more unused capacity in those industries. But it would be difficult to know whether this negative relationship hypothesized is due to increased competion between local products and imports or due to increased investment on products which were formerly imported.

The study has therefore, taken the ratio of total imports to output (in each group of industries) as a proxy measure for competing imports.

(e) It is hypothesized that, change in stocks have significant positive effect on the level of capacity utilisation in the manufacturing industries in Kenya.

The study assumes that, change in output stocks reflects the level of demand for products in a particular group of industries. There are other reasons as to why firms may accumulate stocks. It is possible that, they may accumulate in speculation for higher prices for their products. Secondly, they may have been producing more than the current demand in order to minimize costs of production. Thirdly, the piling up of stocks may help to reduce lead time, thus safe-guarding loss of sales.

(f) It is hypothesized that, the level of profits has significant negative effect on the level of capacity utilisation in Kenya's manufacturing industries.

The study assumes that, the firms main objective in production is to maximize profits rather than output sales. This has some support in the general economic theory, that firms will maximize profits at a lower level of output than the maximum output that can be produced. It is expected that firms with higher rates of profits have low capacity utilisation rates. In monopolistic and oligopolistic market conditions, firms tend to produce less than the quantity demanded in an attempt to inflate the price and earn abnormal profits. It is assumed that total output less total costs (labour and capital costs) equals profits.

3:2. Methodology

It is clear from our discussions in Chapter II that, there is no single definition of capacity. Companies set their own definitions and follow a commonsense definition of capacity such as the maximum output under normal work schedule. Each of these methods has its own limitations mainly based on the sources of data.

In order to get an index of capacity utilisation in Kenya's manufacturing industries, this study will assume that the productive capacity of an industry grows at some linear rate over time. Secondly, shortfalls in capacity utilisation are reflected in the deviations from a trend in production through time. The full capacity trend is established by the observation which represents the largest possible output deviation through time.[6]

Thus we regress

$$Q_{it} = f(t) \quad .. \; .. \; ... \; .. \; .. \; .... \; .. \quad (1)$$

where Q = Output

t = time

i = i^{th} industrial group

Transforming the functional relationship in equation (1) into a linear form.

$$\hat{Q}_t = a + bt \quad .... \; .. \; .. \; .. \; .. \quad (2)$$

Then, the residuals of the actual output from the estimated output can be calculated. The trend level of output, $\hat{Q}_t$, is assumed to be the level of output corresponding to a 'normal' degree of capacity utilisation. The highest level of output greater than the trend estimated level is assumed to correspond to 'full' degree of capacity utilisation. Therefore the greatest difference is written

$$a_o = \text{Max } (Q_t - \hat{Q}_t) \quad .. \; .. \; .. \; .. \; .. \; .. \quad (3)$$

and the equation for full capacity output is

$$\hat{\hat{Q}} = a_o + \hat{Q}_t \quad .. \; .. \; .. \; .. \; .. \; .. \; .. \quad (4)$$

The ratio of actual output to full output is assumed to be a very close approximation of the degree of capacity utilisation.

The ratio of actual output to the estimated full capacity output is the index for the degree of capacity utilisation. The index and its value is

$$Cu_t = \frac{Q_t}{\hat{Q}_t} \leq 1 \quad \ldots \ldots \ldots \ldots \ldots \quad (5)$$

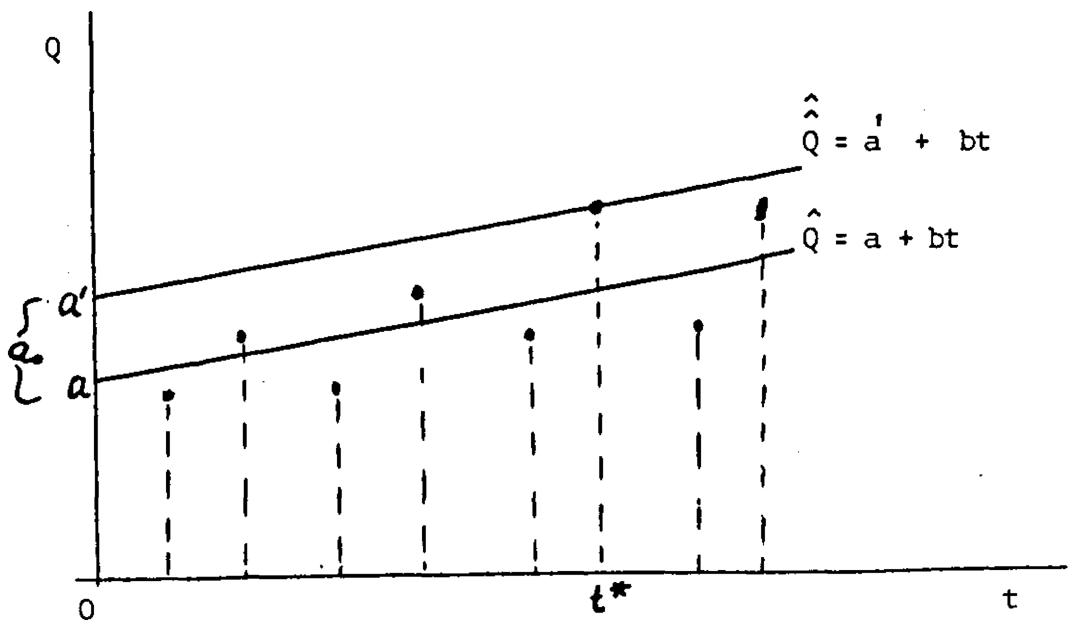
The expansion of this index expression is

$$Cu_t = \frac{Q_t}{a_o + a + bt} \quad \ldots \ldots \ldots \ldots \ldots \quad (6)$$

This index will be calculated over the period 1964 to 1976 for each of the industrial group in the manufacturing sector.

An illustration of the trend relationship is shown in figure 1 where a_o is the difference between the maximum actual output and the estimated output $(\hat{Q})$.

Figure 1. Linear estimate of the index of capacity utilisation



At time t^* the index of capacity utilisation is unity for that industrial group since the highest actual output is on the trend estimated level which is assumed to correspond with the 'full' degree of capacity utilisation.

The basic data for all the variables considered in this analysis will be obtained from the Statistical Abstracts from 1964 to 1976 for the time series analysis while the 1972, Census of industrial production survey will be used for the cross-section analysis.

In an attempt to test the hypotheses of this study, the following functional relationships will be assumed

$$Cu = f(K, L, T) \quad \ldots \quad (7)$$

where

Cu = the level of capacity utilisation

K = the index of labour intensity, estimated by the ratio of labour costs to value added.

L = labour productivity, estimated by the ratio of output to labour

T = time variable

The other two functions this study will consider are

$$Cu = g(K, L, F, T) \quad \ldots \quad (8)$$

and

$$Cu = h(K, L, F, M, T) \quad \ldots \quad (9)$$

where

F = the index of market concentration, estimated by output per firm

M = competing imports, estimated by total imports divided by total output in i^{th} industry.

Other variables are defined as in equation (7) above.

These functions will be estimated using ordinary least squares stepwise regression technique. The structural equations which will be estimated are as follows

$$Cu = \alpha_o + \alpha_1 K + \alpha_2 L + \alpha_3 T + u_1 \ldots \quad \ldots \quad \ldots \quad (10)$$

$$Cu = \beta_o + \beta_1 K + \beta_2 L + \beta_3 F + \beta_4 T + u_2 \ldots \quad \ldots (11)$$

and

$$Cu = \delta_o + \delta_1 K + \delta_2 L + \delta_3 F + \delta_4 M + \delta_5 T + u_3 \ldots (12)$$

These estimates will be done for each industrial group and the correlation matrix will be computed. The study has assumed that the sum of squares for the error term is zero for each industrial group. The aim of running stepwise regressions is to find which is the best fit to explain variations in capacity utilisation in each industry. Equations (10) to (12) will be estimated for the time-series analysis based on data from the statistical abstracts from 1964 to 1976.

For the cross-section analysis, the study will estimate the following functions

$$Cu = C_o + C_1 \Delta S + V_1 \quad .. \quad .. \quad .. \quad (13)$$

where
Cu = index of capacity utilisation

ΔS = change in stocks

C_o, C_1 are constants

V_1 = the error term.

The coefficient C_1, will indicate the influence of change in stocks on the level of capacity utilisation. The constant term C_o will capture the influence of all other variables not included in the above relationship with capacity utilisation. Introducing the index of labour intensity, the relationship will be as follows

$$Cu = C_2 + C_3 \Delta S + C_4 K + V_2 \quad .. \quad .. \quad .. \quad (14)$$

where K = index of labour intensity.

C_2, C_3 and C_4 are constant

V_2 = the error term.

which will be estimated by

$$Cu = \hat{C}_2 + \hat{C}_3 \Delta S + \hat{C}_4 K \quad .. \quad .. \quad .. \quad (15)$$

using ordinary least squares estimation technique.

We shall then add the profitability variable and test the relationship

Thus,

$$Cu = \alpha_o + \alpha_1 \Delta S + d_2 K + d_3 \dot{\pi} + V_3 \quad \ldots \ldots \quad (15)$$

where

π = the ratio of profit to the total output

$\alpha_o, \alpha_1, d_2, d_3$ are constants

V_3 = the error term.

The coefficient d_3 will show the influence of profitability on capacity utilization while the other variables are still included.

To test these hypotheses we shall use the t-statistic at 5% level of significance and the correlation coefficients. Since linear relationships are assumed in all the estimating equations, ordinary least squares econometric method will be used with the following assumptions in mind.[7]

(i) The error term must be normally distributed. $E(\hat{u}) = 0$, $E(\hat{v}) = 0$, etc.

(ii) The error terms are not correlated otherwise this would lead to the problem of autocorrelation

(iii) The error term have a constant variance. This is the assumption of homoscedasticity.

(iv) The error term should not be correlated with any of the regressors, for example $Cov(\hat{u}, Cu) = o$

(v) The regressors are distributed randomly to avoid the problem of multicollinearity.

3:3. Data Sources

The study will attempt to utilise secondary data from various Statistical Abstracts from the Central Bureau of Statistics (C.B.S.) for the period 1964 to 1976, for the time series analysis. Due to lack of data on small firms in the period before 1967, this study will utilise data on large scale manufacturing industries only (firms employing 50 or more people). Some data for some of the establishments will be left out due to the inconsistent manner in which they are presented. This mainly affects the transport industries.

This study has therefore, not considered the transport industries for the time series analysis though it is included for the cross-section analysis. The industrial groups which have been included in the time series analysis includes

(a) Food processing industries

(b) Beverages and tobacco industries

(b) Textile and clothing industries

(d) Wood and wood products industries

(e) Leather and leather products industries

(f) Chemical industries

(g) Non-metallic minerals industries

(h) Metal and metal products industries

Data on cross-section analysis is obtained from the census of industrial production, 1972, (C.B.S.) except for capacity utilisation data which is obtained from the time series data.

The data is presented in an aggregative manner at establishment level rather than at firm level, where establishments may be defined as specific locations in which a clearly defined type of economic activity is undertaken. The reason given by the Central Bureau of Statistics is that the individual firms would like to preserve the confidentiality of the information as stipulated in the 'Statistical Act'.

It is therefore possible that the use of more refined data (at firm level) would lead to different results from the ones we shall obtain in this paper. Again, due to an increase in coverage of industries over the period, the results might not reflect the true relationships between the variables. Some industries do not respond to the questions asked especially if the questions are related to the amount of revenue the firm makes or to the level of profits. All in all, there is a tendency for some of the firms to give incorrect answers to the questionaire, or, not to respond at all to these questions from the Central Bureau of Statistics, and this might adversely affect our results in this study.

FOOTNOTES

1. G.C. Winston, "Capital utilisation in economic development" Economic Journal, Vol. 81, No. 321, May 1971, p.36.

2. M.A. Baily, "Capital utilisation in Kenya manufacturing industry". Institute for Development Studies, University of Nairobi, Discussion Paper No. 206, August 1974, pp.6-8.

3. A detailed discussion of the measures of labour intensity is presented in A.S. Bhalla, Technology and Employment in Industry. I L O , Geneva, 1975, pp. 19-33.

4. A.S. Bhalla, 1975, Ibid., p.20.

5. See H.B. Lary, "Imports of manufactures from less developing countries." New York, National Bureau of Economic Research, 1968.

6. J.H. Power, "Industrialisation in Pakistan: A case of frustrated take-off." Pakistan Development Review, Summer 1963, pp. 191-207.

7. This method is similar to the one used by P.Della Ville, "Productivity and Employment in the Copper and Aluminum Industries" in Technology and Employment in Industry. Edited by A.S. Bhalla, op. cit. pp. 275-303.

8. For detailed discussions on econometric problems, their effects on ordinary least squares regression coefficients and the method of correcting these problems, see J. Johnston, Econometric Methods, (second edition), McGraw-Hill Company, 1972.

CHAPTER IV

REGRESSION ANALYSIS AND CONCLUSIONS

4:1 Analysis of Results

Considering the level of aggregation of the data and the method used to estimate the variables, it would be noted that the regression results might be biased. Nevertheless, this study has used a few of the economic variables which have been expected to have significant effects on capacity utilisation in Kenya's manufacturing industries. These of course, are not the only variables which have influence on capacity use, and others warrant attention too, since whatever the reasons for excess capacity, an increase in utilisation increases output in industrial sector.

The index of capacity utilisation is estimated as discussed in Chapter III and the regression results for equation (2) in the previous chapter are shown in table 4:1.

The indices of capacity utilisation estimated through the method described in section 3:2 of the previous chapter are close to the estimates of the 'capacity survey' done by the Central Bureau of Statistics in 1971 and shown in Appendix I of this paper. However, most of our estimates for 1971 capacity utilisation indices were slightly below those of the Central Bureau of Statistics as shown in table 4:2.

Table 4:1

Regression Coefficients, student's t-values and the coefficients of determination when output, Q, is regressed on time t.

Industrial Group	Constant (a)	Time ($\hat{b}$)	R^2	a_o
Food processing	-0.147 (0.32)	0.346 (6.06)	0.769	0.398
Beverages and Tobacco	-3.458 (1.47)	1.244 (4.20)	0.616	1.941
Textile and clothing	-0.721 (1.34)	0.646 (9.55)	0.859	1.358
Wood and wood products	-0.688 (1.24)	0.597 (8.21)	0.859	1.445
Leather and leather products	-5.358 (2.71)	1.898 (7.63)	0.841	4.459
Chemical industries	-1.325 (1.37)	0.661 (5.42)	0.728	2.168
Non-metalic minerals	-0.148 (0.44)	0.459 (10.73)	0.912	1.230
Metal industries	-0.166 (0.57)	0.436 (11.94)	0.927	0.729
Transport industries	0.818 (6.02)	0.090 (5.27)	0.716	0.294

Notes

(i) a_o = the maximum positive difference between the actual output and estimated output given by equation (3) in Chapter III.

(ii) The figures in parentheses are the t-statistic values and $\hat{b}$ is significant at 99% level of confidence in all the industrial groups.

(iii) The number of observations is 13.

The Spearman's coefficient rank correlation between the two estimates is 0.7143, indicating nearly similar ordering of relative degrees of capacity utilisation.[1]

Table 4:2

Comparison of the index of capacity utilisation between the Central Bureau of Statistics (CBS) Estimates and Our Estimates for 1971.

Industrial group	CBS Estimates		Our Estimates	
	%	rank	%	rank
Food Processing Industries	76.2	6	61.9	6
Beverages and Tobacco	80.6	3	70.8	4
Textile and Clothing	90.9	2	79.9	1
Wood and Wood Products	77.4	4	75.0	2
Leather and leather products	76.9	5	60.0	7
Chemical industries	65.8	7	59.5	8
Non-metallic minerals	92.6	1	71.2	3
Metal and metal products	65.2	8	70.2	5

Source: Capacity utilisation index for Central Bureau of Statistics is calculated by dividing Column(2) by Column(5) in Appendix I. Our Estimates are obtained from Appendix II.

Our estimates show that capacity utilisation was highest in textile and clothing industries followed by wood and wood products, non-metallic mineals, beverages and tobacco, metal products, food processing, leather and leather products and chemical industries respectively. The Central Bureau of Statistics estimates show that it was highest in non-metallic minerals followed by textile and clothing, beverages and tobacco, wood and wood products, leather and leather products, food processing, chemical industries and metal industries in that order. The regression equations based on linear relationships between capacity utilisation, labour, productivity, labour intensity, index of market concentration and competing imports are shown in tables 4:3 to 4:10.

Table 4:3(a)

Correlation matrix in food processing industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.505	1.000				
F	0.811	-0.539	1.000			
M	-0.519	-0.065	-0.715	1.000		
L	0.698	-0.521	0.915	-0.592	1.000	
T	0.713	-0.150	0.791	-0.872	0.677	1.000

Table 4:3(b)

Regression Coefficients, Student's t-values and the Coefficients of Determination in food processing industries

	Constant	K	L	F	M	T	R^2
Cu	0.888	-0.678	0.073			0.020	0.676
	(2.98)*	(0.39)	(0.39)			(2.11)*	
Cu	0.741	-0.451	-0.129	0.001		0.012	0.707
	(2.19)*	(0.88)	(0.45)	(0.94)		(0.90)	
Cu	0.186	0.007	-0.185	0.001	1.107	0.020	0.746
	(0.29)	(0.01)	(0.64)	(1.34)	(1.03)	(1.32)	

NOTES to tables 4:3 to 4:10

(a) The figures in the brackets are the t-statistic values

* means that the coefficient is significant at 95% level of confidence.

** means that the coefficient is significant at 90% level of confidence.

(b) The Coefficient of Determination is given by the R^2 and the variables are defined in the equations in Chapter III.

(c) Total number of observations = 13.

Table 4:4 (a)

Correlation matrix in beverages and tobacco industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.271	1.000				
F	0.888	-0.537	1.000			
M	-0.894	0.262	-0.784	1.000		
L	0.880	-0.505	0.967	-0.783	1.000	
T	0.900	-0.608	0.892	-0.876	0.870	1.000

Table 4:4 (b)

Regression Coefficients, Student's t-values and the Coefficients of Determination in beverages and tobacco industries

	Constant	K	L	F	M	I	R^2
Cu	0.009	1.152	0.069			0.028	0.961
	(0.09)	(5.13)*	(2.70)*			(5.86)*	
Cu	0.033	1.172	0.028	0.001		0.026	0.966
	(0.33)	(5.16)*	(0.56)	(0.96)		(5.10)*	
Cu	-0.087	1.316	0.032	0.001	0.237	0.031	0.966
	(0.39)	(3.94)*	(0.61)	(0.84)	(0.61)	(3.33)*	

Table 4:5 (a)

Correlation matrix in textile and clothing industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.431	1.000				
F	0.928	-0.453	1.000			
M	-0.635	0.578	-0.766	1.000		
L	0.859	-0.664	0.895	-0.920	1.000	
T	0.780	-0.612	0.848	-0.959	0.972	1.000

Table 4:5 (b)

Regression Coefficients, Student's t-values and the Coefficients of Determination in textile and clothing industries

	Constant	K	L	F	M	T	R^2
Cu	0.083	0.431	1.431			-0.024	0.833
	(0.38)	(1.69)**	(3.47)*			(1.91)*	
Cu	0.382	0.181	0.764	0.001		-0.016	0.893
	(1.64)**	(0.73)	(1.56)**	(2.11)*		(1.46)**	
Cu	0.006	0.245	0.837	0.001	0.160	0.006	0.962
	(0.03)	(1.54)**	(2.64)*	(2.14)*	(3.52)*	(0.58)	

Table 4:6 (a)

Correlation matrix in wood and wood products industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.657	1.000				
F	0.895	-0.649	1.000			
M	-0.806	0.262	-0.853	1.000		
L	0.910	-0.599	0.989	-0.897	1.000	
T	0.784	-0.162	0.786	-0.902	0.842	1.000

Table 4:6(b)

Regression Coefficients, t-values and the Coefficients of Determinantion in wood and wood products industries.

	Constant	K	L	F	M	T	R^2
Cu	1.204	-0.953	-0.018			0.018	0.904
	(4.21)*	(2.50)*	(0.09)			(2.17)*	
Cu	1.259	-0.954	0.102	0.102		0.017	0.904
	(3.93)*	(2.35)*	(0.17)	(0.22)		(1.78)**	
Cu	1.819	-1.318	-0.394	0.001	-0.231	0.018	0.923
	(3.18)*	(2.62)*	(0.55)	(0.15)	(1.17)	(1.96)*	

Table 4:7 (a)

Correlation matrix in leather and leather product industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.492	1.000				
F	0.602	-0.819	1.000			
M	-0.126	0.778	-0.646	1.000		
L	0.904	0.564	-0.579	0.322	1.000	
T	0.340	-0.843	0.832	-0.934	-0.465	1.000

Table 4:7 (b)

Regression Coefficients, student's t-values and the Coefficients of Determination in leather and leather product industries.

	Constant	K	L	F	M	T	R^2
Cu	1.058	-0.201	-0.001			-0.009	0.832
	(5.43)*	(0.60)	(5.53)*			(0.88)	
Cu	0.958	-0.010	-0.001	0.001		-0.020	0.897
	(5.67)*	(0.04)	(5.70)*	(2.21)*		(1.99)*	
Cu	0.762	-0.135	0.001	0.001	0.206	0.005	0.912
	(3.16)*	(0.44)	(5.36)*	(0.93)	(1.12)	(0.20)	

Table 4:8 (a)

Correlation matrix in chemical industries

	Cu	K	F	M	L	T
Cu	1.000					
K	0.377	1.000				
F	0.789	0.109	1.000			
M	-0.620	-0.317	-0.533	1.000		
L	0.776	-0.001	0.965	-0.550	1.000	
T	0.674	-0.152	0.803	-0.375	0.912	1.000

Table 4:8(b)

Regression Coefficients, Student's t-values and the Coefficients of Determination in chemical industries.

	Constant	K	L	F	M	T	R^2
Cu	-0.398	2.648	0.128			0.005	0.750
	(1.06)	(2.11)*	(1.38)			(0.33)	
Cu	-0.272	2.482	-0.016	0.001		0.013	0.759
	(1.59)**	(1.82)**	(0.05)	(0.50)		(0.57)	
Cu	0.288	1.832	-0.247	0.001	-0.266	0.027	0.794
	(0.40)	(1.22)	(0.65)	(1.95)*	(1.01)	(1.03)	

Table 4:9 (a)

Correlation matrix in non-metallic minerals industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.016	1.000				
F	0.777	-1.166	1.000			
M	-0.543	0.667	-0.454	1.000		
L	0.852	-0.193	0.830	-0.429	1.000	
T	0.763	0.284	0.800	-0.245	0.771	1.000

Table 4:9 (b)

Regression Coefficients, Student's t-values and the Coefficients of Determination in non-metallic minerals industries.

	Constant	K	L	F	M	T	R^2
Cu	0.075	0.276	0.287			0.007	0.755
	(0.18)	(0.28)	(1.93)*			(0.50)	
Cu	-0.054	0.574	0.272	0.001		0.001	0.764
	(0.10)	(0.48)	(1.72)**	(0.50)		(0.05)	
Cu	-0.599	3.952	0.391	0.001	-2.802	-0.029	0.958
	(2.36)*	(4.78)*	(5.24)*	(2.02)*	(5.35)*	(2.83)*	

Table 4:10 (a)

Correlation matrix in metal and metal products industries

	Cu	K	F	M	L	T
Cu	1.000					
K	-0.381	1.000				
F	0.586	-1.822	1.000			
M	-0.669	0.543	-0.715	1.000		
L	0.379	-0.767	0.879	-0.671	1.000	
T	0.401	-0.787	0.913	-0.746	0.948	1.000

Table 4:10 (b)

Regression Coefficients, Student's t-values and the coefficients of Determination in metal and metal products industries.

	Constant	K	L	F	M	T	R^2
Cu	0.986	-0.483	-0.034			0.013	0.172
	(1.05)	(0.35)	(0.06)			(0.32)	
Cu	-0.291	0.605	-0.105	0.004		-0.023	0.469
	(0.29)	(0.48)	(0.23)	(2.11)*		(0.62)	
Cu	0.657	0.210	0.043	0.004	-1.444	-0.050	0.694
	(0.72)	(0.20)	(0.12)	(2.09)*	(2.27)*	(1.53)**	

(a) <u>The impact of labour productivity on capacity utilisation</u>

Labour productivity is significant at 95% level of confidence in beverages and tobacco, textile and clothing, leather and leather products when equation (10) in the previous chapter is run. But the coefficient, $\hat{\beta}_2$, in equation (11) becomes insignificant in textile and clothing industries. It is possible that the influence of labour productivity is captured by the index of market concentration which is highly correlated to labour productivity index. The correlation coefficient between labour productivity and the index of market concentration in textile and clothing industries is +0.895. This shows that the more concentrated industries (in terms of output), the higher is the labour productivity. This growth in productivity of labour may be due to reorganisation of production and/or better training and better supervison in the larger firms.

The correlation coefficient between labour productivity and the index of market concentration in all industries is greater than 0.800 except for leather and leather products. Also the correlation coefficient between labour productivity and the technological variable (T) is greater than 0.770 in all industries except for leather and leather products.

The study done by the World Bank on Kenya has shown that the productivity elasticity of employment in Kenya's manufacturing industries is 4:10 which implies that, for a unit increase in labour productivity, employment increases by over 4 times, which is more than proportionate.[2] If the World Bank estimate is correct, then one would conclude that increases in labour productivity increase capacity utilisation and labour absorption in the industrial sector. This is especially so in beverages and tobacco, textile and clothing, leather and leather products industries.

The positive impact of labour productivity on capacity utilisation implies that increase in labour productivity increase capacity utilisation. The negative relationship implies that labour productivity decreases the level of capacity utilisation, hence the level of output.

(b) <u>The impact of labour intensity on capacity utilisation</u>

The index of labour intensity takes a negative correlation coefficient with all variables considered in the time series analysis except competing imports, M. But, the correlation coefficients are generally low except with the technological variable, T. Thus, based on correlation coefficients, the index of labour intensity does not exhibit multicollinearity problem with the other variables. More interestingly, the index of labour intensity is significant at 95% level of confidence in beverages and tobacco, wood and wood products and non-metallic minerals, when equation (13) from the previous chapter was run. This variable is also significant in equation (10) and (11) from the previous chapter, in beverages and tobacco, chemical, wood and wood product industries. The results of the regression equations are in table 4:4 (b) and table 4:6(b).

The coefficient of labour intensity in equations (10), (11) and (12) in the previous chapter is negative in wood and wood products.as shown in table 4:6(b). This rejects the hypothesis that increase in level of labour intensity would increase the level of /capacity utilisation. A possible explanation would be that the impact of labour intensity is captured by labour productivity and the index of market concentration both of which are negatively correlated with labour intensity. The correlation coefficients are -0.599 and -0.649 for labour productivity and index of market concentration respectively.

(c) <u>The impact of market concentration on capacity utilisation.</u>

Though this variable has a positive sign in the multiple regression results in equations (11) and (12) from the previous chapter, it is insignificant at 95% level of confidence in all industries excpet textile and clothing, leather and leather products, metal and metal product industries. Its influence may have been captured by the index of labour productivity which is highly correlated to it.

The market concentration index does not improve the explanatory power of the model in equation (11) in the previous chapter as can be seen in tables 4:3(b) to table 4:10(b), except in metal and metal products. Again, a possible explanation would be that it is highly correlated with the index of labour productivity. The index of market concentration is highly correlated with the technological variable, T. Thus, the high concentrated industries (in terms of output) try to keep up with the technological changes. This might have adverse effects on the level of labour absorption, since these technological changes are usually biased towards capital using techniques, though these technological changes might not affect capacity utilisation. The larger firms tend to use modern technology with high coefficient of output per labour, tending to displace labour intensive handicrafts and other small manufacturing establishments.

(d) <u>The impact of competing imports on capacity utilisation</u>

Considering equation (12) in the previous chapter, the competing imports variable improves the explanatory power of the model in all industries. Its coefficient has the correct negative sign hypothesized in wood and wood products, non-metallic minerals, metal and metal products and chemical industries, though not significant at 95% level of confidence in wood and wood products and chemical industries. This negative relationship between competing imports and capacity utilisation may indicate the degree of success (to some extent) in import substitution strategy in these industries.

On the other hand, the competing import variable is positively correlated with capacity utilisation in food processing, beverages and tobacco, textile and clothing and leather and leather product industries. A possible explanation for the positive relationship would be that the installed capacity in those industries is so low that, even if capacity utilisation is increased up to 100%, importation is needed to satisfy local demand. The negative correlation coefficients between competing imports and the technological variable (proxied by Time, T) shows that these imports have been declining over time.

(e) <u>The impact of change in stocks on capacity utilisation</u>

It appears that change in stocks have no effect on the level of capacity utilisation, though the coefficient has the correct sign. The explanatory power of the model is very low (0.098), implying that this variable explains only about 10% variation in capacity utilisation. The high t-statistic value of the constant term show that, capacity utilisation is determined mainly by other factors which have not been included. The regression results for change in stocks is given by

$$Cu = 0.549 + 0.002\ \Delta S \qquad R^2 = 0.098$$
$$(6.55) \qquad (0.26)$$

Total number of observations = 9

The figures in parentheses are the t-statistic values of the regression coefficients. When the index of labour intensity is included in the regression, the coefficient of the change in stocks becomes significcant at 90% level of confidence. And 50% variations in capacity utilisation is explained by variations in labour intensity and change in stocks. This shows that, there is the problem of multicollinearity between the two independent variables.

The regression results when the index of labour intensity is included is given by

$$Cu = 0.0133 + 0.0136\ \Delta S + 0.941K \qquad R^2 = 0.500$$
$$(0.06) \qquad (1.79) \qquad (2.43)$$

Total number of observations = 9

(f) <u>The impact of profitability on capacity utilisation</u>

The profitability variable is insignificant at 95% level of confidence but with the correct sign. This variable also improves the explanatory power of the model by about 5 per cent. Thus, the higher the level of profits realised by the manufacturing firms, the lower the level of capacity utilisation and consequently the lower the level of labour absorption capacity. That is, an increase of 39.3% in profits would lower capacity utilisation by 1%, other variables held constant.

The regression equation when the profitability index is included is given by

$$Cu = \underset{(0.65)}{0.374} + \underset{(1.15)}{0.01}\,\Delta S + \underset{(0.83)}{0.564}\,K - \underset{(0.70)}{0.394}\,\bar{\Lambda} \qquad R^2 = 0.545$$

Total number of observations = 9

The figures in parentheses are the t-statistic values of the regression coefficients.

The index of labour intensity has been included in the cross-section analysis because of its low correlation coefficients with the other variables considered in the time series analysis. Labour intensity together with the absolute size of employment can be helpful in defining priorities for the choice of projects from the the point of view of employment planning.

4:2 Conclusions

The estimates made in this study suggest that employment and output could be expanded considerably if fuller capacity utilisation was achieved. But it appears from the study that progress on more utilisation of industrial output could not be made without the establishment of a reliable and regular system of statistical survey and an evaluation of the degree of capacity utilisation.

However, our empirical findings show a mixture of results. First, the t-statistic values have been very low in some of the variables considered. This might have been due to the presence of multicollinearity between the variables as well as the specification biases. The index of labour productivity was not a significant variable explaining the variations in capacity utilisation in most of the industries. It rejected the hypothesis that it has significant positive effect in all industries except in textile and clothing, leather and leather products industries. In some cases it has indicated a negative relationship with capacity utilisation, implying that increases in labour productivity would lower the level of capacity utilisation. But, as it was explained earlier, this negative relationship may be due to the success of import substitution strategy of industrialisation in Kenya's manufacturing industries. Also it could have been due to the presence of multicollinearity between labour productivity and other variables like the index of market concentration. If one assumes that, in measuring value added per worker we have inevitably measured labour skills, then, since these skills are in critical shortage in LDCs, increases in labour productivity would increase capacity utilisation, although this seems not to be the case in most industries (as indicated by our results).

Other variables like the labour intensity, the index of market concentration and competing imports also indicated different implications on the level of capacity utilisation on different industries. In some industries like food processing, beverages and tobacco, textiles and clothing, leather and leather products industries, capacity utilisation is increased as a result of increasing competing imports. On the contrary, increasing competing imports would lower capacity utilisation in all the other industries.

On the cross-section analysis, the profitability index and the changes in stocks had the correct signs as specified in the hypotheses, although these two variables
did not significantly explain the variations in capacity

utilisation. Firms may accumulate stocks for several reasons. First, if they speculate that the demand for those goods they produce will rise in future, they would hold more stocks and current production would be increased. Secondly, if they speculate that it would be difficult to get inputs in future, they would produce more in the present period such that future shortages of import may not significantly affect their sales. Thirdly, the present demand might be low thus affecting their sales. Nevertheless, recent studies on capacity utilisation have shown that capacity utilisation is affected by a variety of other factors. Some of the factors include

(a) lack of feasibility studies and over-estimation of demand for a particular product. A case in point is the collapse of the East African Common market. Some of the industries which were established in the 1960s in Kenya were aimed at capturing the whole of the East African market. After the collapse of the Community in the mid-1970s, these industries were only restricted to Kenyan market, forcing the industries to underutilise their capacity.

(b) lack of long-term co-ordination of investment policies and lack of information about the degree of capacity utilisation in existing plants.

(c) other factors like, lack of water, electricity and variation in weather conditions.

(d) restrictions on the supply of intermediate and capital goods input. These include shortages of domestic and foreign raw material inputs and imported equipment and machinery.

The inflationary process, which increases the profitability of enterprises in a purely fictitious way, may have given the entreprenuers the illusionary impression that the situation was much better than it was. And this may have been the reason for the inverse relationship between capacity utilisation and the profitability index.

The notion of overcausation, therefore, is simply that there are many reasons which explain why firms underutilise capacity. The significant difficulties are in trying to identify the structure of idle capital as well as in designing policies to cope with it. Together with the necessary conditions for fuller utilisation of installed capacity, this notion leads to the conclusion that capacity utilisation policy must be an integrated combination of measures with a broad coverage.

In order for a proper policy action on capacity utilisation and employment expansion to be effective, this paper would therefore recommended the following measures

(a) Fiscal incentives may be introduced to attract high degree of plant utilisation. This would be helpful if tax credits and depreciation allowances are given only to firms operating two or more shifts per day. Thus, increased investment expenditure in labour intensive industries would result in a lower company profits tax liability. Similarly, some proportion of any expenditure of the company to train its intermediate-level technical manpower could be allowed as a credit against the company's tax liability.

(b) Export duties should be reduced or eliminated and instead direct export subsidies, export credit and guarantee export schemes should be established in order to reduce risks of exporting. Such policies would increase the rate of capacity utilisation and industrial labour absoption capacity in export-orieted establishments.

(c) New industrial investment should be based primarily on the use of local materials and not in industries which use complementary imports which will prevent production from taking place when they are not available.

However, these policies are not conclusive in a number of ways. First, the results of our regression analysis gave a mixture of relationships between the variables for different industrial groups, making it difficult for one to generalise on the correlation between them. Secondly, most of the results in the multiple regression equations had insignificant variables for some of the industrial groups while others were significant at 95% level of confidence. Thirdly, these results were based on large scale manufacturing industries (firms employing 50 workers or more), while it is possible that the results would have been different if small firms (employing less than 50 workers) were included in the analysis. Again, as it was stated in chapter II, different capacity measures would give different results which may have different statistical implications. All in all, whatever one takes to be the measure of capacity, there is clear evidence that there is underutilisation of capacity in Kenya's manufacturing industries. And any attempts to increase utilisation would raise the level of labour absorption in the short-run and in the long-run.

4:3. Limitations of the Study

This study suffers a number of limitations which reduce its usefulness. Firstly, our measurement of the index of capacity utilisation has a number of shortcomings. It assumes that the estimated output (Q) implies the normal degree of utilisation while the highest level of output (given by the maximum positive difference between the actual and estimated output) implies the 'full' degree of capacity utilisation. This statistically estimated 'full' capacity utilisation may not be reflecting the maximum since there would be still some bottlenecks preventing firms from producing the maximum possible. Secondly in order to use this technique of estimating the index of capacity utilisation, one has to plot a scatter diagram first and trace the trend line. The random dispersion of the actual observations from the trend line would indicate whether there is the problem of heteroscedasticity. Our actual data on output had a consistent upward trend, justifying the use of the method described in chapter III (as shown in table 4:1) although this may not have been the case if the study considered individual firm's output.

The growth in output over time may have been due to increase in number of firms and not due to capacity utilisation. In order to capture this influence, the time variable (T) which captures the technological changes in industries was also used to capture this influence. The analysis suffers from multicollinearity problem especially with the index of labour intensity and market concentration index and the consequences may affect our conclusions in a number of ways. First, the precision of estimation falls so that it becomes very difficult, if not impossible, to disentangle the relative influences of the various independent variables. Secondly, we may have ignored some variables or factors which significantly affect capacity utilisation as we could not pick them up with the kind of data the study utilises. The presence of errors of measurement in the variables may have rendered the estimates of the coefficients both biased and inconsistent.

FOOTNOTES

1. The Spearman's rank correlation coefficient is calculated using the following formula

$$r' = 1 - \frac{6\Sigma D^2}{n(n^2-1)}$$

where: r' = the rank correlation

D = the difference between each pair of rank observations.

n = no. of pairs of rank observations.

2. World Bank, Kenya : Into Second Decade. John Hopkins University Press, 1975, p. 147.

APPENDIX I Table A1

CAPACITY SURVEY ANALYSIS, 1971

Sector: Manufacturing 50+

ISIC Code	Major Group	Gross Product per hour	Total GDP: 1971 Respondents	Total GDP: 1971 Respondent at preferred hours	Change 3/2	Total GDP: 1971 Respondent at maximum hours	Change 5/2	Total GDP: 1971, 50+ Respondents & non-respondent	Capacity Survey Coverage in terms of GDP	Weighted Average hours	Weighted preferred hours	Weighted maximum hours
		1	2	3	4	5	6	7	8	9	10	11
		K£000	K£000	K£000	%	K£000	%	K£000	%			
20	Food Manufacturing industries	115.86529	7820.52	8784.67	112.33	10266.86	131.28	10231.92	76.43	67.61	75.08	88.76
21	Beverage Industries	61.61774	6332.64	5640.00	89.06	6089.24	123.74	6332.64	100.00	102.77	91.53	131.28
22	Tabacco Industries	53.21556	2394.70	2394.70	100.00	2767.21	115.56	2394.70	100.00	45.00	45.00	52.00
23	Textiles	20.20353	2591.90	2908.98	112.23	3805.52	108.24	2693.58	96.22	128.29	143.98	138.35
24	Foot-wear clothing and make-up textiles	21.98599	1558.69	1784.13	114.46	1730.68	111.03	1767.49	88.19	70.89	81.15	78.72
25	Wood and Cork	20.30119	1072.70	1135.72	105.87	1214.56	116.02	1106.00	96.99	52.64	55.94	61.30

continued next page

APPENDIX I Table A1 Continued

		1	2	3	4
26	Furniture &Fixture	2.71547	136.20	119.88	88.02
27	Paper and Paper Produ-cts	12.50969	964.69	1401.12	145.24
28.	Printing, Publishing and Allied Industries	28.79394	2284.10	2438.90	106.78
29	Leather & Fur Products	32.78853	270.53	308.34	113.97
30	Rubber manufactu-re	5.18160	481.00	506.15	105.23
31	Chemicals	116.77948	5081.75	10056.01	197.88
31-314	Chemicals less Wattle Bark Extract Extract	92.53585	4678.71	6036.89	129.03
32	Petroleum and Coal Product	17.20184	2803.90	2821.10	100.61
33	Non Metal-lic Minerals	26.04518	3525.63	3773.38	107.o3

5	6	7	8	9	10	11
154.62	113.52	274.60	49.60	50.16	44.15	56.94
1621.80	168.12	964.69	100.00	77.12	112.00	129.64
2756.83	120.70	2416.60	94.52	79.33	84.70	95.74
353.30	130.60	270.53	100.00	71.41	81.39	93.26
611.92	131.38	481.00	100.00	92.83	97.68	121.95
10736.97	211.28	5941.85	85.52	43.52	86.11	91.94
6680.84	142.79	5538.83	84.47	50.51	65.17	72.12
2889.60	103.06	2803.90	100.00	163.00	164.00	168.00
3832.85	108.71	3982.75	88.52	135.37	147.16	147.16

continued next page.

APPENDIX I Table A1 Continued.

		1	2	3	4	5	6	7	8	9	10	11
35	Metal Products	68.86714	3991.40	5143.24	128.86	6526.07	163.50	4126.10	96.74	59.96	74.68	94.76
36	Non-Electrical Machinery	5.17096	254.20	265.42	104.41	323.27	127.96	513.90	49.46	49.16	51.33	62.90
37	Electrical Machinery	21.45374	1336.10	1622.81	119.05	2325.90	170.63	1363.10	100.00	63.54	75.64	108.41
38	Transport Equipment (Ship Building)	6.97800	314.01	314.01	100.00	506.52	161.31	416.53	75.39	45.00	45.00	72.59
	Miscellaneous Manufacturing	5.29054	506.65	812.31	160.33	613.51	121.09	624.91	81.08	94.77	153.54	115.96
2+3	Total Manufacturing	613.76521	4374.31	52230.87	119.39	60179.23	137.56	48706.79	89.82	71.28	85.10	98.05

Note: Figures on weighted hours and GDP at 'preferred' and 'maximum' hours of operation are annual projections based on reported weekly hours of work. The projections are somewhat misleading due to seasonal nature of operations.

Source: Capacity Survey Analysis : Central Bureau of Statistics, 1971. (Unpublished). Nairobi, Kenya.

APPENDIX II

DATA FOR LARGE SCALE MANUFACTURING INDUSTRIES

A. Table 2: Food Processing Industries

	Employment (L)	Labour costs (WL) K£'000	No. of firms (n)	Capacity Utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	9119	2277	23	70.0	5620	0.245	0.459	215	0.54
1965	8889	2318	24	64.0	5657	0.241	0.444	217	0.587
1966	9676	2695	26	63.8	5846	0.219	0.508	204	0.548
1967	9260	3039	26	62.3	4392	0.151	0.659	177	0.498
1968	11439	3116	22	69.4	3635	0.120	0.614	231	0.444
1969	10332	3496	23	59.6	2866	0.085	0.546	278	0.619
1970	10872	4161	25	61.9	4042	0.104	0.535	311	0.715
1971	12093	4211	29	64.5	5800	0.129	0.555	262	0.629
1972	12512	4878	35	65.8	7027	0.141	0.615	227	0.634
1973	15308	5670	35	69.6	5146	0.086	0.487	332	0.780
1974	24987	6608	38	86.6	8668	0.106	0.496	351	0.533
1975	17716	7511	42	95.5	6063	0.061	0.492	364	0.862
1976	20690	11756	46	100.0	6155	0.044	0.429	596	1.325

Source: Calculated from *Statistical Abstracts*, various issues

A. Table 3: Beverages and Tabacco Industries

	Employment (L)	Labour Costs (WL) K£'000	No. of firms (n)	Capacity Utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	3388	1721	8	61.0	2409	0.254	0.366	588	1.388
1965	3249	1713	7	59.0	2200	0.239	0.378	647	1.393
1966	3484	1944	9	64.0	2194	0.225	0.401	539	1.392
1967	3213	2178	7	70.0	1708	0.148	0.408	762	1.660
1968	2709	2246	6	77.0	2632	0.121	0.442	846	1.874
1969	3320	2574	7	79.4	2345	0.087	0.416	884	1.863
1970	3336	2326	6	70.8	3444	0.109	0.348	1113	2.002
1971	3797	2578	6	72.1	4746	0.132	0.323	1330	2.102
1972	4102	2527	8	71.0	5301	0.142	0.281	1124	2.192
1973	4626	2949	7	81.8	6549	0.088	0.088	1326	2.006
1974	4979	4054	9	89.4	6024	0.103	0.342	1317	2.380
1975	5354	5103	7	96.0	6063	0.061	0.360	2027	2.650
1976	5441	5572	8	100.0	9628	0.043	0.313	2625	3.859

Source: Calculated from *Statistical Abstracts*, various issues.

A. Table 4: Textile and Clothing Industries

	Employment (L)	Labour costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	6450	1149	26	79.0	10930	2.076	0.679	65.1	0.262
1965	8620	1201	26	75.8	11925	1.938	0.558	82.7	0.325
1966	8066	1593	28	79.9	15124	1.772	0.553	102.9	0.357
1967	6134	1728	32	71.9	12516	1.353	0.666	81.1	0.319
1968	8789	2012	34	75.0	13841	1.183	0.542	109.3	0.423
1969	9260	2209	43	74.4	14353	1.070	0.588	87.4	0.406
1970	10723	2379	47	72.0	16368	1.121	0.565	89.6	0.393
1971	11960	2708	47	79.9	20225	1.150	0.512	112.5	0.442
1972	13720	3377	54	82.2	18247	0.843	0.489	166.5	0.503
1973	14872	3871	59	88.1	19233	0.739	0.466	157.3	0.558
1974	15401	4754	73	87.9	29599	0.809	0.536	162.4	0.576
1975	16545	5474	69	90.6	22480	0.551	0.541	205.6	0.612
1976	16245	5761	67	100.0	24618	0.508	0.547	313.4	0.648

Source: Calculated from Statistical Abstracts, various issues

A. Table 5: Leather and Leather Products Industries

	Employment (L)	Labour Costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	412	103	4	100.0	762	1.174	0.477	54.0	0.524
1965	373	116	4	82.0	700	1.161	0.665	43.5	0.466
1966	383	112	4	66.0	815	1.023	0.438	64.0	0.668
1967	427	165	5	57.0	696	0.604	0.532	62.0	0.726
1968	486	194	5	57.0	928	0.608	0.446	87.0	0.895
1969	797	268	7	63.0	848	0.379	0.361	106.0	0.930
1970	990	349	7	60.0	960	0.395	0.510	98.0	0.866
1971	1052	414	7	60.0	1335	0.471	0.468	126.3	0.840
1972	1612	688	11	76.0	826	0.119	0.373	167.8	1.145
1973	1799	987	19	82.0	916	0.125	0.299	183.5	1.836
1974	2072	1121	11	95.0	1297	0.105	0.234	436.0	2.315
1975	2295	1266	12	95.0	1339	0.099	0.256	411.3	2.151
1976	2198	976	7	95.0	1723	0.108	0.194	717.4	2.285

Source: Calculated from Statistical Abstracts, various issues.

A. Table 6: Wood and Wood Products Induries

	Employment (L)	Labour costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	6823	1637	46	75	4801	0.828	0.617	57.6	0.389
1965	7301	1814	50	72	5847	1.023	0.596	60.9	0.417
1966	7017	2006	47	76	6807	0.839	0.536	79.7	0.534
1967	6956	2216	49	73	6919	0.732	0.628	72.0	0.507
1968	7560	2517	51	69	7380	0.718	0.687	71.8	0.484
1969	8417	2886	57	69	8470	0.710	0.665	76.2	0.516
1970	9397	3245	69	72	9653	0.669	0.651	72.2	0.530
1971	10451	3658	72	75	12669	0.740	0.666	76.3	0.525
1972	11587	4145	82	80	11967	0.574	0.663	76.5	0.541
1973	12160	4773	83	88	14118	0.641	0.596	96.4	0.658
1974	13073	6691	95	93	22997	0.599	0.600	117.4	0.853
1975	13569	6590	102	89	15302	0.385	0.623	103.7	0.779
1976	13879	7492	90	100	11562	0.242	0.499	166.7	1.081

Source: Calculated from *Statistical Abstracts*, various issues.

A. Table 7: Chemical Industries.

	Employment (L)	Labour costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	2548	1266	15	76.5	10726	0.644	0.336	252	1.480
1965	2419	1317	17	67.3	13260	0.643	0.308	252	1.768
1966	2652	1488	15	66.1	15675	0.724	0.300	331	1.874
1967	2348	1490	16	68.1	13181	0.596	0.330	283	1,925
1968	2588	1408	19	63.6	18398	0.762	0.295	251	1.843
1969	2880	1642	22	60.2	19186	0.713	0.286	261	1.992
1970	3121	1883	25	59.5	22844	0.667	0.298	253	2.027
1971	3650	2233	27	63.5	29324	0.598	0.272	304	2.251
1972	4711	3588	30	73.4	35503	0.640	0.310	386	2.456
1973	4935	3626	32	74.7	51777	0.934	0.281	403	2.613
1974	6095	5253	42	91.8	77776	0.628	0.333	376	2.591
1975	6131	5806	40	100.0	51318	0.351	0.296	490	3.197
1976	5111	6532	32	96.0	61804	0.410	0.329	662	3.885

Source: Calculated from *Statistical Abstracts*, various issues.

A. Table 8: Non-metallic Minerals Industries

	Employment (L)	Labour Costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	1320	532	11	64.9	755	0.221	0.322	150	1.250
1965	1531	585	10	59.6	803	0.197	0.263	223	1.449
1966	1625	645	9	58.7	1060	0.215	0.285	252	1.393
1967	1823	748	9	56.6	1277	0.226	0.321	259	1.276
1968	1956	920	10	50.1	1694	0.293	0.360	256	1.307
1969	2134	956	11	52.0	1722	0.252	0.322	270	1.389
1970	2403	1061	14	59.6	1773	0.202	0.306	246	1.431
1971	2007	1354	16	71.2	2967	0.256	0.325	260	2.076
1972	3320	1606	19	71.1	2795	0.220	0.357	237	1.353
1973	3392	1784	19	68.7	2302	0.173	0.296	317	1.775
1974	3681	2241	21	74.7	3606	0.230	0.388	275	1.567
1975	4027	2633	21	86.6	3957	0.203	0.360	349	1.818
1976	4263	2688	20	100.0	3607	0.149	0.257	523	2.453

Source: Calculated from *Statistical Abstracts*, various issues.

A. Table 9: Metal and Metal Products Industries.

	Employment (L)	Labour costs (WL) K£'000	No. of firms (n)	Capacity utilisation (cu) %	Total imports (M^T) K£'000	M^T/Q	WL/VA	Q/n	Q/L
	1	2	3	4	5	6	7	8	9
1964	4924	1704	15	100.0	2548	0.355	0.636	178	0.544
1965	5106	1873	19	77.0	3131	0.394	0.629	157	0.583
1966	4982	2141	17	63.3	4019	0.472	0.587	215	0.732
1967	5535	2492	24	61.5	5155	0.505	0.585	178	0.770
1968	5452	2717	24	56.7	4426	0.396	0.595	190	0.837
1969	6786	3364	28	60.3	4665	0.338	0.616	195	0.806
1970	8297	4118	34	76.8	5465	0.274	0.565	214	0.879
1971	9227	3951	33	70.2	7523	0.368	0.525	228	0.816
1972	7045	4906	39	66.0	7176	0.337	0.557	226	1.251
1973	10045	5261	39	89.5	8585	0.271	0.457	296	1.147
1974	11303	7029	53	93.2	9935	0.278	0.468	283	1.327
1975	10994	7499	49	90.6	10289	0.272	0.548	279	1.245
1976	11736	8361	48	98.1	11238	0.256	0.256	325	1.340

Source: Calculated from *Statistical Abstracts*, various issues.

A. Table 10: Basic data for large scale manu[illegible]
(Cross-Section Analysis).

INDUSRIAL GROUP	No. Engaged (N)	Labour Costs (WN)	Value-Added Output (Q) K£'000	Profits K£'000 ($\bar{\Lambda}$)	Change in Stocks Δs K£'000	Capacity Utilisation (cu) %	WN/Q	$\bar{\Lambda}$/Q	Q[illegible] K£[illegible]
	1	2	3	4	5	6	7	8	9
Food Processing	13021	5616.6	9656.9	3541.6	350.2	65.8	0.55	0.367	741…
Beverages & Tobacco	4103	2527.1	8993.5	5669.1	69.1	71.0	0.28	0.630	2192…
Textile & Clothing	12639	2973.5	5289.2	2347.2	-104.2	82.2	0.56	0.444	41…
Leather Products	1863	626.6	1425.2	434.0	170.7	76.0	0.37	0.305	765…
Wood Products	11406	4181.3	7107.5	1216.1	65.2	82.0	0.59	0.171	62…
Chemical Products	4096	3123.3	9802.7	5727.3	158.9	73.4	0.32	0.584	239…
Non-Metallic Products	3325	1364.7	4495.5	2112.9	461.3	71.1	0.30	0.470	135…
Metal Products	10088	4908.1	8806.5	3561.1	174.9	66	0.56	0.404	87…
Transport Equipment	19282	4554.4	6196.6	1461.3	93.6	72.1	0.73	0.236	32…

Source: Calculated from Census of Industrial Production, 1972,(Nairobi, Government Printer, February, 1978)

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