Title	UNDEREMPLOYMENT AND RIGIDITY OF INDUSTRIAL EMPLOYMENT IN A THIRD WORLD COUNTRY: THE CASE OF JUTE WEAVING IN BANGLADESH
Sub Title	
Author	KIBRIA, M. G. TISDELL, C. A.
Publisher	Keio Economic Society, Keio University
Publication year	1984
Jtitle	Keio economic studies Vol.21, No.2 (1984.) ,p.69- 87
JaLC DOI	
Abstract	
Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260492-19840002-0069

UNDEREMPLOYMENT AND RIGIDITY OF INDUSTRIAL EMPLOYMENT IN A THIRD WORLD COUNTRY: THE CASE OF JUTE WEAVING IN BANGLADESH

M. G. KIBRIA* and C. A. TISDELL*

1. INTRODUCTION

The claimed widespread existence of disguised unemployment in agriculture in LDCs (Nurkse, 1952; Lewis, 1954; Rosenstein-Rodan, 1957; Fei and Ranis, 1964) has in recent times prompted economists to ask whether similar types of disguised underemployment also occur in the manufacturing sector in the Third World (Todaro, 1977). While the main purpose of this paper is to substantiate the thesis that labour employment is relatively inflexible in Bangladesh jute spinning mills, a subsidiary purpose of this paper is to suggest that disguised unemployment of similar nature can arise within manufacturing industry in LDCs. Some evidence in support of this comes from the existence of inflexibility of labour employment in relation to changes in manufacturing operating capacity in Bangladesh jute weaving mills.

The definition of disguised unemployment used in this paper is similar to that of Wonnacott (1962), namely, disguised unemployment exists if the number of labourers employed is such that the MRP (marginal revenue product) of labour is less than the wage rate. An alternative and more general concept of disguised unemployment or 'over employment' would cover situations in which the quantity of labour is greater than that required to maximize the profit of the firm. On the basis of both concepts, this paper suggests that over employment (disguised unemployment) exists in the jute weaving industry in Bangladesh and that it is largely caused by the rigidity of employment in relation to changes in manufacturing operating capacity.

Rigidity of employment in agriculture has been taken as an indicator of the existence of disguised unemployment (Wonnacott, 1962; Islam, 1964). However, institutional rigidity and the consequent overemployment may be greater in manufacturing compared to agriculture in many LDCs. The small size of family farms and the extreme periodicity of production in agriculture may help to explain rigidity of labour employment and underemployment in this sector (Islam, 1964). A recent study by Masum (1979) found that only a small proportion of the agricultural labour force is fully employed for the whole year. Employment for

* We would like to thank Dr. H. W. Dick for his useful comments on the draft of this paper. The usual caveat applies.

most of the labour force fluctuates seasonally throughout the year. Most agricultural labourers are hired on a daily basis and are constantly moving between jobs and/or employers (Clay, 1976). In Bangladesh, for example, conditions of agricultural employment are not rigidity defined, and payment takes a variety of forms such as "traditional share payments, daily wage with prepared food, and fixed contract payments in cash, sometimes also with prepared food" (Clay, 1976). This relative fluidity of employment in LDC agriculture differentiates it from industrial employment, particularly in nationalized industries, where conditions of employment are far more rigidly defined. Also, in most cases in Bangladesh industrial workers are part of powerful trade unions (Sobhan and Ahmad, 1980). It appears that factors leading to institutional rigidities in agriculture, as considered by Wonnacott, may be more applicable to in the manufacturing sector of LDCs. The evidence presented below suggests that rigidity of labour employment may exist in Bangladesh manufacturing and can culminate in a substantial overemployment in this sector.

The case of jute weaving in Bangladesh provides good empirical support for this proposition. The number of employed weavers in 39 jute weaving mills is related to operating capacity of each to determine the responsiveness of employment to changes in manufacturing operating capacity. This sample, consisting entirely of nationalized mills, accounts for most of jute fabric production in Bangladesh and supports the thesis of 'employment rigidity'. (All weaving mills in Bangladesh are nationalized).

The data was collected by one of the authors in 1981 by paying direct visits to the mills sampled. The data covered yearly labour employment figures and estimates of the year to year manufacturing operating capacity over the life of each of the mills which amounted in some cases to a 26-year period. However, from the operational age of the mills we have omitted five years (1970–71 to 1974–75) because of the disruption of the "Liberation War" and the subsequent nationalisation of the jute mills. The actual number of yearly observations used for each mill can be obtained by adding unity to the numbers in the last column of the Tables appended to the text.

In order to consider the responsiveness of the level of labour employment in jute weaving mills to changes in their operating capacity, appropriate measures of employment of weavers and of manufacturing operating capacity need to be devised. The measures adopted are discussed in the next section. Next, the proposed method of measuring inflexibility of labour employment in relation to changing levels of operating capacity in the relevant mills is outlined. The empirical results using this method are then reported.

2. MEASURING INFLEXIBILITY OF LABOUR EMPLOYMENT IN RELATION TO CHANGING OPERATING CAPACITY IN JUTE WEAVING

The purpose of this paper is to investigate the responsiveness of employment in

jute weaving to variations in operating capacity. Employment is defined in terms of average yearly 'crew-size', that is the number of workers who offered a labour service to the production process. The conventional approach of measuring labour services in terms of man-hour (as has been done by Sen, 1966) was not exactly appropriate in our situation. The industrial practice in Bangladesh jute weaving mills is that once reporting for duty, a worker is supposed to work the full hours of a shift (8 hours). The possibility of varying hours of work being thus eliminated, the problem of measuring the labour services rendered to the process of production resolves into the simple practice of adding up and averaging (to obtain a 'daily' equivalent) out of the number of workers who worked on each working day of the year in question.

Manufacturing operating capacity, is defined as the actual number of operating machines (i.e. looms) multiplied by the actual time of operation of the mill per period of time i.e. an year. While the annual operating time of a mill in a particular year is measured in hours, the measurement of actual manufacturing operating capacity poses a problem in the sense that very few individual looms operate continuously throughout the whole year. Most looms are idle for varying periods in the year due to mechanical breakdowns, repairs and maintenance. However, mills keep records of the time individual looms remain down (management of individual mills is required to report these statistics to the JBMC, Bangladesh Jute Mills Corporation, which is the administrative authority controlling all state-owned jute mills on behalf of the government) and this data can be used to circumvent the above problem of calculation. The annual sum of actual loom-hours operated is calculated and so also are the potential loom-hours that could have been achieved if all the looms actually ran all the time the mill, as a unit, operated.[1] The ratio obtained by dividing the actually attained number of loom-hours by the potential number of loom-hours should give a reasonable approximation to the number of looms operating, on an average, in that particular year. The manufacturing operating capacity therefore indicates the actual annual number of machine-hours (loom-hours) of operation of each weaving mill. It should be noted that in Bangldesh installed capacity has *not* altered over the life of the mills. Each is endowed with its original equipment (Kibria and Tisdell, 1983a; BJMC Study Group, 1980, Vol. IV). Furthermore, the number and time-duration of shifts has not altered during the operational life-time of the mills sampled (Confirmed by data collected for this study; also BJMC Study Group, 1980, Vol. II).

In order to measure the responsiveness of labour employment (i.e. employment of weaver in this study) to variations in operating capacity (i.e. loom-hour) the linear equation

$$n = a + bk \tag{1}$$

[1] Specifically, the number of installed looms multiplied by the maximum available hours of operation for a shift, which is estimated to be 2400 after giving allowance for holiday closures, industrial practices and maintenance requirements.

was fitted to the data.[2] In this equation, n represents the proportionate change in number of weavers employed (compared to those in the previous year) and k represents the proportionate change in operating capacity (looms-hours compared to the previous year), and a and b are parameters.

It follows from equation (1) that any autonomous change in the level of employment is reflected in the intercept-value a. If $a>0$ there is tendency of employment to go up independently of any change in operating capacity, while if $a<0$ there is an autonomous fall in the level of employment. If $a=0$ any autonomous change in employment is absent—the employment level is determined solely by the level of operating capacity.

The value of the parameter b on the other hand indicates the degree of responsiveness of employment to a change in operating capacity. When $b=1$ a variation in proportionate change in operating capacity k is associated with an equal variation in proportionate change in the level of employment n. If $b>1$, any change in k results in a larger variation in n. If $b<1$, the converse holds. Available evidence indicates that operating manufacturing capacity in Bangladesh jute mills tends to be a unimodal function of the age of each. Operating capacity tends to rise with the commencement of the operation of a mill and reaches a maximum after about 2 to 5 years of its operation and then declines with its age (Kibria and Tisdell, 1984). It is possible that labour responsiveness to *rising* capacity utilization differs to that for *falling* utilization. This is a case of possible hysteresis.

It is possible that employment is less sensitive to changes in operating capacity in the downward phase of utilization than in the upward one. If this is so, we would expect where b_1 represents the coefficient in equation (1) for the full phase and b_2 represents that for the declining phase of operating capacity that $b_1<b_2<1$, if our hypothesis of less than proportionate sensitivity of employment changes to variations in operating capacity holds. To test the hypothesis it is necessary to estimate the appropriate coefficients in equation (1).

3. FINDINGS

For the purpose of estimating the coefficients of (1) for Bangladesh jute weaving mills, the following data were assembled for each mill for each year since its inception: the number of looms operated each year, the annual number of hours for which the mill worked and the average number of weavers employed annually. Changes in operating capital-hours (loom-hours) in every year and the corresponding changes in employment of labour (weaver) in that year were calculated on the basis of capital-hours worked and labour employed in the previous year. For each variable, the value corresponding to a particular year was noted as its

[2] An alternative way to deal with asymetry is to use the dummy variable method, perhaps with an intercept as well as a slope dummy, and to test for the asymmetry directly. This method offers higher degrees of freedom in estimating the coefficients. Using this method, one could introduce lags in the response pattern, and compute the adjustment period if necessary.

relative change, in percentage, over the previous year's value. The total number of observations is therefore one less than the total number of years for which data were available. Each observation represents the percentage change in employment in a particular year and the corresponding value for change in operating capacity.

It is possible that variations in operating capacity in one year may influence the employment level of the next year, that is to say with a lagged effect of one year. However, it was found that this lagged relationship did not provide a superior fit to the data compared to the non-lagged relationship. Therefore the non-lagged relationship was adopted. Results are reported separately for two products, sacking and hessian, and for the full phase and the falling phase of operating capacity.

Regression results for equation (1) for both full and falling phases for sacking are presented in Tables 1 and 2 respectively. Regression results for the same function for the hessian mills are shown in Tables 3 and 4. The tables show the values of the parameters a and b of the equation, the coefficient of determination (R^2), the F-statistic and the number of observations upon which the regression is based.

From these tables, it can be seen that linear functions provide a good fit to the observations for most of the mills for both full and falling phase of operating capacity for both sacking or hessian mills. For the full-phase, the R^2 values range around .755 to .981 for sacking and .775 to .987 for hessian. For the declining phase, the value of the coefficient of determination ranges around .803 to .954 for sacking and .837 to .941 for hessian. The estimated parameters for 84.29% of the cases for sacking and 83.78% for hessian are found to be significant at the 1% to 5% levels. The values of the parameter b are positive but less than one ($0 < b < 1$) for almost all cases, that is for both phases for sacking and hessian. The values of the coefficient b (for the full phase i.e. b_1) for sacking range around .271 to .478 (Table 1) and for hessian .304 to .415 (Table 3). b-values for the declining phase (b_2) on the other hand, ranges around .220 to .259 for sacking (Table 2) and .225 to .299 for hessian (Table 4). In all cases $b_1 > b_2 > 1$. The results therefore conform to our earlier prediction (Kibria and Tisdell, 1983a, 1983b and 1984) that employment of labour is rather rigid and that it is relatively insensitive downwards in response to fall in operating capacity in Bangladesh jute weaving mills.

Intercept a, which indicates an autonomous *drift* in employment, assumes positive values in all cases in which the t-statistic is significant for the full-phase of operation for both sacking and hessian production. The positive values of a range around .106 to .219 for sacking and .145 to .180 for hessian. Conversely, a-values for the declining phase of operating capacity for both sacking and hessian mills, are mostly negative the few exceptions having only small positive values. These negative values for both sacking and hessian mostly range around $-.004$ to $-.012$. The almost zero values of a in the falling phase therefore indicates that autonomous change in employment in the declining phase of operating capacity is rather negligible.

TABLE 1. EMPLOYMENT AS A FUNCTION OF CAPACITY UTILIZATION FOR FULL PERIOD OF OPERATION OF SACKING MILLS, BANGLADESH REGRESSION RESULTS

Mill	Coefficients of equation (1) 'a'	'b'	R^2	F-ratio	No. of observations
1	.106	.271**	.859	103.709	20
2	−.001	.274**	.779	59.794	20
3	.157	.077	.062	1.118	20
4	.004	.226**	.852	103.922	20
5	.174	.483**	.966	483.090	20
6	.232	.535**	.928	205.739	19
7	.160	.435**	.973	566.245	19
8	−.253	.017	.183	3.593	19
9	.179	.427**	.977	649.134	18
10	.143	.345**	.942	242.140	18
11	−.443	.004	.001	.014	18
12	.028	.303**	.857	90.210	17
13	Data unusable				
14	−.260	.023	.150	2.294	16
15	.077	.377**	.895	111.257	16
16	.168	.381**	.973	462.650	16
17	.074	.314**	.947	212.163	14
18	.283	.435**	.971	370.382	13
19	.244	.352**	.984	598.088	12
20	−.351	.026	.227	2.936	12
21	.210	.406**	.986	638.078	11
22	.203	.417**	.986	617.523	11
23	.070	.410**	.916	97.599	11
24	.113	.321**	.939	122.796	10
25	Not producing sacking				
26	.171	.478**	.981	367.205	9
27	.219	.454**	.988	576.609	9
28	.209	.351**	.954	146.029	9
29	.080	.380**	.987	459.459	8
30	.109	.349**	.981	311.976	8
31	.174	.386**	.963	155.571	8
32	.013	.299*	.755	18.441	8
33	Not producing sacking				
34	Data unusable				
35	.279	.442**	.961	124.061	7
36	.012	.288*	.762	16.005	7
37	.548	.307*	.804	20.463	7
38	.268	.433**	.927	50.712	6
39	.109	.420**	.994	628.597	6

** 1% level of significance.
* 5% level of significance.

TABLE 2. EMPLOYMENT AS A FUNCTION OF CAPACITY UTILIZATION FOR POST-PEAK FALLING PHASE OF SACKING MILLS, BANGLADESH REGRESSION RESULTS

Mill	Coefficients of equation (1) 'a'	'b'	R^2	F-ratio	No. of observations
1	.015	.227**	.964	431.121	18
2	−.077	.220**	.851	91.437	18
3	−.004	.006	.001	.007	18
4	−.049	.204**	.902	157.094	18
5	.049	.360**	.877	113.852	18
6	−.132	.288**	.735	41.638	17
7	−.016	.280**	.914	148.876	16
8	−.115	.162**	.460	12.770	17
9	−.035	.245**	.913	137.090	15
10	.009	.241**	.954	250.782	14
11	−.012	.278**	.937	198.723	15
12	−.145	.232**	.803	52.930	15
13	Data unusable				
14	−.002	.231**	.899	106.972	14
15	−.311	.099	.195	2.664	13
16	.049	.300**	.916	129.977	14
17	.072	.201**	.856	53.688	11
18	.142	.348**	.923	107.734	11
19	.145	.293**	.830	43.989	11
20	−.060	.230**	.900	80.552	11
21	−.058	.226**	.944	133.720	10
22	.016	.267**	.810	29.864	9
23	−.246	.202*	.546	9.623	10
24	−.007	.253**	.882	44.888	8
25	Not producing sacking				
26	.111	.436**	.791	22.669	8
27	−.054	.252*	.804	20.527	7
28	.005	.259**	.833	29.913	8
29	−.011	.300**	.931	54.098	6
30	.074	.331**	.879	36.141	7
31	−.251	.162*	.745	14.590	7
32	−.267	.130	.561	6.401	7
33	Not producing sacking				
34	Data unusable				
35	−.098	.229**	.984	181.814	5
36	−.129	.167	.810	12.801	5
37	.180	−.050	.056	.179	5
38	−.120	.003	.000	0.000	5
39	−.062	.214*	.960	71.372	5

** 1% level of significance.
* 5% level of significance.

TABLE 3. EMPLOYMENT AS A FUNCTION OF CAPACITY UTILIZATION FOR FULL PERIOD OF OPERATION OF HESSIAN MILLS, BANGLADESH REGRESSION RESULTS

Mill	Coefficients of equation (1) 'a'	'b'	R^2	F-ratio	No. of observations
1	.092	.313**	.838	88.143	20
2	.309	.445	.757	52.813	20
3	.339	.330**	.518	18.275	20
4	.523	.321**	.556	22.554	20
5	.091	.304**	.860	104.690	20
6	.037	.279**	.882	119.968	19
7	.474	.424**	.853	92.547	19
8	.262	.457**	.923	207.874	19
9	.134	.383**	.979	685.467	18
10	.103	.396**	.946	262.494	18
11	.156	.381**	.962	409.732	18
12	.092	.321**	.978	669.825	17
13			Data unusable		
14	.145	.391**	.973	464.330	16
15	.176	.409**	.971	440.064	16
16	.087	.378**	.983	753.479	16
17	.136	.364**	.987	924.482	14
18	.059	.372**	.987	113.284	13
19	.145	.388**	.978	448.674	12
20	.148	.366**	.987	760.519	12
21	.171	.386**	.977	382.782	11
22	−.473	.020	.205	2.320	11
23	.171	.354**	.982	484.806	11
24	.148	.415**	.995	160.856	10
25	−.354	.011	.125	1.142	10
26	.126	.393**	.991	754.902	9
27	.302	.400**	.981	360.270	9
28	.071	.348**	.992	827.542	9
29	−.636	−.017	.013	.078	8
30	.264	.415**	.927	75.943	8
31	.180	.382**	.991	665.926	8
32	.325	.358*	.697	13.790	8
33	−.645	.057	.111	.749	8
34			Data unusable		
35	.082	.331**	.967	148.318	7
36	.085	.409**	.964	135.035	7
37	.075	.457**	.976	199.854	7
38	−.224	−.035	.090	.394	6
39	.358	−.010	.041	.171	6

** 1% level of significance.
* 5% level of significance.

TABLE 4. EMPLOYMENT AS A FUNCTION OF CAPACITY UTILIZATION FOR POST-PEAK FALLING PHASE OF HESSIAN MILLS, BANGLADESH REGRESSION RESULTS

Mill	Coefficients of equation (1) 'a'	'b'	R^2	F-ratio	No. of observations
1	−.004	.250**	.935	230.283	18
2	.156	.228**	.709	34.154	16
3	−.223	−.182*	.255	4.792	16
4	.093	.034	.009	.120	16
5	.058	.278**	.655	30.401	18
6	−.059	.231**	.837	71.974	16
7	.071	−.025	.005	.065	16
8	.062	.325**	.638	26.448	17
9	−.042	.233**	.940	201.896	15
10	−.085	.300**	.900	117.435	15
11	−.004	.230**	.904	122.074	15
12	−.030	.235**	.901	118.912	15
13			Data unusable		
14	.010	.225**	.835	63.707	13
15	.009	.223**	.941	176.357	13
16	.044	.237**	.931	162.414	14
17	.012	.233**	.897	95.402	13
18	−.070	.244**	.841	52.885	12
19	.025	.293**	.896	77.481	11
20	.041	.299**	.866	58.243	11
21	−.005	.223**	.709	19.457	10
22	−.376	.101	.321	3.789	10
23	.128	.326**	.883	60.552	10
24	.080	.367**	.965	165.133	8
25	−.043	.249**	.817	31.151	9
26	.011	.319**	.775	20.665	8
27	.008	.244**	.828	28.781	8
28	−.076	.229**	.852	34.626	8
29	−.198	.225*	.664	9.869	7
30	−.063	.125	.699	6.966	5
31	−.003	.261*	.833	20.009	6
32	−.018	.192**	.965	108.776	6
33	−.140	.286**	.852	28.803	7
34			Data unusable		
35	−.016	.221**	.984	185.451	5
36	.001	.306**	.977	173.266	6
37	−.064	.284**	.931	54.254	6
38	−.044	.290	.980	49.621	5
39	.339	−.032	.035	.108	5

** 1% level of significance.
* 5% level of significance.

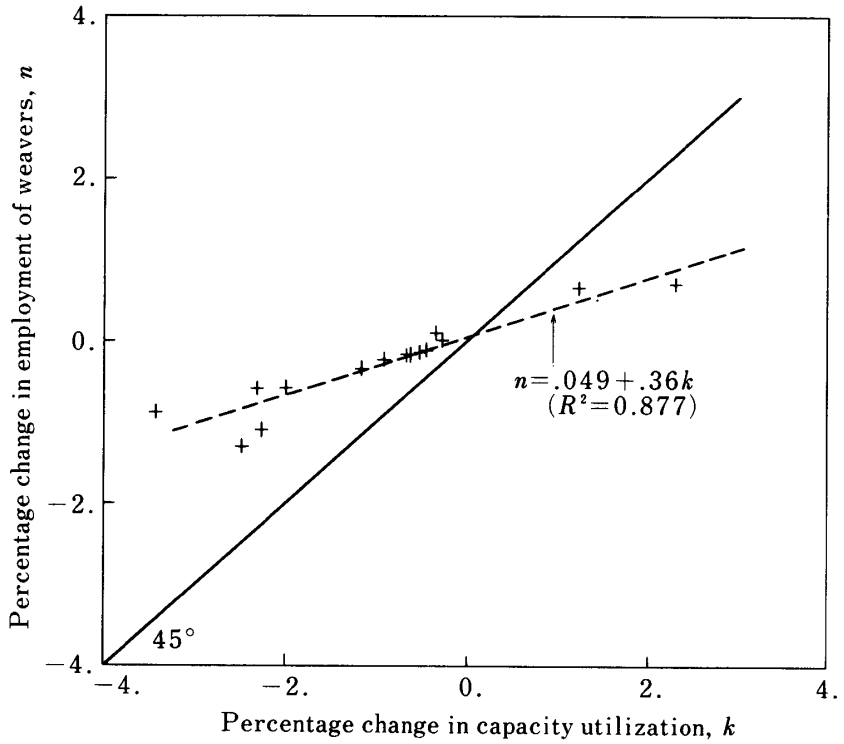

Fig. 1. Observed annual percentage changes in the employment of weavers of sacking related to annual percentage changes in capacity utilization (utilization of looms) for sacking production in Chittagong Jute Mill, Chittagong, Bangladesh for the falling phase of capacity utilization. The broken line shows the implied linear relationship between the two variables when this regression line is fitted by means of least squares.

The method that has been used to measure employment rigidity can be illustrated by reference to Fig. 1. Observations are shown on the figure for Chittagong Jute Mill (Mill 5 in Tables 1 and 2), Chittagong, Bangladesh, for its sacking operations during the *falling* phase of its capacity utilization. Observations for percentage changes in labour employment in sacking are plotted against percentage changes in capacity utilization (looms utilized in sacking) by the mill and a linear regression line is fitted to the data. The regression line obtained by the method of least squares is

$$n = .049 + .360k \tag{2}$$

This equation indicates that for each 1% variation in capacity utilization during the falling phases employment of weavers varies only by 0.36%. Labour employment is relatively unresponsive to variations in capacity utilization. Note that since the fitted line is less steep than the 45° line shown, less than perfect employment responsiveness occurs in relation to changes in capacity utilization.

It can be seen from Table 1 that the fitting of the same function for the full phase of sacking production of this mill gives a relatively higher b-value (.483), but is still

far less than 1. Considerable inflexibility of labour employment in relation to changes in capacity utilization therefore occurs over the full phase even though the degree of this inflexibility is not as great as in the declining phase of capacity utilization. Observe that the constant 0.49 in equation (2) represents the 'autonomous' drift in employment of weavers in sacking for this mill and is very small.[3]

4. INTERPRETATION

The relatively higher values of the coefficient b_1 (for the full phase) as compared to b_2 (for the falling phase of operating capacity) suggest that extra labourers are more readily engaged with expansion of operating capacity in the early life of the mills than are the marginal labourers withdrawn with decline in operating capacity in the later life of the mills. In other words, the findings indicate that employment downward is relatively more inflexible in response to fall in operating capacity. Several factors may need to be taken into account to explain this behaviour.

The production process in a jute weaving mill is such that the whole of the final product, the fabric (cloth), is produced on a particular piece of machinery, the loom. It is, therefore, not like other manufacturing production where parts are produced on different machines and assembled. Each loom (an identifiable unit of capital) uses a fixed proportion of direct labour and other variable inputs to produce either sacking or hessian. Sacking and hessian are produced on different types of looms. An increase in the number of operating machines (looms) calls for a proportionate rise in the number of weavers if the fixed factor proportion condition holds. However labour employment in Bangladesh jute mills is not determined purely by technical and economic considerations but is also influenced by social and institutional factors.

Let us assume that each weaving mill has a fixed number of looms and that weavers are employed in fixed proportion to the number of installed looms. A worker who is attached to a specific machine or machines will therefore be temporarily idle when these machines are out of commission for repair. Since labourers are paid even for those idle hours, a long process of repair and frequent breakdowns will inevitably reduce productivity per labour hour.

Alternatively, in view of the similarity of the machines (looms of the same vintage and type) in each mill, it may be possible for otherwise idle labourers to be engaged on other running machines for the period of down-time of "their" machines. Given this possibility and assuming that there is a regular frequency of breakdown of the looms, it may be suggested that lower ratio of labour to machines can be maintained compared to the ratio dictated by the existing number of machines. However, the notion in the industry is that each crew is assigned to a particular loom and does not casually switch from loom to loom.

Social, institutional and structural factors constrain and influence employment variations in the Bangladesh jute manufacturing industry. Widespread and

[3] The assumption of exogenousness (autonomous) is specific to this model.

frequent absenteeism is one of the important constrain (BJMC Study Group, 1980, Vol. I). Due to lack of residential accommodation in the vicinity of the mills, workers frequently leave for distant villages to meet their families and often fail to resume their duties in time. Many who have a little land adjacent to their village homes often take leave of absence from mills to arrange cropping in those lands in the harvesting seasons. Social calls may make further demands on them. A study by the Management Development Centre, Dacca, Bangladesh, in 1974–75, quoted by Ahmed (1978) reports that absenteeism of weavers in most jute mills normally ranges between 20–25% daily but during agricultural peak seasons (sowing and harvesting) it rises to 35% or more. This migratory character of the labour tends to be a problem for manufacturing industry in countries where a peasant sector predominates (cf. Indian Institute of Management, 1973).

The level of employment chosen by the mills may be higher than that required by the number of operating machines. This would ensure the availability of a pool of labourers skilled in weaving and who can effectively replace absentee-weavers. Otherwise, the average number of operating machines could fall below the operational number and the actual level of output falls below potential output. Thus profit and output levels could be enhanced by ensuring a reserve, a reserve that may be expected to grow as operating capacity declines.

The policy of the government of Bangladesh regarding employment expansion in the industrial sector, particularly in the government-owned industries, contributes to the maintenance of a high labour-capital ratio in the jute manufacturing industry of Bangladesh. Because of this policy, management has little scope to adjust its employment to its optimal technical or economic requirements. The government's overt policy of non-retrenchment, particularly in the nationalized industry of Bangladesh, and the growing power of trade unions in the organized industrial sector of this labour surplus economy contribute to some extent to the rigidity of employment in jute weaving when average number of operating machines are falling.

In view of the above circumstances, management is unlikely to retrench labourers *quickly* when the average number of operating machines (due to aging effects) falls continuously after the mid-life of mills. Moreover, in the later life of mills when average operating capacity falls, *variation* in the rate of operating capacity is most likely to rise. Thus even in older mills the number of operating machines (looms) may be very high at *some* points in the year and the maximum number of weavers, as dictated by the factor proportionality assumption, may be required. This rules out permanent withdrawal of workers without a potential loss in output and therefore management may have to maintain high levels of labour employment to cater for occasions of higher operating capital. A similar possibility has been observed in relation to 'excess' labour employment in agriculture (Pepelasis and Yotopoulos, 1962; Stiglitz, 1974; Yotopoulos and Nugent, 1976).

In view of these considerations and the need to cater for fluctuations in operating machines, it may not be unreasonable to expect that productivity per

underemployed labour (weaver) hour when operating capacity falls may still be at a level well above its break-even point. The apparent level of over employment in the falling phase of operating capacity in jute weaving may not therefore be economically irrational. Consequently, the profitability rationale also may dictate some level of disguised underemployment even in the industrial sector of a developing economy—a possibility hitherto believed to be in existence by and large in the agricultural sector of a developing economy.

Furthermore, one has to take account of the transactions involved in dismissing and hiring new labour as production conditions alter. A cost is involved in training new labour and in the time required for the new labour to acquire new skills (Hartley and Tisdell, 1981; Fisher, 1971). Again, the quality of any newly hired labour is uncertain from management's point of view and therefore it may put a premium on being able to draw on labour stock internal to the firm (Coase, 1937). For all these reasons management may be reluctant to dismiss weavers. The shortage of skilled labour in manufacturing industries in LDC may mean that employment costs (search, hiring and training costs) are relatively higher than in developed countries and therefore on rational grounds management is even more reluctant to shed labour.

Human investment differs from physical capital investment and the "essential difference lies in non-separability of human capital and the consequent problems of raising finance for education, training, and other human investment" (Hartley and Tisdell, 1981). The importance of the employment cost consideration can be easily illustrated using a similar diagram to that in Hartley and Tisdell (1981) in Fig. 2.

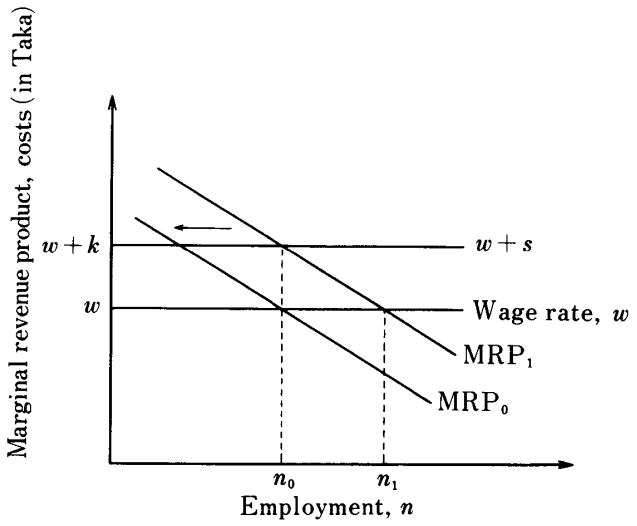

Fig. 2.

In Fig. 2 labour is a quasi fixed-factor and w is the going rate of wage. s represents the fixed employment costs (sunk costs) such as search, hiring, and training costs and MRP is the marginal revenue product. With sunk employment

costs, the initial equilibrium is where $MRP_1 = w + s$ (marginal labour costs, MLC); without fixed employment costs, equilibrium is where $MRP = w$ (MLC). Suppose that the MRP curve shifts downward unexpectedly due to a fall in the marginal productivity of weavers, for example, because machine-breakdowns become more frequent. Sunk costs are now irrelevent for short-run decisions. Hence the firm with s costs will continue to employ n_0 ($MRP_0 = w$). But where the wage rate is the only labour cost (e.g., unskilled; generally-trained workers) the firm will reduce employment from n_1 to n_0.

In a down-turn, the firms will tend to "lay-off" untrained or even generally-trained workers (no training costs borne by firm), while workers with specific training are less likely to be laid-off (fixed or sunk employment costs, with labour as a quasi-fixed factor). The theory of labour as a quasi-fixed factor postulates that a profit-maximizing firm's sunk employment costs will be recouped through rents, represented by the difference between marginal revenue product and the wage rate. This is relevant when it is borne in mind that weavers are relatively skilled workers.

It might be wondered how marginal productivity theory relates to a weaving mill in which each weaving-crew is assigned to a particular loom. If looms are not in identical condition, as is likely, a declining marginal expected productivity curve such as MRP_1 in Fig. 2 can apply. Crews (of the same quality) assigned to looms in better order will make a greater *expected* contribution to production than those crews assigned to looms in a more delapidated condition and which have a higher probability of failure and which may be forced to operate at a slower speed than those in superior order. Also variation in the 'quality' of crews can have this effect. Thus a downward sloping expected marginal productivity curve applies in this case, even though factors are required in fixed proportion. If the expected value of marginal product of weaving falls (that is, a movement from MRP_1 to MRP_0 in Fig. 2), one would expect profit-maximizing mill-operators to dismiss those crews operating looms in poorer condition first. However, they may be reluctant to dimiss workers for the reasons mentioned by Hartley and Tisdell (1981).

The above indicates that even from the point of view of profit-maximization some rigidity in labour employment and some hysteresis in employment are justified. However, it seems likely that greater rigidity in employment exists in jute weaving mills in Bangladesh than can be justified on the grounds of profit maximization. In this respect, it is pertinent to remind ourselves that all the mills under consideration are nationalized. Still more evidence is needed on the aims and behavioural responses of managers of nationalized firms in order to provide a more comprehensive overview of manufacturing employment patterns (see, Jones, 1975; 1983; Sobhan and Ahmad, 1980; Vernon and Aharoni, 1981; Jenkins and Lahouel, 1983; Ansari, 1983; Killick, 1983; Jones et al., forthcoming). Under extremely rigid control structures, public enterprises are often called upon to pursue a mix of commercial and non-commercial objectives, which can include such diverse goals as earning profits, redistributing income, subsidizing particular regions and sectors, earning foreign exchange and importantly, generating em-

ployment. Having such plethora of objectives "can be equivalent to having no objective, and management is all too often free to pursue either its own interest or a constantly shifting incoherent mix" (Jones, 1983). The rigid control structures and lack of effective operating mechanism may mean that management is relatively free to incorporate organizational slack (Cyert and March, 1963; Williamson, 1970). Consequently, the managers are averse to taking risks and do not make serious attempts to minimise costs. Though substantial overmanning exists in most of the public enterprises, especially in LDCs [Killick's study, (1983) of several African countries supports this proposition), it is virtually impossible for management to take any attempt to reduce labour costs by reducing the size of labour employed "because of the emphasis on a fair deal to workers and harmonious labour-management relations" (Syed, 1983). Management tries to hoard labour and this often contributes to rigidity in labour employment in these industries. Thus the effective signals given by the control structures in the absence of the operating mechanisms do *not* stimulate cost-efficiency or encourage public enterprises to act as dynamic agents of development.

In Bangladesh, the development of the jute manufacturing industry in the public sector (unlike in other countries where it developed only gradually) was closely associated with political events and is a direct consequence of the 'War of Liberation'. In the newly emerging Bangladesh, there developed "a new phenomenon following Liberation, which weighted heavily in favour of large-scale nationalization of modern sector industries" (Ahmad, 1978). The fact that about two-thirds of the jute manufacturing industry was abandoned by its Pakistani owners who left the country, further accentuated the call for complete nationalization of the industry. Nationalization meant direct government responsibility for production. But the government which "had traditionally performed civil and military functions as its regular areas of direct responsibility with mainly regulatory and promotional concern in the field of production failed to realize properly the dimension and intensity of direct production responsibility undertaken by it under the nationalization programme" (Ahmad, 1978). Because of this the government has not tackled persistent problems such as ineffective control structures in jute enterprises, the lack of effective planning and programmes for personnel development, and the absence of appropriate policies regarding waves, employment, labour, pricing and incentive systems. However, no matter what are the motivations and objectives of managers of nationalized firms at the plant level, this paper provides definite evidence of rigidity in their employment of labour. This rigidity as previous studies by the authors (Kibria and Tisdell, 1983b; 1985) suggest, contributes significantly to the eventual fall in the labour productivity progress function of the Bangladesh jute weaving mills as they age.

Furthermore, it is possible that the nationalisation following the 'War of Liberation' and the consequent centralisation of management in jute manufacturing has reduced competition among the jute mills in Bangladesh and weakened economic discipline. Large scale migration of both trained labour and manage-

ment to Pakistan following the 'War of Liberation' further constrained the efficient operation of the industry. The new management and labour under the control of a central administration (B.J.M.C. i.e. Bangladesh Jute Mills Corporation) may thus have allowed the growth of substantial "*X*-inefficiency" (Leibenstein, 1966) within the industry. Some evidence for this is provided by the wide variation in labour productivity between jute mills of the same vintage. Productivity was found to vary considerably in the sample of mills investigated. For example, it was found that the labour productivity of Crescent Jute Mill exceeded that of People's Jute Mill by 4.45 to 24.99 per cent for sacking and 8.33 to 17.57 per cent for hessian in all years with an average excess of 13.08 and 12.84 per cent, respectively. Both mills are of the same size, located in Khulna and use machinery of the same vintage and of identical make. Similar evidence of *X*-inefficiency in manufacturing industry in LDC's was found by Harbison (1956) and White (1976).

The factors explaining the relative rigidity of labour employment downwards in Bangladesh jute weaving mills seem to be basically social, structural and institutional (cf. Wonnacott, 1962) even though economic considerations may play a small role. The situation as currently prevails in most LDCs corresponds to the neoclassical scenario of a dualistic disequilibrium, characterized by a divergence in wage rates, and marginal products, between agriculture and non-agriculture. If it is assumed that labourers are paid according to their marginal products in both agricultural and industrial sectors, their marginal productivity and consequently the wages are much higher in the latter. The ability of the manufacturing sector to employ labour is limited by the availability of capital, and the demand for employment in this sector exceeds the ability of this sector to absorb labour. In the face of this, governments prefer to maintain or encourage employment in this sector at *uneconomic* levels, rather than risk a confrontation with the politically volatile work-force. Opportunities for employing the fast growing labour-surplus and unemployed labour in the LDC manufacturing has proven inadequate in recent times[4] despite in many cases rapid growth of industrial output (Turnham, 1971; Ranis, 1973; Morawetz, 1974; Yotopoulos and Nugent, 1976; Oshima, 1981). Elimination of dualism which is the core of both classical and neoclassical objectives in economic policy, has remained an unattained objective. While the explanation for this failure may lie largely in the policy biases characteristic of the LDCs[5] the growing masses of the unemployed and underemployed pose a severe threat to the socio-political balance of these countries. Disguised underemploy-

[4] The number of persons wanting work in LDCs as a whole between 1970 and 1980 increased by an estimated 25% as opposed to 10% in developed countries. (Projection as reported in Yotopoulos and Nugent, 1976.)

[5] The policy biases may include choice of wrong technology or the wrong industries, that is, those with capital intensive technologies, fostered by import substitution fundamentalism; policies relating to distortion of factor prices, i.e. cheapening price of capital relative to labour, undervaluation of foreign exchange, and to the imposition of interest-rate ceilings and other price distortions (cf. Winston, 1982–83).

ment even in the organized industrial sector of a developing economy has thus become almost a rule rather than the exception (Todaro, 1977). Jute manufacturing of Bangladesh being the single largest source of manufacturing employment in the country is no exception to this.

Sectoral dualism has not been eliminated in LDCs and the divergence in wage rates and in marginal products between agriculture and manufacturing industry, as postulated by assumptions of the neoclassical labour surplus theory (due, mainly to Jorgenson, 1961) appears to be relevant in Bangladesh. Jute manufacturing certainly is able to draw labour from agriculture because of its preferential wage rate (BJMC, 1980, Vol. 1). Further, the wide variation in the ratio of operating machines to installed machines (looms) particularly in the falling phase of operating capacity, as has been mentioned before, results in disguised underemployment when number of operating machines falls. Inflexibility of labour employment to the variations in operating capacity in jute weaving can thus have a similar basis to that of disguised underemployment in agriculture in the off-peak (cf. Islam, 1964; Yotopoulos, 1964; Stiglitz 1969, 1974; Oshima 1971, 1981).

CONCLUSIONS

It is observed that the relationship between the level of labour employment and operating capacity in Bangladesh jute weaving mills is not perfectly reversible. Extra labourers are more readily engaged with expansion of operating capacity of the mills than are the labourers withdrawn with declining in manufacturing operating capacity. While the factors influencing the sensitivity of employment in response to rise in operating capacity may be basically economic and technical, the relative inflexibility of employment downwards with the fall in operating capacity seems to be caused largely, by the social, institutional and structural factors commonly found in a labour surplus developing economy like Bangladesh, even though economic (profitability and production) considerations can, as was observed, also contribute to this outcome. Overall, rigidity of labour employment in Bangladesh jute weaving mills has been observed and explanations for this have been suggested. Whether or not this inflexibility of labour employment occurs in manufacturing in other LDCs is uncertain but the possibility of its occurrence cannot be ruled out in those industries dominated by public enterprises.

University of Newcastle, Australia

REFERENCES

Ahmad, Q. K. (1978), "The Manufacturing Sector of Bangladesh—An Overview," *The Bangladesh Development Studies*, Vol. 6, No. 4, Autumn.

Ahmed, S., "Absenteeism of labour in jute sector: Causes, consequences and suggested Remedies," *Problems of Jute Sector As Seen by BJMC*, Public Relations Department, Bangladesh Jute Mills Corporation, September, 1978.

Ansari, J. A. (1983), "Conflicting paradigms: the evaluation of public industrial enterprises as agents of national development," *Industry and Development*, Vol. 7.

BJMC Study Group (1980), *Report on Manufacturing of Jute Goods: Main Report*, Vol. I (Dacca, BJMC, March).

——— (1980), *Report on Manufacturing of Jute Goods: Analysis on Requirements, Inter-mill Transfer of Machinery & Shift Operations Alternatives*, Vol. II (Dacca, BJMC, March).

——— (1980), *Report on Manufacturing of Jute Goods: Project Profiles*, Vol. IV (Dacca, BJMC, March).

Clay, E. J. (1976), "Institutional Change and Agricultural Wages in Bangladesh," *The Bangladesh Development Studies* (Dacca), October, pp. 423–440.

Coase, R. H. (1937), "The Nature of the Firm," *Economica*, Vol. 4, November, pp. 386–405.

Cyert, R. and J. March (1963), *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, N. J.

Fei, J. C. H. and G. Ranis (1964), *Development of the Labour Surplus Economy: Theory and Policy*, Homewood, Irwin.

Harbison, F. (1956), "Entrepreneurial organisation as a factor in economic development," *Quarterly Journal of Economics* (Cambridge, Mass.), August, pp. 364–379.

Hartley, K. and C. Tisdell (1981), *Micro Economic Policy*, John Wiley and Sons, New York and Brisbane.

Indian Institute of Management (1973), *Social Aspects of Industrialisation: Some Problems of the Industrialisation in the Ahmedabad-Boroda Region*, Item No. 9, Provincial Agenda 6th Session of the Committee for Industrial Development, Delhi, India.

Islam, N. (1964), "Concepts and Measurement of Unemployment and Underemployment in Developing Economies," *International Labour Review* (Geneva), January–June, pp. 240–256.

Jenkins, P. J. and M. H. Lahouel (1983), "Evaluation of performance of industrial public enterprises: Criteria and Policies," *Industry and Development*, Vol. 7.

Jones, L. (1983), "The linkage between objectives and control mechanisms in the public manufacturing sector," *Industry and Development*, Vol. 7.

——— (1975), *Public Enterprise and Economic Development: The Korea Case*, Seoul, Korean Development Institute.

Jones et al. (eds.) (forthcoming), *Public Enterprise in Less Developed Countries*, Cambridge University Press, New York.

Jorgenson, D. W. (1961), "The development of a dual economy," *Economic Journal* (London), June, pp. 309–334.

Kibria, M. G. and C. A. Tisdell (1983a), "An Analysis of Technological Change in Jute Weaving in Bangladesh: 1954–55 to 1979–80," *The Developing Economies* (Tokyo), June.

——— and ——— (1983b), "Productivity Progress and Learning by Doing in Bangladesh Jute Weaving Industry," *Research Report or Occasional Paper*, No. 89, Department of economics, University of Newcastle [ISBN 0 7259 0470 4].

——— and ——— (1985), "Operating Capital and Productivity Patterns in Jute Weaving in Bangladesh," *Journal of Development Economics* (forthcoming).

——— and ——— (1984), "Comparative Aspects of Capacity Utilization: Evidence from Bangladesh Jute Weaving Industry," *Journal of Economic Development*, July, pp. 45–66.

Leibenstein, H. (1966), "Allocative efficiency vs. *X*-efficiency," *American Economic Review* (Cambridge, Mass.), June, pp. 392–415.

Lewis, W. A. (1954), "Economic development with unlimited supplies of labour," *Manchester School of Economic and Social Studies* (Manchester), May, pp. 139–191.

Masum, M. (1979), "Unemployment and Underemployment in Bangladesh Agriculture: A Micro Study," *The Bangladesh Development Studies* (Dacca), Summer, pp. 47–69.

Morawetz, D. (1974), "Employment Implications of Industrialisation in Developing Countries: A Survey," *The Economic Journal* (London), September, pp. 491–542.

Nurkse, R. (1953), *Problems of Capital Formation in Underdeveloped Countries*, Oxford University Press, New York.

Oshima, H. T. (1971), "Labor absorption in east and southeast Asia: a summary with interpretation of postwar experience," *The Malayan Economic Review* (Singapore), October, pp. 55–77.

——— (1981), "A Lewis' dualistic theory and its relevance for postwar Asian Growth," *The Malayan Economic Review* (Singapore), October, pp. 1–26.

Pepelasis, A. A. and P. A. Yotopoulos (1962), *Surplus Labor in Greek Agriculture, 1953–1960* (Athens, Center of Planning and Economic Research).

Ranis, G. (1973), "Industrial Sector Labour Absorption," *Economic Development and Cultural Change* (Chicago), April, pp. 387–408.

Rosenstein-Rodan, P. N. (1957), "Disguised unemployment and underemployment in agriculture," *Monthly Bulletin of Agricultural Economics and Statistics-FAO* (Rome), July–August, pp. 1–10.

Sen, A. K., "Peasants and dualism with or without surplus labour," *Journal of Political Economy* (Chicago), October, pp. 425–450.

Sobhan, R. and M. Ahmad (1980), *Public Enterprise in an Intermediate Regime: A Study of the Political Economy of Bangladesh*, Bangladesh Institute of Development Studies, Dacca.

Stiglitz, J. E. (1969), "Rural-urban migration, surplus labor and the relationship between urban and rural wages," *Eastern Africa Economic Review* (Nairobi), December, pp. 210–211.

——— (1974), "Alternative theories of wage determination and unemployment in LDCs: The labor turnover model," *Quarterly Journal of Economics* (Cambridge, Mass.), May, pp. 194–227.

Syed, R. H. (1983), "Note on control structures and efficiency in the public industrial sector: reflections based on the case of Pakistan," *Industry and Development*, Volume 7.

Todaro, M. P. (1977), *Economic Development in the Third World*, Longman, London.

Turnham, D. J. (1971), *The Employment Problem to Less Developed Countries: A Review of Evidence*, Paris, OECD Development Center.

Vernon, R. and Y. Aharoni (1981), *State-Owned Enterprises in the Western Economies*, St. Martin's Press, New York.

White, L. J. (1976), "Appropriate technology, *X*-inefficiency, and a comparative environment: some evidence from Pakistan," *Quarterly Journal of Economics*, November, pp. 575–589.

Williamson, O. E. (1970), *Corporate Control and Business Behaviour: An Enquiry into the Effects of Organization Form on enterprise Behaviour*, Prentice-Hall, Englewood Cliffs, N. J.

Wonnacott, P. (1962), "Disguised and overt unemployment in underdeveloped economies," *Quarterly Journal of Economics*, May, pp. 279–297.

Yotopoulos, P. A. (1964), *The Elasticity of the Labor Supply Curve: A Theory and an Evaluation for Greek Agriculture*, Athens, Center of Planning and Economic Research.

Yotopoulos, P. A. and J. B. Nugent (1976), *Economics of Development: Empirical Investigations*, Harper & Row, New York.