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Factor Utilisation in Manufacturing: Evidence from Pakistan

SAHAR AMJAD SHAIKH and BISMA HASEEB KHAN

1. INTRODUCTION

Many developing countries have experienced 'jobless growth' in recent years, with employment growth either lagging behind economic growth or increasing unemployment rates during times of economic booms. This is particularly seen in the manufacturing sectors, as countries face early 'de-industrialisation' i.e., a fall in the manufacturing sector's share in total employment [Dasgupta and Singh (2006)]. Pakistan is no different as although the manufacturing sector is second only to agriculture in its contribution to GDP, it employs only 13.7 percent [Pakistan (2009-2010)] of the total labour force. Recent changes to capital-based foreign technology have led to the substitution of labour for non-labour factors and hence under-utilisation of the abundant labour force in the country. This is a pertinent issue as Pakistan has the 10th largest labour force in the world making employment creation essential for it to take advantage of this growing demographic dividend. Furthermore, labour market earnings are the main source of income for workers who lack social safety nets and capital and financial assets.

Manufacturing is considered to be the engine for growth, but the lack of employment creation in this sector raises concerns about the sustainability and distribution of this growth. According to Haider (2009), the employment elasticity with respect to GDP in the manufacturing sector is merely 0.02 percent. This may be due to the under-utilisation of labour in this sector. This paper aims to investigate this hypothesis by using the World Bank Investment Climate Surveys data to analyse the extent of utilisation of production, non-production labour and capital in the manufacturing sector of Pakistan and further conducts an industry-wise analysis to examine the relationship between input utilisation, productivity and other industrial characteristics.

Under(Over)-utilisation of a factor implies an 'abnormally' low (high) factor employment conditional on firm productivity; amount of other factors employed and factor costs. Following the framework provided by Pakes and Fernandes (2008) similar study done on the Indian manufacturing sector, we obtain the rate of factor utilisation by

Sahar Amjad Shaikh <saharamjadshaikh@gmail.com> is Research Fellow, Centre for Research in Economics and Business, Lahore School of Economics, Lahore. Bisma Haseeb Khan <bismahaseeb88@gmail.com> is affiliated with the Centre for Research in Economics and Business, Lahore School of Economics, Lahore.

dividing the actual employment with the optimal employment. The optimal employment is the level which equates the marginal cost of labour with the marginal revenue generated by each additional worker. In the Pakes and Fernanandes study, under-utilisation of labour is attributed to the hiring and firing costs entailed by the labour laws of India, however, in Pakistan these costs are relatively low and underutilisation instead results from lower than optimal wages or skill-mismatch (incompatibility of labour demand and supply), causing firms to substitute away from labour [Fasih (2008)]. To empirically investigate the reasons behind the under-utilisation of labour we compare the utilisation rates of labour and capital across industries in 2002 and 2007. We further use utilisation rates as the dependent variable and analyse its link with other institutional constraints and industrial characteristics such as extent of unionisation, corruption and electricity shortage in that industry. Our main findings suggest a significant extent of under-utilisation of both production and non-production workers, with firms suffering greater losses due to power outages having higher levels of underutilisation. Capital is found to be over-utilised suggesting the adoption of capital intensive technology. Furthermore, union activity is seen to be negatively related to labour utilisation.

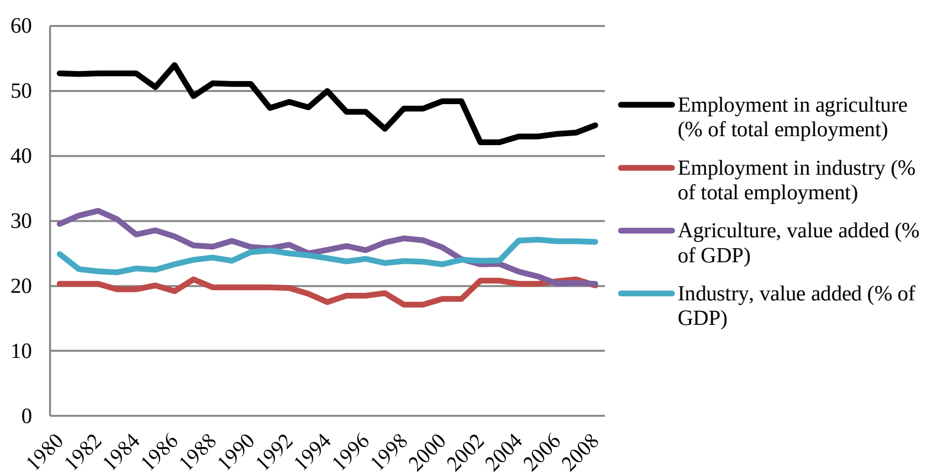
The contribution of this paper is novel as it is the first study explicitly measuring the extent of factor utilisation in the manufacturing sector of Pakistan and distinguishing between production and non-production labour. It also augments the framework of Fernandes and Pakes (2008) by employing the method introduced by Levinsohn and Petrin (2003) to estimate the production function, using intermediate goods rather than investment to proxy for productivity and to account for the endogeneity bias inherent in production function estimation. It further provides policy implications in order to attain employment enhancing growth in the future. The remaining paper is organised as follows: the next section gives a brief background and literature review on the issue of jobless growth, Section 3 discusses the methodology, Section 4 describes the data, Section 5 presents the results and Section 6 give policy recommendations on the basis of these results. The last section concludes.

2. BACKGROUND

As a country develops, through the process of urbanisation the surplus labour in its agricultural sector shifts to the industrial sector until the marginal product of labour (MPL) in the agricultural sector equals the marginal cost of labour in that sector and disguised unemployment is eliminated [Lewis (1954)]. Hence a structural change takes place in the economy with the share of the industrial sector in the GDP and in total employment increasing and the share of agriculture decreasing. This entails high employment elasticity with respect to GDP in the manufacturing sector, so that the rate of absorption of excess labour is close to the rate of growth of GDP. The manufacturing sector hence becomes the engine for growth and development. According to Kaldor's seminal work (1966), this is due to the three laws of economic growth: (1) the faster the growth of the manufacturing sector, the faster the growth of GDP; (2) the existence of increasing returns to scale in the manufacturing sector; (3) the growth for productivity for the entire economy as a whole is related to the growth in output in the manufacturing sector through labour reallocation from the other sectors to the manufacturing sector [Alessendrini (2009)]. Although Pakistan's economy has followed a similar path, with an export-led growth policy leading to an increasing contribution of the manufacturing sector to its GDP, it seems to defy Kaldor's third law as employment growth in manufacturing has not been at par with the growth in the GDP. This has in turn led to an overall 'job-less growth' in the economy.

Pakistan experienced low growth rates and an overall economic downturn during the 1990s and early 2000s. However, the economy began to recover in 2002 resulting from faster growth in the industrial sector reflected in the rise in exports and imports of intermediate goods [Anwar (2004)]. This growth in the industrial sector, which accounted for 25.6[1] percent of GDP in that period, was mainly due to the high growth rates of the large scale manufacturing (LSM) which accelerated exports and resulted in an increase in the foreign exchange reserves. The industrial growth was in part due to increased consumption loans and the utilisation of excess capacity (30–40 percent) created in the mid 1990s due to increased investments in independent power projects (IPPs), cement, sugar, automobile and consumer electronics [Anwar (2004)]. However this pattern of growth did not generate sufficient employment to absorb the growing labour force in the country. Job-less nature of economic growth is evident in Figure 1 below.

Fig. 1. Contributions to the Economy of Agricultural and Industrial Sector



As shown, although the GDP share of manufacturing went up during the period 2002–2007, its employment share remained stagnant. Empirical work done by Haider (2009, 2010) investigates the extent of this jobless growth by estimating labour demand in the seven sectors of the economy and calculating the employment elasticities in these sectors with respect to the growth in GDP. Table 1 indicates that the employment elasticity of large scale manufacturing sector is very low relative to other sectors. Hence, Haider (2009) identifies manufacturing as playing a key role in the job-less growth experienced by Pakistan's economy.

[1]Federal Bureau of Statistics (FBS).

Table 1

Employment Elasticities with Respect to GDP

Sector of Activity	Elasticities
Overall Elasticity	0.41
Agriculture	0.37
Large Scale Manufacturing	0.02
Small Scale Manufacturing	0.85
Construction	0.87
Transport and Communication	0.45
Trade	0.57
Electricity and Gas	0.54
Others	0.68

Source: Anwar (2004).

This pre-mature de-industrialisation is seen in other developing countries as well, such as India and Sri Lanka [Alessindrini (2009); Dasgupta and Singh (2006)]. According to Dasgupta and Singh (2006), at present the employment growth in developing countries is far below that observed in the past for today's advanced countries. This is true not only for slow-growing economies (as in Latin America) but also for fast-growing economies (for instance, India). Employing the Kaldorian framework, Dasgupta and Singh (2006) analyse this issue using a data set of 48 developing countries for the period 1990-2000. They find that excess labour in the agriculture sector in the reference countries either remains there, or enters the informal sector thus increasing the unregistered manufacturing employment. Furthermore, they conclude that the inability of non-conforming structures to satisfy changes in consumer demand or the required changes in production technique that occur during the process of industrialisation, along with the introduction of new technology such as the information and communication technology, may lead to service sector replacing or complimenting manufacturing as the engine for economic growth.

A similar study done on India by Alessindrini (2009) uses a dynamic dataset of 15 Indian states for the period 1980–2004 and finds a strong positive link between agriculture sector demand and employment in manufacturing. He also finds an inverse relation between growth of employment in the informal sector and that in the formal manufacturing sector. He attributes this to a sharp, sudden shift away from labour intensive economic activities to capital intensive ones coupled with a lack of educated and appropriately skilled workforce in the manufacturing sector. Bhalotra (1998), on the other hand, finds evidence of job-less growth in Indian manufacturing through calculating employment elasticities. His findings suggest an aggregate employment elasticity of 0.15 for the reference period. Bhattcharya and Sakhtiwal (2003) find a similar result and attribute their findings to stringent labour laws introduced in India which accelerated union activity as well as wage rates.

Fernanades and Pakes (2008) adopt a different approach towards the issue of job-less growth and define it in terms of labour under-utilisation in the manufacturing sector. They estimate the production function using the Olley and Pakes (1996) method and calculate factor under-utilisation in terms of the percent increase in employment that would result if there were no hiring and firing costs. They find substantial underutilisation of labour and over-utilisation of capital, with the results varying across states. Attributing this result to dysfunctioning labour markets, they further run reduced form regressions to investigate the relationship between factor utilisation, productivity and institutional constraints. According to their study, underutilisation is significant in industries suffering from increased power outages as well as union activity hence wage rigidity. They conclude that liberalising the labour market in states where labour laws are stringent will result in the reduction of the underutilisation of labour and also a rise in wage rates.

Although in Pakistan the labour market is not as rigid as in India and other developing nations, with unions having less bargaining power, under-utilisation of labour may still result in its manufacturing sector due to firstly increased power outages and secondly skill-mismatch and substitution away from labour to capital intensive production. Hence, less than optimal labour employment may be one of the reasons behind the jobless growth witnessed during the past growth spurt of the economy. However, literature investigating jobless growth merely goes as far as calculating employment elasticity and the impact of sectoral reallocation of labour on employment in the manufacturing sector [Haider (2009)]. Under-utilisation as a cause of under-employment has not been analysed. This paper seeks to fill this gap in the literature by not only estimating the extent of underutilisation of labour but also the relation between factor underutilisation, productivity and other industrial characteristics. The following section describes the methodology used to estimate the production function and carry out our empirical analysis.

3. METHODOLOGY

A production technology relates output to inputs of production like capital and labour. Measuring the rate of input utilisation in different industries requires obtaining parameter estimates of this production function so as to compare the optimal level of productive inputs to the actual usage of these inputs. Optimal Input employment is computed by equating marginal revenue productivity (derivative of the sales generating function) to marginal cost (input prices). It is assumed that the sales generating function is a constant elasticity demand function[2] multiplied by a Cobb-Douglas production function.

$$Sales = P(Y(K,L) \times Y(K,L)$$
$$where\ P(Y) = Y^{\varepsilon} and\ \ Y = AK^{\alpha}L^{\beta}$$
$$K = Capital\ input$$
$$L = Labour\ input$$

For the purpose of investigation, production and non-production workers feed in separately into the production technology as the measure of labour. Taking logs of the sales generating functions yields the estimable equation:

[2]To have a log-log relationship between sales and inputs it is assumed that each firm's demand curve has a constant elasticity conditional on the output (or prices of the other firm). [Fernandes and Pakes (2008)].

$$Sales_t = \beta_0 + \sum_{\substack{i=production\,labour,\\ non-production\,labour}} \beta_i L_{it} + \beta_k K_t + \omega_t + \eta_t$$

$$where\ \beta_j : parameters\ of\ sales\ generating\ function$$

$$\omega_t : unorthgonal\ error\ term$$

$$\eta_t : orthogonal\ error\ term$$

Simple OLS estimation of the above equation not possible due to endogeneity bias induced by correlation between factor input choices and unobserved productivity (ω_t). Such a bias can occur if an unobserved shock like productivity simultaneously determines the level of production as well as employment of factor inputs.[3] This happens because over time firms responding to positive productivity shocks invest in capital and labour inputs and indirectly affect output. Since the level of productivity of a firm cannot be accurately measured or observed so it enters the error term in the regression equation as a component ω_t that is correlated with the input demands.

Consequently, a significant amount of literature has been devoted to dealing with endogeneity of input demands with the initial approaches focusing on Instrumental Variable methods and Fixed effect estimation. The IV solution requires finding a variable that is correlated with the input demands but orthogonal to the unobservables in the production function but finding such a valid instrument is a difficult task. Due to high persistence in the data series on inputs and sales, the instruments used in the literature are weak that negatively affects the results. On the other hand, fixed effect estimator successfully addresses the endogeneity issue only if the assumption of time invariant firm specific unobservables holds true. As a result, these two methods are believed to be ineffective in addressing the issues of endogeneity satisfactorily.

The literature has evolved to find more sophisticated techniques for dealing with this simultaneity bias and consequently two approaches have emerged. The underlying set of assumptions characterises the difference between these two approaches. One follows dynamic panel data techniques for the identification of production functions and has been discussed in papers like Blundell and Bond (2000) who propose an extended GMM estimator to apply to the dynamic representation of the production function equation.

The foundation for the second approach was laid down in the seminal paper by Olley and Pakes (1996) that involved semi-parametric estimation of the production technology's parameters. It employed investment as a proxy to control for the unobserved variation in productivity in estimating the production function.

Levinsohn and Petrin (2003) highlighted few concerns with the choice of investment proxy and instead proposed using the demand for intermediate inputs to control for this correlation. They pointed out that while investment may only respond to unexpected changes in productivity thus only accounting for a small part of correlation, the demand for variable inputs completely adjusts to fully reflect any shock to the productivity process, be it anticipated or unanticipated. Also, in firm level data a significant portion of sample may report zero new investment and dropping out such firms from the analysis to satisfy the 'invertibility condition' may introduce truncation

[3]This was first identified by Marschak and Andrews (1944).

bias. On the other hand, the utilisation of intermediate inputs is normally reported to be non-zero for all firms. Our empirical analysis drawing on this method of Levinsohn and Petrin (2003) uses firm's *electricity consumption* ($Elec_t$) *as* a proxy because unlike other intermediate goods like raw materials and fuel it cannot be stored. This allows us to specify the unobserved productivity ω_t as function of the two state variables: K_t and $Elec_t$. $\phi_t (K_t, Elec_t)$ is approximated by substituting a polynomial in K_t and $Elec_t$. Using this semi-parametric estimation in the first stage yields estimates of β_{pro}, β_{nonpro} and ϕ_t. The second stage then identifies β_{Elec} and β_k from the estimate of ϕ_t.

$$Sales_t = \sum_{\substack{i=production\,labour,\\ non-production\,labour}} \beta_i L_{it} + \phi_t(K_t, Elec_t) + \eta_t$$

Where

$$\phi_t(K_t, Elec_t) = \beta_0 + \beta_{Elec} Elec_t + \beta_k K_t + \omega_t(K_t, Elec_t)$$

Semi-parametric estimation yields the estimates for the parameters of the sales-generating functions, which are then substituted into the marginal revenue productivity function for each type of input (production labour, non-production labour and capital) and equated to their respective marginal costs (wages and rental rates) to calculate optimal labour and capital employment. Factor utilisation is obtained for the years 2002 and 2007 for each type of input as:

$$\frac{ActualFactorEmployment}{OptimalFactorEmployment} \times 100$$

Firm's factor utilisation =
(percent)

An utilisation rate of below (above) 100 percent means that the factor is under (over)-utilised. Post-estimation we calculate the productivity as the residual obtained from the sales-generating function estimation and using Seemingly Unrelated Regression Equation estimation a reduced form analysis is done on input utilisation, productivity, and some institutional characteristics of the firms.

4. DATA

The firm level data on total sales, utilisation of factor inputs and input prices required for our empirical investigation is obtained from the Enterprise Surveys website.[4] These surveys have been conducted by the World Bank in a large number of countries at regular intervals since 2002 to gather company level information on a country's business and investment environment, and to analyse the obstacles faced by the manufacturing and services sectors in an economy.

This paper employs the panel data on Pakistan available for the years 2002 and 2007. Applying stratified random sampling, 402 firms were selected from all four provinces and their characteristics were tracked over time. In order to estimate the production function, data on total annual sales reported by the firms for the last fiscal year deflated by the Producer Price Index is used. For the specification of the labour

[4]http://www.enterprisesurveys.org/

variable, the analysis distinguishes between production and non-production (managerial, administrative and sales positions) workers because our assumption is the utilisation of low-cost production workers will normally differ from relatively educated and high-cost non-production workers so they need to be identified by separate parameters in the production function. Due to lack of information on the replacement value, capital is measured as the net book value (the value of assets after depreciation) of the firm for the last fiscal year while the total annual cost for electricity is used as the intermediate input proxy variable. As opposed to other intermediate inputs like raw materials and fuel, by nature electricity cannot be stored unless a firm generates electricity itself, therefore the fluctuations in consumption of electricity ought to reflect exogenous changes in productivity and can accurately proxy for the unobserved unorthogonal component in the error term. Firm's productivity is then extracted as a residual from the estimation of production function. Ideally an industry specific production function ought to be estimated as these structural parameters will vary with the type of industry but due to the limitation imposed by the scarcity of data only one production function is specified for all industries.

To assess the utilisation of capital and labour by the firms the actual employment needs to be compared to the optimal employment, and for calculating this optimal level the increase in sales due to employing an additional unit of input needs to be equated to the cost of employing that extra unit. If at the actual level of employment the marginal increase to sales is greater than the marginal cost, then the firm is underutilising the input and can benefit from increasing its usage, whereas if the marginal increase to sales is less than the marginal cost then the firm is suffering from over-utilisation of the input and can gain from reducing the input. For the purpose of calculating marginal costs i.e. the cost of employing one additional unit of input, we need information on factor costs (wages and rental rates) faced by the firms. The labour costs are reported in the survey as the average compensation including benefits to production and non-production workers whereas rental rates are approximated using the total rental costs and the measure on capital.

The subsequent reduced form analysis on input utilisation and productivity makes use of the variables similar to Fernandes and Pakes (2008) i.e. unionisation of labour force, percentage loss in sales due to power outages, corruption reported in labour inspections and whether the firm acquired a loan or overdraft from a financial institution. A four equation simultaneous system is then estimated using seemingly unrelated regression and employing these firm characteristics as the 'explanatory variables' and the average utilisation measures of labour and capital and firm productivity as the dependent variables. However, the results can be only presented as correlations (and not cause and effect) but this will help us infer policies regarding utilisation of factor inputs and jobless growth.

5. RESULTS

Applying the modified Levinsohn and Petrin (2003) technique to the data yields the parameter estimates for the production function which are reported in Table 2.

Table 2

Production Function Parameters

Production Labour	0.2176***
	(0.073)
Non-production Labour	0.3894***
	(0.069)
Capital	0.2051***
	(0.074)
Electricity	0.5918***
	(0.149)

Note: Standard errors are reported in parentheses, and '***', '**' and '*' indicate significance at one, five and ten percent level respectively.

The utilisation rates of production and non-production labour, and capital are then obtained for 2002 and 2007 using the method described in the previous section (reported in Table 3). In both the years, our results broadly show under-utilisation of labour and over-utilisation of capital across all firms, thus lending credit to our hypothesis that labour under-utilisation in firms may be one of the explanatory factors for jobless growth in manufacturing.

Table 3

Input Utilisation Industry-wise Averages for 2002 and 2007 (in Percent)

	Production Labour		Non-Production Labour		Capital	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Industry	2002	2007	2002	2007	2002	2007
Food	31	26	49	21	217	118
Garments	63	87	11	23	56	80
Textiles	20	56	29	25	39	42
Chemicals	37	64	12	22	166	88
Electronics	18	89	6	10	94	109
Leather and Leather Products	116	133	31	36	91	114
Other Manufacturing	153	137	57	32	128	196
Average Utilisation	**46**	**79**	**27**	**25**	**105**	**103**

Source: Author's estimates.

However, there exist significant differences within industries and within the two types of labour. During the period of high GDP growth (2002–2007), average utilisation rate of production labour seems to have improved from 46 percent to 79 percent but it is still 21 percent below the optimal level of employment. On the contrary, utilisation rates of non-production labour appear to be stagnant with a heavy under-utilisation of around 75 percent below the optimal in both the years. This may indicate the lack of skills for such jobs or the employees not meeting the requisite qualifications. Consequently, this skill mismatch may have led the firms to over-utilise capital by substituting capital for labour. An interesting thing to note is although capital is over-utilised, its magnitude is not sufficiently high to explain the heavy under-utilisation of labour through the substitution between capital and labour. Employment of capital is only 5 and 3 percent above the optimal level in 2002 and 2007 respectively.

Across industries, there are wide differences in the utilisation rates. In case of production workers, underutilisation is found in Pakistan's main export industries such as Textiles and Garments. In 2002 production labour employment was 80 percent below the optimal for Textiles. This improved in 2007 but labour remained under-utilised, the utilisation rate being 44 percent below optimal. In other industries like Leather, we find over-utilisation of such labour with production labour employment being 33 percent above the optimal in 2007.

Similarly, it is evident from Table 3 that non-production workers are being under-utilised across all industries in both years. Mixed results are obtained for the utilisation of non-production workers across the two years. For some industries, labour utilisation improved between 2002 and 2007 whereas for other industries (Food, Textiles and other Manufacturing) it worsened. Capital utilisation, on the other hand, has substantial variation by industry. In both years, it is over-utilised in some industries and under-utilised in others. This variation in utilisation of labour inputs and capital by industries suggests the need for industry specific policies to generate employment for the growing labour force.

The results from our subsequent analysis using Seemingly Unrelated Regression Equations to analyse the link between firm characteristics, input utilisation and productivity are shown in Table 4. The coefficients, however, do not have a causal interpretation but merely give us the correlation and the direction of the relationship.

Table 4

Utilisation of Production Labour, Non-production Labour, and Capital, and Productivity

'Explanatory' Variables / Dependent Variable is	Corruption During Labour Inspections	Degree of Unionisation of Firms	Loss in Sales Due to Power Outages	Loan Provided by a Financial Institution
a. Utilisation of Production Labour	7.56***	–0.309*	–0.117*	–
	(1.47)	(0.188)	(0.07)	
b. Utilisation of Non-production Labour	8.63***	–0.05***	–0.11***	–
	(1.43)	(0.006)	(0.034)	
c. Utilisation of Capital	37.0*	0.341	–0.569*	12.3***
	(20.8)	(0.275)	(0.323)	(2.47)
d. Productivity	0.337***	–0.009**	–0.015*	0.207*
	(0.064)	(0.004)	(0.08)	(0.118)

Note: Seeming unrelated regressions equations estimations used. Standard errors are reported in parentheses and '***', '**' and '*' indicate significance at one, five and ten percent level respectively.

Our results suggest a positive relation between the corruption inherent in a firm and its level of productivity. This is in-line with the finding of Fernandes and Pakes (2008) study on the Indian manufacturing industry, and reflects that more productive firms are more averse to corruption and hence are more likely to report it. The coefficients for the corruption variable in the utilisation equations for production and non-production workers both have a positive sign indicating that a higher incidence of money demanded by government officials during labour inspections results in an improved utilisation of both types of workers by a firm. This may be because firms are reluctant to pay bribe to government officials so they tend to comply with labour regulations and employ optimal amount of labour. In the capital utilisation equation the corruption variable again has a positive coefficient implying that firms who complain more about corruption by labour department officials tend to employ more capital. This may suggest that firms which are more efficient, thus having better utilisation of labour and capital, are more concerned with corruption of labour officials and hence are more likely to report it and also avoid paying money by employing optimal inputs.

The coefficient for the unionisation variable is negative in the productivity equation implying an inverse relationship between these variables. This coefficient is also negative in both the equations for utilisation of production and non-production labour. We infer from this that firms where labour has higher bargaining power and higher and more rigid wages due to the presence of unions, tend to employ less labour and substitute more capital for labour, leading to lower utilisation of labour and higher utilisation of capital. This can also be interpreted in light of the [Insider-Outsider model of Blanchard and Summers (1986)] where the insiders (existing workforce) enjoy favourable position in their firms and set high wages to deter hiring of outsiders, thus resulting in sub-optimal labour employment. Moreover, higher union activity leads to less productive firms due to costs involved in hiring and firing and giving firm-specific training. This in turn reduces the effort put in by the workers as they tend to "shirk" more due to the protection granted to them through union membership. Also, according to Haque, *et al.* (2011) rigid labour laws in Pakistan act as an impediment for firms by increasing the time and complicating the procedure required to deal with their employees. Therefore, the need arises to relax these regulations to allow the firms to become more competitive and utilise labour to their full capacity.

Loss in sales due to 'load shedding' is seen to have a negative relation with the rate of utilisation of production and non-production workers, and with capital as well. As expected, higher losses from power shortages are also observed to be negatively associated with productivity of the firms. This is intuitive as firms aren't able to fully utilise their capacity, resulting in lower productivity and less than optimal factor employment. Evidence on the effect of load shedding on the rate of capacity utilisation in the large scale manufacturing sector of Pakistan was also provided by Kalim (2001) who finds a high level of capacity underutilisation across different industries and estimates that a one percent change in electricity consumption would increase the capacity utilisation by 0.2 percent.

Lastly, the variable controlling for whether the firm has taken a loan from a financial institution, has a positive coefficient in the equations for capital and productivity. This positive relation between attaining a loan and higher productivity indicates that financial institutions are more willing to provide capital assistance to more productive firms to reduce the risk associated with default. Such financing remains important for firms as it allows them to expand by innovating and investing in state of the art technologies. The positive relation in the capital utilisation equations is not surprising as one would expect firms with greater investment through loans to more effectively utilise capital inputs.

6. POLICY CONCLUSIONS

The main results of this paper demonstrate that labour under-utilisation can be one of the driving forces behind the jobless growth and pre-mature deindustrialisation experienced by Pakistan during the period of our analysis 2002–2007. Such under-utilisation is primarily found in the non-production labour force which may indicate lack of skills required for such jobs. This confirms the evidence of under-investment in human capital with only a minimal allocation to the education sector in Pakistan's national and provincial budgets (only around 5 percent in the national budget of 2011-2012). However the issue is not limited to under investment in human capital as there is evidence of substantial skill-mismatch in the industrial sector too. The skills that are acquired by the labour force are not demanded by the industries so industries prefer to employ less labour and more capital leading to job-less economic growth. This explains the capital over-utilisation found in our analysis. In order to remedy this situation, firstly greater investments in human capital is required and secondly, demand-driven vocational training needs to be provided so that labour supply matches labour demand. The quality of education also needs to be improved so that workers have the requisite qualifications demanded by the industries. Furthermore, regulations governing the labour force sector need to be relaxed to allow the firms to allow then to hire workers at their optimal level.

In the current context of severe power outages, this problem has worsened with workers being laid off and industrial plants operating below their full capacity. As seen in our reduced form analysis, losses in sales due to power outages worsens the utilisation of both capital and labour and reduce firm productivity. Pakistan's export sector has greatly suffered as a result, causing a slowdown in export-driven economic and employment growth. A recent report by the World Bank (2011) on South Asia finds that due to the industrial load shedding there has been a massive loss of about 400, 000 jobs in Pakistan. The solution lies in encouraging investment in power sector and promoting the emergence of Independent Power Projects (IPPs), and reducing the circular debt that plagues the power sector. Once this power shortage has been dealt with, firms will be able to operate at full capacity, reducing under-utilisation of labour hence boosting employment growth.

7. CONCLUSION

This paper aimed to investigate the utilisation of factors in Pakistan's manufacturing sector and explore labour under-utilisation as one of the major causes of the job-less growth experienced by Pakistan in the past decade, with a distinction being made between production and non-production workers. Using the Levhinson and Petrin (2003) method to estimate the production function, firm level estimates were obtained for labour and capital-utilisation in 2002 and 2007, as well as for productivity. Furthermore, industry wise averages were obtained in order to gain further insight into the issue of lagging employment growth. Our results give evidence of labour under-utilisation and capital over-utilisation in the manufacturing sector, with the results varying across industries. Interestingly, Pakistan's main industries such as textiles and garments, and important industrial cities, suffer the most from under-utilisation of labour. Our reduced form estimates suggest that power outages and capital substitution may be the main causes of this phenomenon.

Our analysis evokes the need to invest in human capital in order to reduce the growing skill gap that may result in skill-mismatch and hence under employment of labour. Moreover, the need to resolve the issue of power shortage is also emphasised as greater the loss suffered from power outages, less is the labour employed by the firms. However, another major cause of under-employment in the manufacturing sector that is not investigated is the growth of the informal sector in its impact on formal manufacturing employment. Due to the lack of data on the growing unregistered manufacturing sector our study could not carry out this investigation and it is left to future research. Other avenues of further research include conducting an industry specific analysis by calculating industry specific production functions and looking at the relation between structural change, inter-sectoral linkages and labour utilisation in a Kaldorian framework. In addition to this, more recent data should be collected and analysed to observe how the recent economic slowdown has affected labour and capital-utilisation. Such research will help to complete the examination of what has caused the observed job-less growth in Pakistan and hence further suggest policies to deal with this phenomenon.

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