Increasing Labor Demand and Labor Productivity in Ghana

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Abstract

The purpose of this study is to propose policies aimed at enhancing labor demand and labor productivity in Ghana. Consequently, the study has three main objectives. The first objective is to identify the determinants of labor demand in Ghana. This includes measuring the substitution parameters between homogenous labor and capital, and indirectly estimating the own-wage elasticity of demand for labor as well as the cross-elasticities among heterogeneous labor inputs. The second objective is to assess the effects of some conceptually identified non-firm-level factors, such as hiring and firing regulations, on the demand for labor. The third objective is to model value-added per worker, a surrogate for labor productivity, as a function of firm-level variables such as the capital-labor ratio, the real wages paid to workers, the type of ownership, the age of machinery and equipment used by firms, and the capacity utilization.

The study used panel data from five manufacturing industries and cross-sectional data from firms across all sectors of the economy. The panel data covers the period 1972 to 1984 while the cross-sectional data was collected in 1995. Results of the study revealed that there is considerable ease in substitution between capital and labor in the industries studied. This suggests that firms replace workers with machinery and thus reduce the demand for labor when the price of machinery becomes cheaper relative to wages either through subsidized cost of credit or overvalued currency. The study found that firms' labor demand is to a large extent influenced by who operates the firms and how. For example, foreign-owned firms tend to hire more workers, while firms with higher capacity utilization also employ more workers. While the data could not allow us to discriminate between public and private ownership, we think such a distinction may have revealed profound effects on the employment level and productivity. Further assessment of labor demand concluded that capital constraints, concerns about firing laws, and labor costs are major factors reducing the likelihood that firms will hire more workers.

The assessment of the determinants of labor productivity showed that the capital-labor ratio, wages of production workers, and capacity utilization are the major factors with statistically significant impacts on value-added per worker. Finally, the study found out that there has been a consistent technical retrogression over time in the manufacturing industries studied. Various policy recommendations have been made in the executive summary based on the findings.

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George Gyan-Baffour, Washington, D.C

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EXECUTIVE SUMMARY

The Ghanaian economy is characterized by low employment growth and low labor productivity against a backdrop of a relatively high growth in population. The labor force is growing faster than the rate of job creation. This imbalance is exerting negative pressure on economic growth and development. Reversal of the tendency requires a vigorous policy aimed at promoting employment. Trends, however, indicate that not only has employment not been able to keep up with growth in the labor force, but that for over three decades formal sector employment has been declining. Furthermore, the level of real wages cannot be sustained because productivity has not been rising enough to cope with increases in the size of the labor force. Available data on labor productivity in the manufacturing sector suggests that the productivity in Ghanaian firms is lower than that of firms in other African nations, and certainly lower than the productivity of firms in developed economies. The purpose of this study is to identify the determinants of employment demand and labor productivity in Ghana. This study also proposes policies that will help increase employment levels, enhance the purchasing power of the population, improve labor productivity, and make local firms more competitive in an interdependent global economy.

Historical data (1972-1984) from five manufacturing industries and a 1995 cross-sectional survey of selected firms across all sectors of the Ghanaian economy were used to assess the impact of theoretically developed factors on labor demand and labor productivity. This study provides a detailed analysis of labor demand and labor productivity in the five industries studied. It also provides recent trends in employment levels across major occupational categories and across sectors.

Employment Trends Across Occupational Categories and Sectors

Results from the survey data shows that employers think that the overall employment level in the surveyed firms went up between 1980 and 1990 but declined slightly between 1990 and 1995. However, there was some slight increase in employment at the managerial level between 1990 and 1995. Furthermore, employment of the technical or production workers actually went up in 1990 but declined precipitously thereafter. This is obviously the effect of the well-discussed decline in employment in the manufacturing sector since 1990. While there was a decline in employment of unskilled workers between 1980 and 1990, there has been a strong rally in this employment category in the interim.

The study also shows that the bulk of employment has been in the non-tradable sector. It is also obvious that while the employment level in the tradable sector has increased dramatically, the increase does not translate into large head counts because of its low employment base compared with the base in the non-tradable sector where, unfortunately, the level has been declining. With trade liberalization, it is expected that there will be a decline in labor demand in the importable sector, and we expect an increase in demand in the exportable sector (Edwards and Edwards, 1994). The evidence of an overall increase in demand in the tradable sector suggests that the increase in labor demand in the exportable sector more than offsets the decline in employment in the importable sector. This seems to be a good employment response to the trade liberalization regime that began in 1984. The policy implication is that there is a need for further incentives for

firms in the exportable sector, either financial or non-financial. On the other hand, we also expected that the removal of capital controls in 1984 should have increased employment in the non-tradable sector through a positive expenditure effect (Edwards and Edwards, 1994, p143). The evidence here, however, suggests the opposite has occurred.

Determinants of Employment Demand

The elasticity of substitution between labor and capital based on the historical data ranged from 0.226 in the garment industry to 0.572 in the paper and printing industry. This suggests that as the relative price of labor to capital increases (declines) by 10%, the relative use of capital to labor increases (declines) by between 2.26 % in the garment industry and by about 5.70% in the paper and printing industry. Thus a policy that reduces the relative price of capital tends to discourage the hiring of labor and encourage the use of more capital in all industries studied, but more so in the paper and printing industry. This finding of the greater ease of substitutability between capital and labor in the paper and printing industry supports the high capital-labor ratio in the industry reported elsewhere in this report. It should be noted that during the period under study, imported machinery and equipment were relatively cheap due to overvalued currency. Consequently, it was cheaper for firms in the paper and printing industry to replace people with machinery. In general, the relatively high elasticity of substitution across the five industries provided firms greater incentive to replace people with machinery. The current liberalization of the capital market and the removal of subsidies on credit as a result of the structural adjustment program will make capital relatively more expensive than labor and will encourage more employment in the industrial sector unless existing hiring and firing rigidities encourage employers to do otherwise.

The own-wage elasticity of demand for homogenous labor in the sectors studied ranges from 0.171 in the non-metallic industry through 0.287 in the food, tobacco, and beverages industry, to a high of 0.495 in the paper and printing industry. These estimates fall within the expected range of 0.15 and 0.75 (Hammermesh, 1993, p.135). These suggest that the manufacturing sector in Ghana will benefit from average labor demand increases when the general level of wages declines, and vice-versa with the paper and printing sector experiencing more changes, followed by the food, tobacco, and beverages sector. Given that the food sector is also the major employer among the industries surveyed, it will lose the most workers in response to mandated increase in wages and will absorb the most when wages are flexible downwards.

The study shows that skilled labor demand is more sensitive to wage changes in the garment industry, followed by the food, tobacco, and beverages industry. The industries with the least sensitivity to skilled labor wage changes are the paper and printing and the non-metallic industries. Again, unskilled labor demand is most sensitive to wage changes in the garment industry, followed by the metal and food industries. In general, the own-wage elasticity of demand for skilled labor is greater than that of unskilled labor in all but the metal industry. This finding suggests that an increase in skilled wage will reduce skilled employment more than a similar

proportionate increase in unskilled wage will affect unskilled employment. Consequently, selective increases in wages of skilled workers require caution lest they reduce overall employment.

The cross-elasticity of demand for skilled and unskilled labor indicates that they are substitutes. When the wage of skilled labor increases, more unskilled workers are hired to replace the skilled labor lost due to wage increases. Similarly, when the wage of unskilled labor increases, there is the tendency for skilled labor to be hired to replace the lost unskilled workers. Thus, while an increase in unskilled wages generates a relatively higher decline in unskilled employment than the increase in skilled employment that ensues, the high cost of hiring skilled workers can raise production cost drastically. On the other hand, an increase in the wages of skilled workers will tend to reduce the number of skilled workers hired and to increase the number of unskilled workers hired, thus reducing the total cost of production. The resulting policy implication is that mandated minimum wage increases have the tendency to increase employment of higher paid skilled workers with an associated increase in production cost. Unless the use of more skilled workers results in higher productivity, the higher cost of production may have to be absorbed by firms or passed on as higher prices to consumers. Either case may make the firms less competitive.

The study also shows that a major determinant of labor demand is real output produced by the firm. The implication for the robust positive effects of real output on employment is that firms that are able to produce more are more likely to hire more workers. First, firms will produce more only if they can sell more. Controlling for demand, firms can sell more if their products are competitive on the market. The implication of this finding is that firms will be able to employ more if they can be competitive, and that policies that increase competitiveness such as productivity enhancement, privatization, and openness will enhance labor absorption.

Furthermore, the study shows that the capital-labor ratio bore no negative effect on the level of employment. This suggests that capital-intensive technologies do not necessarily lead to lower levels of employment. The study also suggests that a firm's demand for labor is influenced by who operates the firm and how. For example, the effect of capacity utilization on employment demand was in the expected direction for all the equations and was significant in the food, tobacco and beverages industry equations. The implication here is that firms that operate at near capacity tend to hire more workers. The ability of firms within a given industry to operate at levels of capacity higher than competitors depends on the resourcefulness of the firm's management. Another policy implication of this finding regards the benefit of increased training for current and future managers. Furthermore, the results show that the effect of foreign ownership on employment levels was positive and significant in most equations. This suggests that multinational corporations tend to employ more workers than do indigenous firms. This is also probably due to better management and efficiency associated with these multinationals. It follows that there is a need to vigorously encourage foreign direct investment. Finally, the survey data suggests that capital constraints, concerns about firing laws, and labor cost constraints are major factors reducing the likelihood that firms will hire additional workers. Furthermore, while unions may have negative

effects on the likelihood of firms hiring more workers, the effect is not statistically significant. However, firms that are facing more industrial actions are likely to hire less. The policy implications here are obvious. First, there is the need to ease credit availability to businesses in general. Second, there has to be some review of the current hiring and firing laws in order to reduce the cost of hiring workers. Third, there is the need to shift labor actions from the political arena into the industrial realm as a way of encouraging direct, non-political, and more peaceful employer-employee/union bargaining and negotiations processes.

Determinants of Labor Productivity

As indicated earlier, the highest value-added per employee was recorded in the food, tobacco, and beverages industry, followed by the paper and printing industry. The study also shows that real wages for production workers were highest in the food, tobacco, and beverages industry. This finding is not surprising. Since the food, tobacco, and beverages industry is the most efficient industry, it can pay its workers high wages. Alternatively, the industry is perhaps the most efficient because it can attract highly qualified workers. This finding suggests that productivity correlates positively with level of training, experience, and qualification. A significant implication of this finding is the need for increasing both on-the-job and general training in order to provide workers with the necessary skills and qualifications.

The study confirms that capital-labor ratio, wages, and capacity utilization are the major determinants of value-added per worker in the industries surveyed. There are several implications for these findings. First, there is the need to update the firms' technology to include relatively more capital-intensive technologies. A major policy recommendation is to ease credit availability for the purpose of updating technologies. Second, even though capital-intensive technology is needed to increase productivity, investment in human capital, as demonstrated by the level of wages, is critical for productivity increase. Another policy implication of this finding is the need to encourage both on-the-job training as well as general skill training through government-industry partnership.

The study also indicates that for many of the years under study, the coefficients of the year dummy variables were negative and highly significant across all sectors. This finding implies that there has been a consistent technological retrogression in the manufacturing sector over the years under investigation. There is therefore a need for purposeful research and development programs in the industrial sector. This can take the form of a partnership between the corporate world and the research institutions, such as those under the Council for Scientific and Industrial Research of Ghana (CSIR) facilitated by Government.

Employment, Productivity, and Wage Nexus

The study shows that the food, tobacco, and beverages industry (ISIC 31) was the major employer of production workers. The industry with the least average employment was paper and printing (ISIC 34). It is further shown that value-added per worker was highest in the food, tobacco, and beverages industry followed by the paper and printing industry. Thus the food, tobacco, and beverages industry is both the major employer and the most productive industry among the industries studied. The industry is more likely to hire more workers and also be more competitive with imports than any other industry studied due to its high level of productivity. To enhance both labor absorption and labor productivity in the manufacturing sector, resources should be directed to the food, tobacco and beverages sector.

Again, while the paper and printing industry registered the lowest level of employment, it had the second highest value-added per worker. This finding, together with the finding that the food, tobacco, and beverages industry had the highest employment level and highest value-added per worker, indicates that there is no a priori relationship between employment level and productivity. Both high and low employment levels are compatible with high levels of productivity.

Finally, the study shows that the paper and printing industry is the most capital-intensive industry, followed by the metal industry. The food, tobacco, and beverages industry is the least capital-intensive. The interesting finding here is that while the food, tobacco, and beverages industry is the least capital-intensive, it is the one with the highest value-added per worker and with the highest paid employees. This suggests that the wage rate, as a surrogate for human capital, is a better predictor of productivity than capital intensity. The implication of this finding is clear. Productivity and competitiveness of firms in Ghana hinge, to a very large extent, on the appropriateness of available human capital. This requires a vigorous campaign of relevant technical and managerial training geared towards the needs of the marketplace.

Introduction

The Ghanaian economy is characterized by low employment growth and low labor productivity against a backdrop of a relatively high growth in population. The labor force is growing faster than the rate of job creation. This imbalance is exerting pressure on economic growth and development of the country. Reversal of the tendency requires a vigorous policy aimed at promoting employment. Trends, however, indicate that not only has employment not been able to keep up with growth in the labor force, but that employment decreased at an annual rate of 1.4% in the formal sector between 1960 and 1991 (ISSER, 1995) and has continued to decline. Furthermore, with such an increase in labor force, productivity of labor has to increase enough to provide employment at the same level of real wage. Additional increase in real wage will require further increase in productivity. However, available data on labor productivity in the manufacturing sector suggests that the productivity of firms in Ghana is lower than that of firms in other African nations, and has been declining since 1991. A more recent study (Teal, 1998) also concludes that the substantial growth recorded in the manufacturing sector between 1991 and 1995 occurred through increases in both labor and capital inputs, with no evidence of a rise in underlying productivity over time. The current study focuses on efforts to increase labor demand and labor productivity in Ghana. First, it assesses the determinants of employers' decisions about the number of workers employed. Second, it assesses the determinants of the variability in workers' productivity. Based on the relative importance of identified determinants of labor demand and productivity, the paper will propose policies for increasing labor absorption and for enhancing labor productivity in Ghana. The aims of such policy proposals are to help reduce unemployment, enhance the purchasing power of the population, reduce poverty, pre-empt more hardships in the future, and make firms more efficient in the utilization of labor resources in order to strengthen them and prevent further de-industrialization of the economy.

The research has three main objectives. The first objective is to identify the determinants of firms' choices regarding the appropriate inputs of workers used in production in relation to other productive inputs. This includes measuring the parameters describing the demand for labor, such as the elasticity of demand for labor and the substitution parameters between homogenous labor and capital, as well as among heterogeneous labor inputs. Second, the study focuses on the effects of regulations and other policies on demand for labor. This includes the effects of hiring and firing regulations on the demand for labor. Additionally, we explore other labor market distortions, such as unionism and their impact on labor demand. Third, the study focuses on the effects of firm-level factors on labor productivity. In the following section, we describe the labor market and the industrial relations system in Ghana to provide readers with some understanding of the context in which the exchange of Ghana's labor resources and their utilization in production take place.

Characteristics of the Labor Markets in Ghana

Social inequities such as persistent poverty, income inequality, unequal access to education and training, and the emergence of non-competing groups in labor markets are more pronounced when these markets are subject to many market imperfections. In a developing economy with a high degree of imperfection like Ghana's, markets are often sheltered from competitive forces due to constraints such as physical or occupational mobility, technological dualism, and differences in education across regions and groups. Consequently, the labor market in Ghana is characterized by subtle yet profound segmentation by region, by socio-economic status, by gender, and, to a lesser extent, by institutional factors such as unions and social employment norms and customs. The labor market segmentation affects the degree of labor force participation, employers' decisions about employment, and wage setting across various sectors of the economy and population.

Labor Force, Employment and Unemployment

The UN African Statistical Yearbook for 1990/91 estimated the economically active population in Ghana in 1990 to be 5,686,000, or 38% of a total population of 15,028,000[1]. The economically active population is equally divided between the agricultural labor force, with a population of 2,839,000, and the non-agricultural labor force, with a population of 2,847,000. The Ghana Statistical Services Quarterly Digest of Statistics estimates that only 229,000 of the economically active population (4% of the non-agricultural labor force) were employed in the formal sector. On the other hand, the Jobs and Skills Program for Africa (JASPA) estimates that about 1,266,000, or 44% of the non-agricultural labor force, is employed in the informal sector. Assuming that all informal sector employment were in the non-agricultural sector, then unemployment in the non-agricultural sector alone in 1990 was as high as 1,282,000 or 45% of the non-agricultural labor force. While the data reported here is somewhat dated, it nonetheless gives a more realistic depiction of the employment situation in Ghana than most official statistics seem to suggest.

For example, The ILO Yearbook of Labor Statistics reported a registered non-agricultural unemployment figure of 31,000 for 1990. This figure, considered as a percentage of the non-agricultural labor force of 2.847 million, suggests an unemployment rate of 1%. A more recent estimate puts the unemployment rate at 5.5% of the active population (Beaudry and Sowa, 1994). The first estimate is admittedly based on registered unemployment. Considering the infantile stage of labor market institutions in Ghana, recorded information by the employment agencies is a gross under-representation of actual unemployment. The second estimate was calculated from the Ghana Living Standards Survey (GLSS). The GLSS defines unemployment to include active people either searching for jobs in the last one week, waiting to start new jobs, or not searching for jobs because they did not believe jobs were available.

The estimates from the GLSS and the ILO Labor Statistics notwithstanding, a casual observation of the streets and alleys in both the rural and urban areas in Ghana during working hours suggests

1 It is estimated that the population was 19 million in 1995 and would be 24 million by this year (ISSER, 1995).

a massive under-utilization of labor. This under-utilization of labor is not -- or cannot be -- effectively measured using standard definitions. Clearly the rate of unemployment among the non-agricultural labor force could be as high as 45%.

Table 1
Estimated Unemployment in the Non-Agricultural Sector

Year	Total Non-Agric Labor Force (a)	Formal Sector Employment (b)	Informal Sector Employment (c)	Residual [a- (b+c)]
1990	2,847,000	299,000	1,266,000	1,282,000

Sources: Non-Agricultural Labor Force figures from the UN African Statistical Yearbook 1990/91. Formal Sector employment figures from Ghana Statistical Services Quarterly Digest of Statistics. Informal Sector employment figures from the Jobs and Skills Program for Africa (JASPA).

Formal/Informal Sector Employment

Formal sector employment is defined as the recorded employment in establishments employing five or more workers (ISSER, 1995). This sector consists of workers in both the private and public sectors. The major sectors comprising the formal sector include the formal agricultural sector, the mining and quarrying sector, manufacturing, electricity, gas and water, construction and services. The construction sector has the lowest share of formal employment, with only 4.2% of total formal sector employment. It is followed by employment in formal agriculture, which declined from 17.3% in 1960 to 7.9% in 1991. The mining and quarrying sector constitutes 9.2% of total formal sector employment, recording an increase of 2.5 percentage points from 6.7 % in 1965. The manufacturing sector accounts for 12% of formal sector employment, declining from its peak of 21% in 1987. Services are the main means of labor absorption in the formal sector, recording a share of 66.8% of all employment in the formal sector.

Overall, formal sector employment decreased by 44% from 1960 to 1991. Close examination reveals that it increased from 332,900 in 1960 to 483,500 in 1976, and then began to decline in 1979, reaching a low of 186,300 in 1991. The sharp decline in formal sector employment after 1985 is due to the retrenchment in the public sector as part of the structural adjustment program. Private sector employment declined from 149,000 in 1960 (45% of formal sector employment) to only 31,000 by 1991 (16%), and contributed significantly to the overall decline in formal sector employment.

The conceptual difference between the formal sector and the informal sector in Ghana is based on ease of entry into the respective job markets and methods of production (Mazumdar, 1995). It is easier for job seekers to get jobs in the informal sector; it is difficult to get jobs in the formal sector. It is thus not surprising in a period of retrenchment in the public sector and decline in

overall employment in the formal sector that employment in the informal sector has been increasing. It is estimated that in 1990, the share of informal sector employment in total overall employment was 45%, and its share of urban employment was between 60% and 84%.

The informal sector in Ghana consists of two major sub-groups: the wage earners and the self-employed. Although casual observation suggests a surge in the number of self-employed workers, entry into the informal sector may be easier for the wage earners than for the self-employed. This is because the wage earners tend to operate in a more flexible labor market with no institutional constraints, such as union-bargained wages and legislated minimum wages. Consequently, wages are not held above the supply price. Wage flexibility in this sector provides job seekers with easy access to jobs as long as they are willing to accept wages below the prevailing levels.

Self-employed labor is characterized by the existence of entrepreneurial skills as well as working capital, and it can be divided into different categories according to the size of capital and/or the extent of overhead carried. In fact, the return on investment of this group of "owner-workers" reflects, to a large extent, the size of capital available to them and the overhead cost incurred. The earnings that self-employed gain are usually for their labor, their enterprise, and their capital.

The wide disparity in the use of capital and entrepreneurial skills tends to define the dispersion of earnings in the sector. Owner-workers possessing large capital and good entrepreneurial skills may earn more than workers in the formal sector. Nevertheless, it is quite obvious that some of them with little or virtually no personal capital who rely on financial means owned by larger businessmen, may face wages lower than those earned by casual laborers.

A major segmentation in the Ghanaian labor market is the division between the formal and informal sector. Whereas it is easy to enter the informal sector, entry into the formal sector is difficult. The reasons for the difficulty in entering the formal sector include the retrenchment exercise carried out in the public sector during the Structural Adjustment Program (SAP) and the effects of import liberalization on manufacturing employment.

Even though there is no data on average earnings in the informal sector, the surge of employment in the sector and the flexibility associated with its wages suggest a downward pressure on informal earnings. At the same time, compression of wages in the public sector and the minimum wage increases paid by employers in the formal sector suggest that average earnings in the formal sector exceed average earnings in the informal sector. The differences in earnings between the two sectors and the protection accorded the employees in the formal sector due to a de facto employment freeze in the public sector, has created a "labor aristocracy" in the urban labor market. A small proportion of the labor force privileged to be employed in the formal sector controls a large proportion of the income generated in this more modern sector. Meanwhile, a large number of workers are left to share the dwindling income in the informal sector and denied entry into the formal sector.

As mentioned earlier, the JASPA estimates that total employment in the informal sector has increased in the last two decades by 250%, moving from 356,000 in 1970 to 1,266,000 in 1990. The informal sector is usually the employer of last resort, mainly because of the ease of entry associated with it and the relatively unstructured nature of its operations. Consequently, it attracts workers with low potential to obtain employment in the formal sector, especially migrants from rural communities possessing little or no formal education.

Rural/Urban Labor Markets

The rural labor market in Ghana has the largest share of the active population, with a ratio of rural to urban employment of 4:3. Farm labor dominates the rural labor market; while the formal and informal sectors of the economy are diffused into both the rural and urban markets, there is a greater concentration of both in the urban labor market.

Even though there seems to be evidence of a rural-urban shift in Ghana, the transmission mechanism may be different from that postulated in the Harris and Todaro model. Migrants do not move to the urban areas with expectations of jobs in the formal sector. In general, migrants seem to have accepted the fact that there are no jobs in the formal sector, and come to the urban centers with the hope of owning their own businesses. The expectation is not to join the formal sector but to be part of the informal sector, which is easier to enter. This interpretation suggests that the wages in the urban informal sectors are higher than rural wages.

Education, Gender and the Labor Market

Segmentation of the labor market also occurs when attributes of labor are used as labels in hiring employees or selecting occupations. When this happens, the labor market may be split into non-competing groups. In Ghana, the most significant of such attributes are gender and education. Women typically self-select themselves into retail self-employment. For instance, over 33% of women, as compared with 17% of men, work in household businesses, while the ratio of men to women in the formal sector exceeds 3.0 (Beaudry and Sowa, 1994, p. 370). Even though some women's incomes in the household business sector may be relatively high, a large proportion of women, especially among the younger ones, is driven into a narrow and lower band of household business (e.g. as peddlers of, say, "iced water"). Another characteristic associated with women's employment is the relatively lower level of education received by women. According to recent estimates, fewer than 30% of women in Ghana have education above primary school level, as compared with 50% for men. The women's lower level of education, as well as their self-selection process, restricts their entry into higher paying jobs in government, state enterprises, and the private non-household sectors.

Another source of segmentation in the labor market is unionism. Even though unions in Ghana are not as militant as elsewhere in Africa, they have the potential of creating competing groups that are worth mentioning. We therefore discuss the industrial relations system in Ghana and discuss

the legal and regulatory framework in which the exchange of labor takes place.

The Industrial Relations System

The Actors

The main actors in the industrial relations system of Ghana are the workers and their unions, the employers and their representatives, and the government agencies concerned with workers, enterprises, and their relationships. The role of government in most industrial relations systems is indirect. However, since the government of Ghana has historically been the single most important employer of labor, its role in the system of industrial relations has been unusually strong.

During the 1960s and throughout the First Republic, the Trades Union Congress (TUC) -- the federation of all unions in Ghana -- was an instrument of government control over labor as the government appointed its leaders. Between 1966 and 1971, the First Military government and, later, the Busiah administration, attempted to sever relations with the unions and adopt a policy of confrontation by decentralizing TUC' s operations. With the overthrow of the Busiah administration, attempts by the Second Military government of 1972-78 to coopt the unions failed. Between 1985 and 1992, the PNDC military Junta used coercive measures to cope with labor agitation and to allow government to implement wage, employment, and pricing policies prescribed by the SAP. Labor-government relations in the Fourth Republic have been eroded further due to declining real wages, increasing unemployment, and the general sense of insecurity among workers.

The Trade Union Congress of Ghana is a federation of 8 national unions. These are the General Agricultural Workers Union (GAWU), the Industrial & Commercial Workers Union (ICU), the Local Government Workers Union (LOWU), the Maritime & Dock-Workers' Union (MDU), the National Union of Seamen (NSU), the Public Utility Workers Union (PUWU), the Railway Workers Union (RWU), and the Teachers & Education Workers Union (TEWU). In 1988, the total membership of all unions combined was 371,339, with the Industrial & Commercial Workers Union and the General Agricultural Workers Union alone representing about 40% of the total unionized sector. However, by 1991, membership in unions had dwindled to 297,332, recording a decline of 20% since 1988. In absolute terms, the major decline came from the Industrial & Commercial Workers Union, the Local Government Workers Union, and the Teachers & Educational Workers Union, which combined lost over 50,000 members.

Although private sector employers traditionally have not been major actors in the industrial relations system in Ghana, less restrictive labor regulations under the Economic Recovery Program (ERP) have strengthened the bargaining power of employers and have allowed them to shed excess labor. This action on the part of employers, coupled with the retrenchment in the public sector, contributed to the shrinkage in the size of union membership in the country.

The Context

The actors in an industrial relations system operate within a context of technical, market and power relations within the larger community. These contexts, which are external to the industrial relations system, are decisive in shaping the rules established by the actors. In Ghana, the technical and market constraints facing actors in the system in the last decade or so have largely been defined by the Economic Recovery Program (ERP) or the Structural Adjustment Program (SAP). The three most important aspects of the ERP/SAP, as they affect the industrial relations system in Ghana, have been the liberalization of trade, divestiture, and the retrenchment in the public sector. These three aspects of the recovery and adjustment programs have influenced labor regulations in the country. To carry through the liberalization, divestiture, and retrenchment policies, the government had to move away from its traditional alliance with labor, which was prevalent in the 1960s, to a position of non-cooperation. The government did this in two ways. First, its support for a centralized collective bargaining system was withdrawn, leaving national and local unions to bargain individually. Second, the government abandoned the national incomes policy. Labor reacted to these changes through frequent disputes and strike actions. These actions have soared since 1989. In 1990 and 1991, 24 strike activities were recorded each year, in comparison with an average of 18 strikes in the previous three years.

The Outcome

Historically, the outcome of the interaction among the actors within the context of the technical, market, and political environment in Ghana has been characterized by a system of centralized collective bargaining, under which wage levels and structures, as well as working conditions, were established at the national level. Individual local unions then negotiated with their employers within the framework of the national agreement. This system was, however, abolished with the introduction of the ERP and SAP in 1983-84. The abandonment of centralized bargaining paved the way for the massive retrenchment exercise embarked upon by the government in the public sector. Workers were then left to negotiate with their employers at the local level. The result has been a "chaotic situation whereby wages and wage structures ...are being settled through strike actions and other ad hoc procedures rather than through bargaining and negotiation" (ISSER, 1995, p.159).

Labor Supply and Demand

The population of Ghana was estimated at 12.8 million in 1985 and 19.0 million in 1995 (ISSER, 1995). With a total fertility rate of 5.5, a crude birth rate of 38/1000, and a relatively low death rate of 13/1000, the natural rate of population growth over the period is estimated at 3.0% (Ghana Statistical Services, 1994). If these trends continue, it is projected that the population of Ghana will reach 24 million by the year 2000. With the current rate of increase in population, the labor force is expected to increase from 4.9 million in 1985 to 7.7 million by 2000, representing an average annual growth rate of over 3% (ISSER, 1995 p. 136). The labor supply curve in a

developing nation like Ghana is very elastic. A rapid increase in labor force will shift the labor supply curve[2] so that a significant shift in labor demand will be necessary to simply increase employment at constant real wage with constant rate of unemployment (The World Bank, 1984). However, the current trend in employment demand has not been able to keep pace with the growth in the labor force.

The relatively low level of labor absorption in the country as the population grows at such a relatively high rate would throw more and more people into unemployment and/or into underemployment in the low-wage informal sector. As a result, an increasingly large proportion of the people would be pushed below the poverty level. This dynamic will trigger the need for state intervention through welfare programs that will put pressure on government spending, which will in turn undermine the stabilization process. In the absence of such poverty alleviation measures, a high level of unemployment and underemployment could lead to social discontent that might endanger the sustainability of current and future growth-related policies.

Labor Productivity

The rapidly increasing labor force in Ghana will require the marginal labor productivity to increase just high enough to provide employment at a constant real wage (The World Bank, 1984). Additional increase in the real wage, which would improve the purchasing power of the people, will require a further increase in the marginal productivity of labor. Estimates of the productivity of labor in Ghana are generally hard to come by. However, recent measures of labor productivity in selected manufacturing industries in three African countries, including Ghana, indicate that most African firms, particularly those in Ghana, are generally poor performers as compared to the most efficient firms within these countries (Biggs, Shah & Srivastava, 1996).

It is clear from Table 2 that estimates of labor productivity in the manufacturing sectors surveyed in Ghana are by far lower than estimates from similar sectors in other African countries.

2 For a complete assessment of the labor supply in Ghana see P. Beaudry and N. K. Sowah in "Labor Markets in an Era of Adjustment", Vol. 2, EDI Development Studies, 1994

Table 2
Comparable Labor Productivity Estimates in Selected African Countries by Size of Firm

	Firm Size					
Country	**5-9**	**10-19**	**20-49**	**50-99**	**100-199**	**200+**
Ghana	507	683	1807	1575	1735	1918
Kenya	2200	3869	3395	3588	6774	4540
Zimbabwe	3734	2952	4528	4750	5613	7721

Source: Adapted from Technological Capabilities and Learning in African Enterprises, by Biggs et al., 1996, Table 3.1. Currency in USD.

It is also obvious from Table 3 that despite the relatively low level of productivity, there was a continuous decline in average productivity in dollar terms in the sectors covered over the three-year period for which the data exists.

Table 3
Labor Productivity in Selected Sectors in Ghana (1991 – 1993 '000 cedis)

	1991		1992		1993	
Sector	Value Added/(per worker) (cedis)	Real Output/(per worker) (cedis)	Value Added/(per worker) (cedis)	Real Output/(per worker) (cedis)	Value Added/(per worker) (cedis)	Real Output/(per worker) (cedis)
Foods	1,700	4,100	1,600	3,700	2,160	4,190
Furniture	680	1,470	400	630	590	900
Machinery	965	4,800	600	1,700	795	1,930
Metals	670	2,245	833	1,900	965	1,960
Bakery	950	5,100	1,016	4,050	950	4,580
Garments	180	480	205	385	230	515
Wood	765	1,650	960	2,140	1,615	1,570
Average	**750**	**2,450**	**730**	**1,870**	**905**	**2,060**
US$ (Equi.)	**192**	**627**	**140**	**359**	**110**	**251**

Source: Summary Report of the RPED study, October 1994.

This trend suggests possible decline in the near future.

The relatively lower productivity of firms in Ghana indicates greater difficulties for these firms in competing with the more efficient or lower cost foreign firms as Ghana continues with its liberalization program. Consequently, the ability of local firms to survive extensive trade liberalization is and will continue to be hampered. This will result in a rapid de-industrialization of the economy and will adversely effect economic growth.

The Theoretical and Analytical Framework

Employers' demand for labor depends on several factors. Standard economic theory suggests that labor demand is a function of the characteristics of demand for the products that labor services are used to produce. Thus labor demand will be high if the demand for the products that the labor resources are used to produce is high. Next, labor demand is also a function of the characteristics of the production process used. The ease with which labor can be substituted with other factors, such as capital, influences the amount of labor that will be demanded. If it is easier to use labor inputs instead of machinery and equipment when producing a given set of goods or services, employers will have an incentive to employ more labor when there is an increase in the relative price of capital. Finally, and most importantly, the demand for labor is a function of the wage paid to workers and the prices of other factors of production.

The Effects of the Wage Rate and other Factor Prices on Labor Demand

In a competitive market, a profit-maximizing firm will employ labor up to the point where the marginal revenue (MR) or the additional revenue derived from hiring the last worker equals the money wage rate. The schedule of points combining the nominal wage paid by employers and the number of workers hired traces the labor demand curve. Because the labor demand curve is negatively sloping, an increase in nominal wage leads to a decline in the number of workers employed, and vice-versa. Thus, for a given production process and all other things being equal, a change in wages will result in a change in demand for the labor used in production. The extent of the change, however, depends on the slopes of the demand curve. The slope indicates the percentage change in employment that can be induced by a percentage change in the wage rate. This is called the wage elasticity of demand for the type of labor in question. Therefore, whether the responsiveness of demand to changes in the wage rate will be high or low depends on the wage elasticity of demand for the particular labor. Any factor that can influence the elasticity of demand to make it more responsive to changes in nominal wages can, in principle, change the demand for labor when wages change either through minimum wage legislation or through market forces.

The product market condition that can affect the elasticity of demand can be inferred from Hicks-Marshall's First Law of Derived Demand. According to Hicks-Marshall, the own-elasticity of demand for a category of labor is high when the quantity demanded for the product being produced is very sensitive to price change. If a slight decline in the price of the product being produced will lead to a high increase in quantity demanded, then a slight decrease in the wage of the labor used to produce it will lead to a high increase in the demand for the labor. This will be so because the decline in wages will be translated into a decline in product price. This decline in product price will lead to an increase in the quantity of products demanded, which will lead to an increase in the factors such as labor used to produce the additional products. So when demand in the product market is very elastic with respect to price, then demand for labor in the labor market will also be very responsive with respect to the wage rate.

The Ease of Use in the Production Process

The three remaining Hicks-Marshall laws of derived demand focus on the production process. They are concerned with how the ease of use of labor resources in the production process, combined with the prices of other factors of production, affect the elasticity of demand for labor resources. First, these laws suggest that the elasticity of demand for labor will be high if other factors of production can be easily substituted for a given category of labor. If machines can easily substitute for a category of labor, then a small increase in wage rate will lead to a large shift toward the use of the machines and to a massive decline in the category of labor employed. Alternatively, if the category of labor can easily substitute for the use of machines, then a slight increase in the price of the machines will lead to a large increase in labor demand. The extent to which a category of labor can be easily substituted by other factors of production depends on the production function or the technologies used. In some technologies, labor can easily substitute for capital, whereas substitution possibilities do not exist easily in other technologies. Thus, the possibility of substitutability factors and their impact on the wage elasticity of demand depends on the state of technological development and employers' choice of particular technologies. If those choices can be influenced by policy, it will provide policy makers an opportunity to influence the elasticity of demand for labor. Limitations or ease of substitution possibilities need not be solely technical ones. For instance, government can legislate limitations by specifying minimum employment levels for safety reasons, such as requiring every airplane to have a copilot. Some limitations can also be bargained for by unions, such as a contract's (mandatory) inclusion of a minimum crew size regulation for railroad locomotives.

The elasticity of labor demand will also be high when the prices of other factors of production do not increase substantially with use. If additional use of machines will not lead to an increase in their price, then a slight increase in wages will result in a large use of the machines and a large decline in the employment of labor. Finally, the elasticity of labor demand will be high when the cost of employing labor is a large portion of the cost of production. Thus if the wage rate increases, the total cost of production increases astronomically. Firms will therefore reduce the use of labor resources in order to minimize total cost. Consequently, the elasticity of demand for labor depends on the production process, the technical and non-technical substitutability of labor for other factors of production, the supply condition of other factors, and the share of labor in total cost of production.

The Effects of Labor Market Policies on Labor Demand

Various government policies may have direct or indirect impact on labor demand. These policies can be grouped into two major categories: those that immediately affect factor prices, especially wages, and those that affect labor demand indirectly through the policy's effects on quantity of labor supplied. The first group consists of policies such as payroll taxes and subsidies, and minimum wage laws and requirements for hiring, firing and severance pay. The second group consists of policies including those that help increase the number of workers available through

subsidized higher education and training; programs for developing skills through on-the-job training in the private sector; and programs that increase the stock of trained workers. These policies may be reclassified further into those that affect all categories of labor and those that affect specific categories of labor. All of these policies however affect labor demand through the effects of changes in factor-price elasticities or cross-factor-demand elasticities.

Productivity and the Production Process

Productivity change has been conceptualized in the literature as a shift in the production function over time, as opposed to a mere movement along the production function (Solow, 1957). Defined this way productivity change is synonymous with technical change. This definition makes estimating productivity interesting by linking productivity with an underlying productivity theory. However, operating on a production possibility frontier assumes the prevalence of technical efficiency. This assumption has its empirical problems. First, merely being on the production possibility frontier or having the new technology does not ensure an increase in productivity. For instance, factors of production could be employed wastefully due to inefficiency or bounded rationality. Changes in the degree of inefficiencies will affect productivity but will not necessarily affect technical change. Thus, productivity can be linked with output increases resulting from increases in the quality of labor and other inputs. Since these input-output relationships are engineering concepts that apply to the production process of individual plants, the measure of productivity is most easily understood at the micro level.

Determinants of Productivity

There are several factors that cause change in labor productivity. A major factor is investment in physical capital. Capital investment is the means by which human energy is replaced by mechanical power, which raises labor productivity. Capital investment is also the vehicle through which new methods of production are absorbed into the capital stock, creating efficiencies of both capital and labor. Another determinant of labor productivity is the change in the quality of labor. This suggests that as the labor force becomes more educated or more experienced, its output is more likely to increase. The third factor influencing productivity is improvement in technologies, which I define here as new ways of combining the labor and capital that are frequently embodied in new technological innovations. When these new technologies are applied to production, they lead to increases in the efficiency of both labor and capital. While, for instance, increases in both capital and labor can lead to proportionate increases in value-added to output, new technologies with embodied productivity enhancement attributes can increase value-added over and above what mere input increases will provide. In this study we assess the effects of physical capital, human capital, and technical progress on productivity in Ghana. We determine the relative effects of these factors on value-added per worker, which is the measure of labor productivity used. We then discuss the implications of the findings, and provide some suggestions regarding the policies that can enhance productivity in the economy.

The Labor Demand and Labor Productivity Models Specification

The study uses two main models to estimate the demand parameters for the manufacturing industry data. Data from the survey will be interpreted using various types of analytical tools. For the manufacturing industry data we use the production function approach. We first estimate the elasticity of substitution between labor and capital and then derive the labor demand elasticities from firm-level data using the constant elasticity of substitution (CES) technology production function. Then we use a more general approach where labor demand is modeled as a function of several firm-level factors. We include factors that may affect firms' employment decisions but are not traditionally included in production functions. We estimate three equations using total production workers, skilled labor, and unskilled labor sub-aggregates as dependent variables. We use real value-added per worker as the measure of productivity. We use this measure because gross output in this data set overestimates the productivity measure due to a very high ratio of imported intermediate input. This use of value-added per worker as a measure of productivity, however, risks the implicit assumption of an additive and separable production function (Y=VA + M where Y is gross output, VA is value-added and M is the intermediate input). Details of the model specification are in Appendix B.

The Data Used

The data used for the study was from two main sources: manufacturing industry data and data from a 1995 survey of selected firms across all sectors of the economy. The manufacturing industry data consists of information from annual returns of manufacturing firms from five 2-digit ISIC industries. These include the food, tobacco and beverages industries (ISIC 31), the garment industry (ISIC 32), the paper and printing industry (ISIC 34), the non-metallic minerals products industry (ISIC 36), and the metals and metal fabrication industry (ISIC 38). The data covers a period of 11 years in some industries (1972-1983). The annual returns data was collected from all manufacturing firms under section 2 of the Manufacturing Industries Regulations of 1972. This act was later repealed and there has not been any other law in place requiring firms to submit such returns to the Ministry of Trade and Industries. Therefore, no such comprehensive data exists after 1984. The returns contain information about ownership, fixed assets in land, buildings and machinery, types of machinery used, maximum or installed output capacity, and actual annual output. It also contains quantity and value of raw materials used, stock of finished products at the beginning of the year, the quantity and value of raw materials imported and actually consumed, local raw materials used, utilities consumed, and employment and earnings by skill category.

This data set covers the 1970s and the early 1980s. The extended period of coverage permits a better understanding of the underlying technical and structural factors influencing labor demand and productivity. Furthermore, while using more recent data from the 1990s tells us more about the current state of labor demand and labor productivity in Ghana, their comparative utility is limited. The current study provides a benchmark for comparing current labor demand and productivity conditions with pre-SAP situations. Such a comparison will throw more light on the so-called "slackened response from the structural adjustment."

The survey data used was collected in 1995 from firms across all sectors of the economy. While the data collected was more perceptual, it supplemented the industrial sector data and also permitted investigation of the effect of some non-firm-level factors such as hiring and firing laws on labor demand.

Results

In the following section we present the results from the manufacturing industry returns and the survey data. Because we assumed a CES production function, we estimated separate labor demand equations for each of the five industries studied. Due to spatial constraint -- but without loss of generality -- we only present and discuss fully the equations for the food, tobacco, and beverages industry.[3] We do, however, provide four additional tables with estimates that permit a comparative analysis of all five industries studied. The survey results are reported entirely. All tables are in Appendix A.

Food, Tobacco, and Beverages Industry (ISIC 31)

The means and standard deviation for average production employment and real value-added per production worker in the food, tobacco, and beverage industry are presented in Table M.1. The table suggests some similarity in the pattern of employment changes and the changes in value-added per employee. On the average, 212 production workers were employed in a typical food and beverages firm over the period. While there was a continuous decline in employment from the 1973 peak of 226 production employees through 1978, employment levels shot up in 1979 and again in 1981. Meanwhile, value-added per employee also declined continuously over the period reaching its lowest level in 1978, and then began rising in 1979. Even though value-added per employee began to rise in 1979, the upward climb was much slower in comparison to the rise in employment level.

Table M.2 presents the factors relevant for explaining the employment pattern found in the data; the explanation for the value-added changes will be explained in subsequent discussions. The table shows that larger firms with higher employment levels tend to have relatively higher levels of capital-labor ratio, produce more, pay their workers higher wages, and have higher shares of foreign ownership than smaller firms. This suggests that in the food, beverages, and tobacco industry, larger firms or firms that employ more workers were relatively more capital-intensive, that they paid premium wages, and were more multinational in ownership than smaller firms.

These findings are not surprising, since the larger firms in this sector included the more efficient multinational companies with more capital-intensive technologies than the small indigenous distilleries and bakeries, such as the breweries, the large tobacco companies, the milk and flour companies, and cocoa product companies. Interestingly, the larger firms tended to have much

3 Detailed estimates of the equations for the remaining four industries can be obtained from the author.

older machinery and equipment, and they also produced at lower capacity levels. The older machinery probably reflects the fact that the larger firms are the more entrenched firms in the industry and that the smaller ones were more recently established with newer machinery. The capacity utilization levels of the larger firms were lower than the levels for the smaller firms. This suggests the flexibility associated with smaller firms. Frequent breakdowns of older machines for larger firms could also be one major cause.

While most of the labor demand determinants were positively related to employment size, the descriptive statistics do not allow for the isolation of the partial effects of each variable. We therefore sought explanation for the labor demand pattern through estimates of elasticities and other regression coefficients. The labor demand elasticities for the food and beverages industry are presented in Table M.3. The elasticity of substitution between labor and capital (σ_{LK}) was estimated at 0.439. This suggests that as the relative price of labor to capital decreases by 10%, the relative use of labor to capital increases by 4%. As shown in the table, the own-wage elasticity of demand for homogenous labor is 0.287, suggesting that for every 10% decrease in the wage rate, the number of production workers employed increased by 2.8 %. These findings suggest that policies that reduce (increase) the wage rate would likely increase (reduce) the number of workers employed in the food and beverages industry.

The partial elasticity of demand for skilled labor is 0.623, while the partial elasticity of demand for unskilled labor is 0.459. These also suggest that the own-wage elasticity of demand for labor is higher when one considers skilled and unskilled labor individually, as opposed to homogenous labor. The table shows that an increase in the wage of skilled labor by 10% will lead to a decline in the demand for skilled labor by 6%. Similarly, an increase in the wage of unskilled labor by 10% will lead to a decline in unskilled employment by over 4%. However, a similar, across-the-board increase for all production workers will reduce employment by 2.8%, or less than 3%. This suggests that in the food, tobacco, and beverages industry, employment changes tend to be more responsive to selective wage changes than to across-the-board wage changes. The estimates for the cross-elasticities also suggest a strong substitutability in production between skilled workers and unskilled workers in the food, tobacco and beverages industry.

The effects of other factors not traditionally included in the production function equations but that nonetheless affect the demand for labor are considered in the following regression equations. Table M.4 reports the estimates of the hierarchical regression of labor demand for all productionworkers[4] on log of wage rate, log of real output, log of capital-labor ratio, log of capacity utilization, log of age of machinery, percentage of foreign ownership, location, and year dummies. Model 1 includes the log of wage rate and real output as the determinants of labor demand. Included variables are foreign ownership, location of plant, and year dummies. The model suggests that the effect of the log of real output on demand for labor was positive and statistically significant. Similarly, the effect of foreign ownership was positive and significant. The model also shows that the year dummies for 4 out of the 10 years, beginning from 1973 through 1976, were negative and significant. These suggest that the level of employment fell in each of these years. This suggests an underlying structural problem in the firms studied which encouraged

job losses instead of job creation. Model 2 includes log of capital-labor ratio, log of capacity utilization and age as additional predictors of labor demand. The R^2 for the model increased substantially, suggesting that the additional variables do explain some of the variations in the employment level. The model shows that in addition to real output and foreign ownership, the capital-labor ratio and capacity utilization had positive and significant effects on employment levels in the food, tobacco, and beverages industry. These findings suggest that the major factors affecting the level of employment in the food, tobacco, and beverages industries are the level of output and whether or not a higher percentage of the company is foreign-owned. The implication of the positive effect of real output on employment is that if firms are able to produce more, they are likely to hire more workers. The effect of foreign ownership probably suggests that foreign-owned firms were able to keep their companies operating and hiring more workers continuously, even through hard times. This seems to support the positive effect of capacity utilization on employment level shown in the full model. In this industry, the data also indicates that the more capital-intensive the firm, the more workers they employed. This suggests that in the food, tobacco, and beverages industry, capital-intensive firms tend to hire more workers than do those with lower capital intensity. The coefficients of all the year dummies were negative. The significant ones were reported, and they suggest an underlying negative trend in employment because of government policies and inherent industry structure.

Table M.5 reports the coefficients for the demand for skilled labor and unskilled labor equations. The table shows that for skilled labor, real output level is the major determinant of employment. For unskilled labor, the coefficients for real output, capital-labor ratio, capacity utilization, and foreign ownership were all positive and significant. Additionally, while the dummies were not significant in the skilled labor equation, they were significant in the unskilled labor equation for 1973 through 1976. This suggests that the decline in the level of employment in the food and beverages industry was probably limited to unskilled employment. The signs for the coefficients for wages were in the expected direction but not significant in any of the equations.

Table M.6 reports the means and standard deviations of firms across the four levels of value-added per worker. The table shows that firms in the higher productivity group have higher levels of capital-labor ratios. This means that firms that have higher levels of value-added per employee tend to be more capital-intensive. The table also shows a positive association between value-added per employee and number of production workers employed. This suggests that firms with higher value-added per employee are larger ones with high levels of employment. Similarly, firms with higher levels of value-added per employee have higher levels of real wages, newer machinery, and produce at higher capacity levels.

To explore these relationships further, we present regression results in Table M.7 with value-added per employee as the dependent variable. The equation for all firms shows that the wage rate had positive and significant effects on value-added per employee in both the reduced and full models. In addition, all the year dummies were negative, and one was statistically significant in each of the equations.

The positive and significant effect of wage rate on value-added per employee suggests that the higher the wage rate, the higher the value-added per worker. Since firms are likely to pay workers with better skills higher wages than those with lower skills, this finding is indicative of the positive effect of human capital accumulation on firm productivity. The negative effects of all the year dummies, and its significance in 1977, reflect the underlying technical change on value-added per worker in the food sector. While the negative coefficients cover the entire period, their effect was only significant in 1977, suggesting this to be the highest point in technical regression in the industry over the period under study.

Table M.8 presents two equations. The first equation regresses the percentage difference between value-added per worker for high productivity firms and the industry average value-added per worker based on the differences between the predictor values for high productivity firms as compared with the industry's average values for the predictors. The table shows that the variation in the difference in value-added per worker between firms in the top quartile in terms of productivity and the average firm can be explained by the differences in the wage rate paid, the capacity utilization, and the age of the plant. The regression coefficient of 0.578 in line 2 of the Table shows that for each 10% increment in a high-productivity firm's real wage, the firm's excess of value-added over the average was 5.78% higher. This does not mean that any firm could achieve 5.78% higher value-added simply by giving its production workers a 10% raise (although some incentive effect from a higher wage cannot be ruled out.) Rather, the higher the real wage paid by a firm, the more skilled its labor force is likely to be. Therefore, ceteris paribus, abstracting from changes in the other independent variables, raising the skill level of its labor force enables a firm to increase the margin of its value-added over the average. The finding suggests that productivity enhancement requires enhanced human capital investment. The Table further shows that there is an underlying technological regression throughout the period under study, especially among the low productivity firms and in 1972 and 1974.

The Comparative Analysis Across all Five Industries

In this section we provide a comparative analysis of the study across all five industries studied. Table C.1 compares the means of the relevant variables across the 5 industries. The table shows that the food, tobacco, and beverages industry (SIC 32) was the major employer of production workers. The industry with the least average employment was paper and printing (SIC 34). The table also shows that value-added per employee varied across industries with the highest value-added per worker recorded in the food, tobacco, and beverages industry, followed by the paper and printing industry.

The table also shows that real wages for production workers vary across industries, with the highest wage paid in the food, tobacco, and beverages industry. The data further shows that real output is highest in the food, tobacco, and beverages industry, followed by the metal industry. The paper and printing industry is the most capital-intensive industry, followed by the metal industry. The food, tobacco, and beverages industry is the least capital-intensive. The interesting finding here is that while the food, tobacco, and beverages industry is the least capital-intensive, it

is the one with the highest value-added per worker and with the highest number of employees, as well as the highest paid employees.

Table C.2 presents the labor demand elasticities. The elasticity of substitution between labor and capital ranged from 0.226 in the garment industry to 0.572 in the paper and printing industry. This suggests that as the relative price of labor to capital increases by 10%, the relative use of capital to labor increases by between 2.2 % in the garment industry and by about 5.7% in the paper and printing industry. Thus a policy that increases the price of capital tends to encourage the hiring of more labor in all the industries studied, but more so in the paper and printing industry.

The own-wage elasticity of demand for homogenous labor in the sectors studied ranges from 0.171 in the non-metallic sector through 0.287 in the food, tobacco, and beverages industry, to a high of 0.495 in the paper and printing industry. These estimates fall within the expected range of 0.15 and 0.75 (Hammermesh, 1993, p.135).

The table also presents the own-wage demand elasticity for skilled and unskilled labor. Skilled labor demand is more sensitive to wage change in the garment industry, followed by the food, tobacco, and beverages industry. The industries with the least sensitivity to skilled wage changes are the paper and printing and the non-metallic industries. In general, the own-wage elasticity of substitution for skilled labor is greater than that for unskilled labor in all but the metal industry. This finding contradicts the empirical findings in studies in developed economies, which suggest that the own-wage elasticity of demand decreases as the skills embodied in a group of workers increase (Hammermesh, 1993).

The cross-elasticity of demand for skilled and unskilled labor indicates that they are substitutes. When the wage of skilled labor increases, more unskilled labor will be hired to replace the skilled labor lost because of its wage increase. Similarly, when the wage of unskilled labor increases, more skilled labor will have to be hired to replace the lost unskilled workers. Thus, even though an increase in unskilled wages generates the same percentage decline in unskilled employment as the increase in skilled employment that follows, the high cost of hiring skilled workers can raise production costs drastically. On the other hand, an increase in the wages of skilled workers leads to replacement of skilled workers by unskilled workers at a lower per unit cost, reducing total production costs. This suggests that increasing the wages of skilled workers instead of unskilled workers, though a very controversial proposition, will make firms more competitive.

Table C.3 provides an industry summary of the results of the regression equations that relate employment demand with a set of independent variables. As indicated in the table, we expected real output to have a positive influence on level of employment. As evident in the first row, the coefficients for the regression of real output on employment level were positive, significant and robust across all industries. Also, the results suggest that a firm’s demand for labor is influenced by who operates the firm and how. For example, the effect of capacity utilization on employment demand was in the expected direction for all the equations and significant in the food, tobacco, and beverages industry equations. Furthermore, the results show that the effect of foreign

ownership on employment levels was positive and significant in 3 of the 5 industries. This suggests that multinational corporations tend to employ more workers than do indigenous firms. This is probably due to the better management and efficiency associated with these multinationals.

Table C.4 summarizes the regression of relative productivity difference on relative differences in the variables between high productivity and average productivity firms. The table confirms that capital-labor ratio, production wages, and capacity utilization are the major determinants of value-added per worker in the industries surveyed. Finally, the data indicated that for many of the years under study, the coefficients of the year dummy variables were negative and highly significant across all sectors. This finding implies that there has been a consistent technological retrogression in all the manufacturing industries studied throughout the years under investigation.

Results from the survey data are clear. As shown in Table S.1, the overall average employment level in the surveyed firms has declined slightly since 1990. There was a decline of 1.7% in 1990, compared to the 1980's average and a decline of 9.4% in 1995. However, as shown in the table, there was some slight increase in employment at the managerial level. Furthermore, employment of technical/production workers actually went up in 1990 before it started to decline thereafter. This is obviously the effect of the well-discussed decline in employment in the manufacturing sector since 1990. While there was a decline in employment of other non-managerial, non-technical/production workers, there has been a strong rally in this employment category since 1990.

It is also clear from Table S.2 that the bulk of employment is in the non-tradable sector. Moreover, it is obvious that while employment in the tradable sector has been particularly strong, the increases do not translate to significant head counts due to its low employment base as compared to the base in the non-tradable sector where, unfortunately, the level has been declining.

With trade liberalization, it is expected that there will be a decline in labor demand in the importable sector, and we expect an increase in demand in the exportable sector (Edwards and Edwards, 1994). The evidence of an overall increase in labor demand in the tradable sector suggests that the increase in labor demand in the exportable sector more than compensates for the decline in employment in the importable sector. This seems to be a good employment response to trade liberalization. Finally, Table S.3 suggests that capital constraints, concerns about firing laws, and labor cost constraints are major factors that reduce the likelihood that firms will hire additional workers. Furthermore, while unions may have negative effects on the likelihood of firms' hiring more workers, the effect is not statistically significant. However, firms that are facing more industrial actions are likely to hire less.

Policy Implications of the Study

In this section we discuss the implications of the study's results and provide some policy recommendations. Major implications of the study are as follows:

- The food, tobacco, and beverages industry is both the major employer and the most productive industry among the industries studied. This industry is more likely to hire more workers and also be more competitive with imports than any other industry studied due to its high level of productivity. To enhance both labor absorption and labor productivity in the manufacturing sector, investments in the food, tobacco, and beverages industry need to be encouraged.

- Efficient industries such as the food, tobacco, and beverages industry are those that employ highly qualified workers, which suggests that productivity correlates positively with level of training, experience, and qualification. Hence, there is the need for increasing both on-the-job and general training that will provide workers with the necessary skills and qualifications to make the firms competitive.

- Value-added was highest in the food, tobacco, and beverages industry, followed by the paper and printing industry. Food, tobacco, and beverages registered the highest level of employment, while paper and printing registered the lowest level of employment. Observing these findings jointly indicates that there is no a priori relationship between employment level and productivity. Both high and low employment levels are compatible with high levels of productivity.

- The food, tobacco, and beverages industry is the least capital-intensive but it is also the one with the highest value-added per worker and with the highest paid employees. This suggests that wages, when used as a surrogate for human capital, is a better predictor of productivity than capital intensity. Hence, there is the need for increased technical training.

- The relatively high elasticity of substitution across the five industries provided firms greater incentive to replace people with machinery. Overvalued currency and policies that reduce the relative price of capital will result in a decline in labor demand. The current liberalization of the capital markets and the removal of subsidies on credit as a result of the structural adjustment program will make capital relatively more expensive than labor and encourage more employment in the industrial sector. This policy should be pursued vigorously.

- In general, the own-wage elasticity of substitution for skilled labor is greater than that for unskilled labor in most industries studied. This finding suggests that an increase in skilled wage will reduce skilled employment more than a similar proportionate increase in unskilled wage will affect unskilled employment. Consequently, selective increases in wages of skilled workers require caution lest they reduce overall employment.

- Increases in wages of unskilled workers have the tendency through substitution to increase employment of the higher paid skilled workers, and cause an associated increase in production cost. Unless the use of more skilled workers results in higher productivity, the higher cost of production may have to be absorbed by firms or passed on as higher prices to consumers. Either case may make the firms less competitive.

- Firms will be able to employ more workers only if they can be competitive; policies that increase competitiveness, such as productivity enhancement, privatization, and openness, will enhance labor absorption.

- Firms that operate at near capacity tend to hire more workers. The ability of firms within a given industry to operate at levels of capacity higher than competitors depends on the resourcefulness of the firm's management. Existing and future managers will benefit immensely from effective management training.

- Multinational corporations tend to employ more workers than do indigenous firms. This is also probably due to better management and efficiency associated with these multinationals. This indicates a need to vigorously encourage foreign direct investment.

- There is the need to update the technology used by firms to include relatively more capital-intensive technologies.

- Even though capital-intensive technology is needed to increase productivity, investment in human capital is also critical for productivity increase. There is the need to encourage both on-the-job training as well as general skill training through government-industry partnership.

- There has been a consistent technological retrogression in the manufacturing industry during the years under investigation. The solution lies in purposeful research and development programs in the industrial sector. This can take the form of a partnership between the corporate world and the research institutions such as those under the Council for Scientific and Industrial Research of Ghana (CSIR) facilitated by Government.

- The bulk of employment is in the non-tradable sector. While employment in the tradable sector has been particularly strong, the increases do not translate into large head counts due to its low employment base compared with the base in the non-tradable sector, where unfortunately, the level has been declining.

- The overall increase in labor demand in the tradable sector suggests that the increase in labor demand in the exportable sector more than compensates for the expected decline in employment in the importable sector. This seems to be a good employment response to trade liberalization. Further incentives for firms in the exportables sector are necessary; these could be financial or non-financial incentives.

- Capital constraints, concerns about firing laws, and labor cost constraints are major factors reducing the likelihood that firms will hire additional workers. There is the need for easing credit availability to businesses in general. There also has to be some review of the current hiring and firing laws in order to reduce the cost of hiring workers.

- Firms that are facing more industrial actions are likely to hire less. There is the need to shift labor actions from the political arena into the industrial realm as a way of encouraging direct, non-political, and more peaceful employer-employee/union bargaining and negotiation processes.

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Appendix A

Table M.1 – Food, Tobacco and Beverages (ISIC 31)

Means, (Standard Deviations) and Number of Observations

Year	Average Production Employment per Firm	Value-added per Employee (Millions of 1977 cedis)
1972	212.0 (221.0)	0.0808 (0.2031)
1973	226.0 (207.0)	0.0571 (0.0567)
1974	170.0 (173.0)	0.0119 (0.1500)
1975	194.0 (182.0)	-0.0425 (0.3814)
1976	168.0 (193.0)	0.0417 (0.3814)
1977	179.0 (171.0)	0.0185 (0.0227)
1978	151.0 (180.0)	0.0100 (0.0210)
1979	222.0 (180.0)	0.019 (0.043)
1980	158.0 (163.0)	0.0129 (0.0377)
1981	337.0 (250.0)	0.0377 (0.0197)
Total	**212.0** (195.0) N=130	**0.0377** (0.0197) N=121

Note: Standard Deviations are in parentheses.

Table M.2 - Food, Tobacco and Beverages (ISIC 31)

Means and Standard Deviation of Selected Variables by Employment Level

Employment Level	K/L Ratio	Real Output	Real Wage (All)	Real Wage (Skilled)	Real Wage (Unskill)	Plant Age	Capacity Used	Foreign Share (%)
Micro	0.11	1.043	0.0013	0.0025	0.0011	6.3	0.73	7.18
	(0.28)	(0.001)	(0.0012)	0.0056)	(0.008)	(3.1)	(1.02)	(14.36)
Small	0.13	5.934	0.0019	0.0026	0.0015	6.3	0.30	26.81
	(0.1)	(12.48)	(0.001)	(0.002)	(0.001)	(3.7)	(0.30)	(36.61)
Medium	0.05	15.526	00024	0.0024	0.0023	8.9	0.59	48.17
	(0.07)	(20.629)	(0.002)	(0.001)	(0.004)	(5.8)	(0.353)	(39.05)
Large	0.23	38.47	0.0024	0.0027	0.0022	7.5	0.60	40.37
	(0.4)	39.99	(0.0019)	(0.002)	(0.0019)	(5.2)	(0.50)	(32.78)
Total	0.13	15.06	0.002	0.0026	0.0018	7.28	0.420	29.79
	(0.27)	(26.98)	(0.002)	(0.003)	(0.0023)	(4.66)	(0.501)	(35.27)
	N=129	N=128	N=130	N=130	N=130	N=125	N=122	N=120

Notes: All wage and output values in millions of 1977 cedis
Standard deviations (SD) in parentheses
Micro: Firms with employment lower than one SD below the mean
Small: Firms with employment greater than one SD below the mean but less than the mean
Medium: Firms with employment greater than the mean but less than one SD above the mean
Large: Firms with average employment greater than one SD above the mean

Table M.3 – Food and Beverages (ISIC 31)

Labor Demand Parameter Estimates

Parameter	Coefficient
1. The Elasticity of Substitution (σ_{LK}) Between Labor and Capital	0.431
2. Own-wage Elasticity of Demand for Labor $-\eta_{LL} = -(1 - s)\,\sigma$; where $s = wL/Y$	0.287
3. Own-wage Elasticity of Demand for Skilled Labor w.r.t change in price of skilled labor $-\eta_{SS} = \eta'_{SS} + S_S*\eta_{LL}$	0.623
4. Own-wage Elasticity of Demand for Unskilled Labor w.r.t change in price of unskilled labor $-\eta_{UU} = \eta'_{UU} + S_U*\eta_{LL}$	0.459
5. Cross-elasticity of Demand for Skilled Labor w.r.t. change in price of unskilled labor $\eta_{SU} = \eta'_{SU} + S_U*\eta_{LL}$	0.454
6. Cross-elasticity of Demand for Unskilled Labor w.r.t change in the price of skilled labor $\eta_{US} = \eta'_{US} + S_S*\eta_{LL}$	0.427

Notes: η'_{IJ} is the labor-constant [i.e. L=G(Li, Lj)] demand elasticity for labor i with respect to the price of labor j and S_I is labor i's share of total output.

Table M.4- Food and Beverages Industry (ISIC 31)

2-Stage Least Squares Estimates with Production Employment Demand as Dependent Variables

Variables	Model 1	Model 2
Ln (Wage rate)	.220 (.267)	.238 (.350)
Ln (Real Output)	(.507)*** (.079)	.515 (.104)
Ln (K/L ratio)	-	.201** (.092)
Ln (Capacity Utilization)	-	.190* (.109)
Ln (Age of Equipment)	-	.252 (.221)
Foreign Ownership	.004** (.002)	.007** (.003)
Location	.103 (.105)	.065 (.087)
Year Dummies[2]		
1973	-1.612*** (.610)	-2.537*** (.992)
1974	-1.404*** (.520)	-2.226*** (.958)
1975	-1.765*** (.539)	-2.474*** (.885)
1976	-1.253** (.541)	-1.963** (.878)
1977		-1500* (.843)
Constant	6.121** (2.158)	8.196 (3.175)
Adjusted R^2	.723	.785
R^2 Change		.060*

Notes:

1. * = p<.1; ** = p<.05; *** = p<.01.
2. Panel data from 1972-1981. Only years with significant coefficients are reported.

Table M.5 – Food and Beverages (ISIC 31)

Demand For Labor – Skilled and Unskilled Labor as Dependent Variables

Variables	Skilled Labor	Unskilled Labor
Ln (Wage rate of Skilled)	-.650 (.567)	-
Ln (Wage rate Unskilled)	-	-.113 (.323)
Ln (Real Output)	.836*** (.125)	.425*** (.106)
Ln (K/L ratio)	.164 (.162)	.314*** (.123)
Ln (Capacity Utilization)	.228 (.206)	.283*** (.126)
Ln (Age of Equipment	.451 (.397)	.093 (.259)
Foreign Ownership	.005 (.005)	.010*** (.004)
Location	-.027 (.156)	-.121 (.100)
Year Dummies[2]		
1973		3.785*** (1.238)
1974		-3.056*** (1.187)
1975		-3.272*** (1.001)
1976		-2.612** (1.002
Constant	-1.036 (.413)	-1.5** (.489)
Adjusted R^2	.478	.638

Note:

1. * = p<.1; ** = p<.05; *** = p<.01.
2. Panel data from 1972-1981. Only years with significant coefficients are reported.

Table M.6 – Food, Tobacco, and Beverages Industry (ISIC 31)

Means, Standard Deviations and Sample Size for Selected Variables Across Very Low, Low, Medium and High Productivity Firms

Productivity Level	K/L Ratio	Production Employment	Real Wages	Plant Age	Capacity Used
Very Low	0.11	122.0	0.001	7.8	0.44
	(0.2)	(171.0)	(0.001)	(4.5)	(0.42)
Low	0.03	187.0	0.0008	8.16	0.42
	(0.04)	(176.0)	(0.0006)	(5.48)	(0.51)
Medium	0.7	228.0	0.0019	7.68	0.49
	(0.12)	(174.0)	(0.0011)	(4.91)	(0.60)
High	0.27	347.0	0.004	6.4	0.60
	(0.37)	(200.0)	(0.0029)	(4.0)	(0.42)
Total	0.12	221.0	0.002	7.5	0.50
	(0.26)	(197.0)	(0.002)	(4.7)	(0.25)
	N=114	N=114	N=115	N=111	N=111

Note: All wage values 1977 Million cedis
Standard deviations (SD) in parentheses

Very Low: Firms with value-added per worker lower than one SD below the mean
Low: Firms with value-added per worker greater than one SD below the mean but less than the mean
Medium: Firms with value-added per worker greater than the mean but less than one SD above the mean
High: Firms with value-added per worker greater than one SD above the mean

Table M.7 - Food, Tobacco, and Beverages (ISIC 31)

Labor Productivity with Ln (Value-Added per Employee) as the Dependent Variable

Variables	Model 1	Model 2
Ln (Wage Rate)	.003 (.069)	.018 (.071)
Ln (Real Output)	1.164*** (.210)	1.129*** (.217)
Ln (K/L ratio)	-.001 (.113)	-.007 (.118)
Ln (Capacity Utilization)	-	.054 (.068)
Ln (Age of Plant)		.204 (.154)
Year Dummies[2]		
1977	-1.362*	-1.476
Constant	4.255** (2.110)	4.409** (2.137)
Adjusted R^2	.593	.595
R^2 Change		.013

Notes:

1. * = p<.1; ** = p<.05; *** = p<.01.
2. Panel data from 1972-1981. Only years with significant coefficients are reported.

Table M.8 – Food, Tobacco and Beverages Industry (ISIC 31)

Multiple Regressions – Relative Productivity Difference as Dependent Variable

	% Difference in Value-Added	
Independent Variables	High vs. Average Productivity	Low vs. Average Productivity
Ln (K/L Ratio)	.034 (.071)	-.004 (.085)
Ln (Wage Rate)	.578** (.245)	.350* (.187)
Ln (Labor)	.099 (.121)	.055 (.074)
Ln (Capacity Utilization)	.207** (.086)	-.025 (.074)
Ln (Age of Plant)	-.643*** (.180)	-.338* (.195)
Year Dummies[2]		
1972		-1.136** (.650)
1974		-1.130* (.606)
Constant	1.389 (2.351)	-2.990* (1.781)
Adjusted R^2	.294	.067

Notes:

1. * = p<.1; ** = p<.05; *** = p<.01.
2. Panel data from 1972-1981. Only years with significant coefficients are reported.

Table C.1
Summary of Firm Means by Industries

Variables	Metals (SIC 38)	Food T&B (SIC 31)	Garments (SIC 32)	Non-metallic (SIC 36)	Paper/Printing (SIC 34)
Production Employment	47.0	212.0	40.0	75.0	29.0
Real Value Added per worker	12.2	37.7	13.2	10.0	25.0
Real Wages of Production	1.7	2.0	1.4	1.7	1.3
Real Wages of Skilled Workers	1.9	2.6	1.6n	2.2	1.6
Real Wages of Unskilled Workers	1.5	1.8	1.1	1.3	.9
Real Output	1216	2698	1038	899	520
Capital Labor Ratio	.55	.27	.52	.40	.90
Capacity Utilization	.28	.50	.55	.48	.37

Table C.2
Labor Demand Parameter Estimates by Industry

	Coefficient				
Parameter	Metals (SIC 38)	Food T&B (SIC 31)	Garments (SIC 32)	Non-metallic (SIC 36)	Paper & P (SIC 34)
1. The Elasticity of Substitution Between Labor and Capital (σ_{LK})	0.300	0.431	0.226	0.230	0.572
2. Own Elasticity of Demand for Labor $-\eta_{LL} = -(1 - s)\sigma$; where $s = wL/Y$	0.260	0.287	0.186	0.171	0.495
3. Own elasticity of demand for skilled labor w.r.t change in price of skilled labor $-\eta_{SS} = \eta'_{SS} + S_S*\eta_{LL}$	0.217	0.623	0.802	0.091	0.069
4. Own elasticity of demand for unskilled labor w.r.t change in price of unskilled labor $\eta_{UU} = \eta'_{UU} + S_U*\eta_{LL}$	0.674	0.459	0.732	0.090	0.045
5. Cross-elasticity of demand for skilled labor w.r.t change in price of unskilled labor $\eta_{SU} = \eta'_{SU} + S_U*\eta_{LL}$	0.312	0.454	0.687	0.133	0.060
6. Cross-elasticity of demand for unskilled labor w.r.t change in the price of skilled labor $\eta_{US} = \eta'_{US} + S_S*\eta_{LL}$	0.524	0.427	1.00	0.458	0.006

Note: η'_{IJ} is the labor-constant [i.e. L=G(Li, Lj)] demand elasticity for labor i with respect to the price of labor j and S_I is labor i's

Table C.3
Summary of Hypotheses Tested Across Industries:
Employment Demand As Dependent Variable

Variables	Expected Direction	Is Result in Expected Direction?				
		Metals SIC 38	Food T & B SIC 31	Garment SIC 32	Non-metallic SIC 36	Paper & P SIC 34
Real Output	+	Yes*	Yes*	Yes*	Yes*	Yes*
Age of Equipment	+	Yes	Yes	Yes	No	No
Capital Labor Ratio	?	Yes	No*	No	No	Yes
Capacity Utilization	+	Yes	Yes*	Yes	No	No
Skilled Wage	-	Yes	Yes	Yes	Yes	Yes
Unskilled Wage	?	Yes*	Yes	No	No	Yes
Total Production Wage	-	No	No	Yes	Yes	No
Foreign Ownership	?	+*	+*	+*	-	-

Notes:

* = relationship statistically significant in at least one equation.
+ = Positive relationship
- = Negative relationship
? = Could not predict direction a priori

Table C.4
Summary of Multiple Regression Results

Relative Productivity Difference As Dependent Variable

Independent Variables	**Expected Direction**	**Is Result in Expected Direction?**				
% Difference in:		**Metals**	**Food T& B**	**Garment**	**Non-metallic**	**Paper & P**
Capital-Labor Ratio	+	Yes*	Yes	Yes*	Yes*	Yes
Wages of Production Workers	+	Yes*	Yes*	Yes	Yes*	Yes*
Total Production Workers	?	-	+	+	+	-*
Capacity Utilization	+	Yes*	Yes*	Yes*	Yes	Yes*
Age of Plant	-	No	Yes*	Yes*	No	No*
Year Dummies	?					

Notes: * = relationship statistically significant in at least one equation.
+ = Positive relationship
- = Negative relationship
? = Could not predict direction a priori

Table S.1: Survey Data

Average Firm Employment Levels by Occupations

Occupation	1980	1990	1995
Managerial Employment	8.73	12.67	19.95
Technical/Production Employment	203.35	210.92	162.15
Non-Managerial Employment	112.47	95.25	109.66
Total	324.33	318.84	288.7
% Change	-	(1.7)	(9.4)

Table S.2: Survey Data

Average Firm Employment by Sectors

Sector	1980	1990	1995
Tradable	134.9 (-)	192.65 (42%)	279.66 (45%)
Non-Tradable	419.34 (-)	383.56 (-8.53%)	293.31 (-23.4%)

Note: Percent change in parenthesis.

Table S.3: Survey Data

Logistic Regression Estimates With Employment Increases as Dependent Variables

Constant	Capital Constraints	Labor Cost	Hiring Laws	Union	Product Demand Constraints	Firing Law Constraints	Industrial Actions	-2LL
1.97*	-1.49***	1.11*	1.04	-0.04	.61	-.96*	-.33*	65.17
(1.18)	(.50)	(.60)	(.66)	(.71)	(.39)	(.54)	(.20)	

*** p<.01
** p<.05
* p<.10

Appendix B

I. Models of Labor Demand

Following Hammermesh, (1993), the linear homogenous production function used is as follows:

$Y = [\alpha L^{\rho} + (1 - \alpha) K^{\rho}]^{1/\rho}$ ……(1)

Where α and ρ are parameters, $1 > \alpha > 0$, $1 \geq \rho \geq -\infty$. Marginal products are

$\partial Y/ \partial L = \alpha(Y/L)^{1-\rho}$ ……(2)

and

$\partial Y/ \partial K = [1 - \alpha] (Y/K)^{1-\rho}$……(3)

Letting the ratio of (2) and (3) equal to the factor price ratio, taking logarithms and differentiating with respect to Log (w/r) gives

$\partial Log(K/L)/ \partial Log (w/r) = \sigma = 1/[1- \rho]$ ……(4)

From this production function, the CES cost function was derived a la Ferguson (1969,167) as follows:

$C = Y [\alpha^{\sigma} w^{1-\sigma} + [1 - \alpha]^{\sigma} r^{1-\sigma}]^{1/(1-\sigma)}$ ……(5)

Where $\sigma = 1/ [1- \rho] \geq 0$.

The demand for labor is

$L = \delta C/\delta w = \alpha^{\sigma} w^{-\sigma} Y$ ……(6)

Taking logarithms on both the left and right hand sides of the equation yields

$\ln L = \alpha^* - \sigma \ln w + \ln Y$ ……. ……..…(7)

Where α^* is a constant. This equation will be used to estimate the elasticity of substitution as follows (Hammermesh, 1991):

$-\delta \ln(K/L)/\delta \ln(w/r) = \sigma = 1/ [1- \rho]$ ……(8)

From (8), the own-price elasticity of labor demand can be indirectly estimated as follows:

$\eta_{LL} = -[1- s]\sigma$ ……..…(9)

Where $s = w*L/Y$, the share of labor in total revenue.

The cross-elasticity of labor demand with respect to a change in the price of capital can be estimated as follows:

$\eta_{Lk} = [1- s]\sigma$ ……(10)

We also obtain the own partial elasticity of demand for skilled and unskilled labor as well as their cross-elasticities as follows:

$-\eta_{SS} = \eta'_{SS} + S_S*\eta_{LL}$…….……(11)

$-\eta_{UU} = \eta'_{UU} + S_U*\eta_{LL}$……(12)

$\eta_{SU} = \eta'_{SU} + S_U*\eta_{LL}$……. (13)

$\eta_{US} = \eta'_{US} + S_S*\eta_{LL}$……. (14)

where η'_{ij} is the labor-constant [i.e. $L=G(L_i, L_j)$] demand elasticity for labor i with respect to the price of labor j and Si is labor i's share of total output (Berndt and Wood, 1979).

So we estimate the elasticity of substitution from equation (7) and then indirectly calculate the demand elasticity parameters for homogenous production workers, skilled workers and

unskilled workers using equations 9 through 14. Then we will calculate the demand elasticity parameters for homogenous production workers, skilled workers, and unskilled workers using equations 9 through 14.

We then go further to estimate a second set of regression equations. These equations assume that employment decisions depend on real wages, real capacity of output, the rate of capacity utilization, the age of machinery used in production and the capital-labor ratio. This model is similar to the one used by Deutch and Rodler's 1990 study of the Austrian labor market. The equation is as follows:

$$\text{Log } L_{it} = \alpha_0 + ß_{i1}\log W_{it} + ß_{i2}\text{Log } Q_{it} + ß_{i3}\text{Log } AM_{it} + ß_{i4}\text{Log}(K/L)_{it} + ß_{i5}\text{Log } CU_{it} + ß_{i6}O_{it} + \text{time dummies} + \varepsilon_{it} \text{……………………}(15)$$

Where α is an unexplained long-term rate of labor saving due to innovations; L_{ti} is employment at firm $_i$ in period $_t$;W_{it} is the real wages in firm $_i$ in period $_t$; Q_{it} is the real output in firm $_i$ in period $_t$; CU_{it} is the capacity utilization in firm $_i$ in period $_t$; AM_{it} is the age of machinery in firm $_i$ in period $_t$ and $(K/L)_{it}$ is the capital-labor ratio in firm $_i$ in period $_t$ and O_{it} is ownership of firm $_i$ in year $_t$. The ownership variable measures the share of foreign ownership in a firm. The time dummies are used as controls. This model will be estimated by type of labor, i.e. homogenous labor, skilled and unskilled labor. Only own-wage effects induced by wages for each labor type are considered. So, for example, demand for skilled labor is assumed not to depend on the real wages of unskilled labor. Under an assumption of cost-minimization, this assumption implies a locally additive separable technology (Deutsch and Rodler, 1990). Because of the endogeneity and measurement error problems associated with the labor demand function, all the labor equations were estimated with two-stage least squares . The lagged independent variables were used as the instruments.

Furthermore, the analysis will compare the results across industries to assess the differences or similarities of the parameters across these sectors. The survey data will be analyzed within the framework of three main categories. These categories will be (1) Exportables (2) Importables, and (3) Non-tradables. All firms that do export or are likely to export their products are classified as exportables. Firms that do not traditionally export their products but are however faced with competition from imports are classified as importables. Finally, firms whose products are normally not traded internationally are categorized as non-tradables. The rationale here is to facilitate synchronizing policy proposals that will emerge from this study with the existing reform process.

II. Model for the Determinants of Productivity

As mentioned earlier the study conceptualizes productivity as either a shift of the production function because of technological advancement or as a result of improvements in the quality of inputs used in production. This definition links productivity to production functions. However we are not interested in estimating total factor productivity per se as much as we are in determining the major factors that affect the size and growth pattern of factor productivity.

In assessing the determinants of labor productivity the following model will be used:

$$\text{Log } (VA/L)_{it} = \Omega_0 + b_{i1}\text{ Log } K_{it} + b_{i2}\text{ Log } L_{it} + b_{i3}\text{Log } W_{it} + b_{i4}\text{Log } AM_{it} + b_{i5}\text{Log}O_{it} + \text{time dummy} + \varepsilon_{it} \text{……………………}(18)$$

Where $(VA/L)_{it}$ is real value-added per employee in firm $_i$ in year $_t$ as proxy for productivity; K_{it} is real capital stock in firm $_i$ in year$_t$; L_{it} is employment in firm $_i$ in year $_t$; W_{it} is real wages in firm $_i$ in year $_t$; AM_{it} is the average age of machinery in firm $_i$ in year $_t$; and O_{it} is ownership of firm $_i$ in year $_t$. The ownership is measured by the percent of foreign ownership in the firm. The time dummies are included to measure the underlying changes in the production function or technical progress. Productivity of labor (value-added per employee) will further be modeled across groups of high productivity firms and low productivity firms to find out if the determinants differ across groups. Then we will find out the factors that influence the differences in productivity between high and low productivity firms in the same industry. We use ordinary least squares (OLS) for estimating the productivity equations.

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