The Ghanaian Manufacturing Enterprise Survey 2000

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November 2002

We wish to acknowledge the financial support of the Department for International Development (DFID) for funding the survey and of UNIDO for its continuing support of work on manufacturing enterprise in Africa. We also particularly need to thank the survey team members for their commitment and enthusiasm and the firms, their managers and employees for their willingness to participate. All errors remain the responsibility of the authors.

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MAP OF GHANA


0 50 100 km
0 50 100 mi
BURKINA FASO
Bolgatanga
BENIN
Tamale
CÔTE D'IVOIRE
TOGO
Lake Volta
Kumasi
Ho
Asamankese
Nsawam
Bight of Benin
Tarkwa
ACCRA
Tema
Cape Coast
Takoradi
Gulf of Guinea

Foreword

The sixth wave of the Ghanaian Manufacturing Enterprise Survey (GMES) was carried out in November 2000. The data collected during the sixth wave covered the period from 1998 to 1999. In this Report we have linked this data with that from the five earlier surveys carried out in 1992, 1993, 1994, 1996 and 1998.

The period during which the survey was carried out was a very difficult time for firms in Ghana's manufacturing sector. We are greatly indebted to the firms for their willingness to participate in the survey. As a result of the co-operation of the firms included in the survey we are able in this Report to provide an overview of the performance of Ghana's manufacturing sector over the period 1991 to 1999. Such data complements the regular data colleted by the Ghana Statistical Office, in that it enables a micro view to be taken of the problems facing firms in the various sectors which comprise manufacturing.

Officers of the GSO both in Accra and Kumasi have provided invaluable support to both conducting the survey and in analysing the data. Mr Anthony Amuzu carried out detailed work at the CSAE in Oxford that provided the basis for the statistical tables reported in the appendix to this report.

The intention of this Report is to show how the kind of detailed surveys which the GSO and the CSAE have now carried out over a long period, provide insights into the problems of the manufacturing sector that are an important input into policy in this area. The survey was undertaken with generous financial support from the UK Government's Department for International Development (DFID). Analysis on the Report was supported by the United Nations Industrial Development Organisation (UNIDO). The original three surveys in the early 1990's, upon which this later work builds, were undertaken as part of the World Bank's Regional Program on Enterprise Development.

November 2002

Executive Summary

This report is an analysis of Ghanaian manufacturing during the 1990s. It is primarily based on the information collected in a number of firm-level surveys over the period from 1991 till 1999.

- Ghanaian GDP has grown consistently since the introduction of economic reforms in the early 1980s. This period of sustained macroeconomic growth has been associated with considerable instability in the macroeconomic policy environment. There have been large changes in the real exchange rate which have been of great importance for the manufacturing sector.
- This report provides detailed micro-economic data on firms in the manufacturing sector, for the period 1991 to 1999, that enables the links between firm characteristics, performance and macroeconomic policy to be investigated.
- The survey covers the whole of the size spectrum and the most important sectors within manufacturing for generating value-added and employment. Larger firms tend to be older, are more likely to have foreign or state ownership, have much higher labour productivity, are more capital intensive, far more likely to invest in any year and far more likely to be exporters.
- This Report shows that there are major differences in performance between the two halves of the 1990s. On average, real output, real value added and employment increased between 1991 and 1995, while between 1995 and 1999 these measures declined to levels similar to those in 1991.
- Performance differs by firm size and by sector. Small and micro firms experienced more variable performance than medium and large firms. Micro and medium firms increased real output between 1991 and 1999. Medium firms increased value added, and micro and large firms increased employment. On average, firms in all sectors grew during the first half of the 1990s. In the second half the only sector which experienced positive growth, on average, was the metal, machinery and chemicals sector.

- Productivity and capital intensity vary by sector. The food and beverages and metals, machines and chemicals sectors have the highest productivity. They also have the highest capital intensity.
- Controlling for inputs and firm characteristics suggests that the food sector has the highest level of underlying productivity.
- There is little evidence that underlying firm productivity has changed over the period.
- Investment in plant and machinery is low. Less than half the firms in the sample invested. The average firm invested 14 percent of its capital stock if it invested. This behaviour is closely related to firm size. Larger firms are more likely to invest but, given that a firm invests, smaller firms invest more. This suggests that smaller firms are credit constrained and cannot borrow in order to invest. Younger firms are more likely to invest as they need to build up their capital stock.
- More efficient firms are more likely to invest. There is little evidence that the probability of investing has changed substantially over most of the period.
- Less than a fifth of firms in the sample export. These exporting firms export on average 49 percent of output. The propensity to export is positively related to size – larger firms are more likely to export. Export propensity and export intensity differs markedly across sectors. Firms in the wood and furniture sector have a higher export propensity and export intensity than other sectors. The textiles and garments sector has the lowest export propensity and the metals, machinery and chemicals sector has the lowest export intensity.
- The technical efficiency of a firm is closely related to the probability of exporting. This may reflect the fact that higher levels of efficiency are needed for export or that firms lean from exporting – or both. Firm age is negatively related to export probability, indicating that newer firms are exporting more.
- The export market is vital for firm growth. Industrial policy which targets efficiency and productivity, may establish important links with exporting and investment and thus the long run growth potential of the firms.

1. Background

1.1 Economic Performance in the 1990s in context

In the 1990s it appeared that economic policy in Ghana had begun to reverse the decades of economic failure since independence. Both GDP and exports grew on the basis of household survey data and it seemed that poverty had declined, GSO (1995, 2000). One important qualification was the failure of policy to provide for macroeconomic stability. These macroeconomic problems came under increased scrutiny as a result of the collapse of the currency in the period 1998 to 2000. The exchange rate of the cedi to the US$ fell from 2340 in 1998 to 6000 by the end of the year 2000, a rise of 150 per cent when the price level rose by 34 per cent.

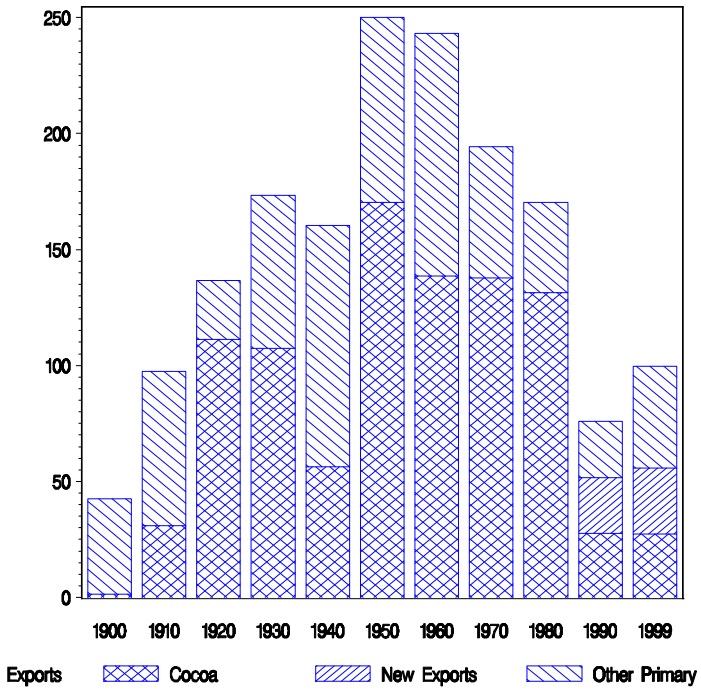
In Figure 1.1 we show both GDP and exports on a per capita basis. The figures for GDP are in purchasing power parity 1995 US$, exports are a volume index series based on 1974=100. Both series are on a per capita basis. The recovery in both GDP and exports, which began in the mid 1980s, is very clear from the figure. Our data begins in 1991 so the background to the figures in this Report is a sustained rise in both GDP and export volumes. An important feature of the recovery of exports in the 1990s has been that non-cocoa exports have grown both absolutely and relatively to cocoa exports. Further what are termed non-traditional exports have grown in importance. To put these issues in a very long term context, Chart 1.1 shows a decadal breakdown of exports for the years 1900 to 1999 with the category of new exports shown only for 1990 and 1999. The chart shows exports per capita in US$ 1995 prices. Exports on a per capita basis peaked in the 1950s, and then fell at an increasing rate until the end of the 1980s. The chart shows how limited has been the recovery in exports in the 1990s in a longer run context. By the end of the 1990s, exports on a per capita basis were back to their level of 1910.

Chart 1.1 shows that, again on a per capita basis, growth over the 1990s was due to traditional non-cocoa exports, new exports made a negligible contribution to growth. Of equal importance is their small absolute size. In broad terms by 1999, Ghana's exports were divided equally between cocoa, non-cocoa primary exports and new exports. Even this breakdown exaggerates the importance of non-primary exports as

Figure 1.1. GDP per Capita, PPP (in 1995 international $) (Left hand scale) and Export Volumes Index (1974=100) (Right hand scale)

Sources: GDP figures are from the World Bank Indicators Data base and the PENN World Tables. Export Volume figures are based on constant price exports figures from the World Bank Indicators Data base converted to an index number.

Chart 1.1 Ghana's Exports per Capita in US$ (1995 prices), selected years



Source: Teal (2002).

within the new category most are processed agricultural products.[1] It is clear that over this period Ghana has failed to break into markets for new export products.

Current policy focuses on three areas. The first is diversification across agricultural products, the second is in seeking further domestic processing of such goods, the third is in promoting the growth of manufactures. In all these areas, policy in Ghana in the 1990s was a failure in terms of generating rapid growth of new exports. In this report we focus on the factors that underlie the failure to promote manufacturing exports.

The relative success of the 1990s was due to the rectification in errors in policy towards the exchange rate. Figure 1.2 shows a measure of the real exchange rate for non-cocoa exports from 1970 to 2000.

Figure 1.2 The Real Exchange Rate for Non-Cocoa Exports

The definition of the measure of the real exchange rate is as follows:
(Export Prices for Non-cocoa Exports in 1995 US$ * Official Exchange Rate)/
Consumer Price Index)
Source: Teal (2002)

[1] ISSER (2000, p.65) provides a breakdown of these non-traditional exports. The most important are processed and semi-processed agricultural products, exports of which were valued at US$ 313.3 million in 1999. There is a category termed handicrafts, which presumably includes manufacturing exports not of a processed form. These are miniscule, their export value in 1999 was US$ 6.7 million.

A rise in this index indicates a devaluation – ie. the index is measuring how export prices in cedis compare to prices generally, so a rise in the cedi value of the exchange rate relative to the US$ will cause the index to rise. The massive rise in the cedi following the reforms of the mid 1980s is clearly visible in the figure. For most of the 1990s the cedi appreciated, although there was sharp devaluation in the middle of the 1990s and a sharper rise at the end. It will be noted that despite the very large changes in the nominal exchange rate already noted - the exchange rate of the cedi to the US$ fell from 2340 in 1998 to 6000 by the end of the year 2000 – the real value of the exchange rate was little changed from 1990. Clearly the incentives to increase exports put in place over the last half of the 1980s were not sustained in the 1990s. Why have manufacturers not benefited from the real devaluation that has occurred in the latter part of the 1990s?

We show in this Report that several factors are at work. The first is that firms remain overwhelmingly focused on the domestic market. For such firms, where they import a substantial part of their inputs, devaluation can greatly raise costs. Thus a focus on the domestic market will ensure that large falls in the real exchange rate hurt rather than help firms in the manufacturing sector. The second is that exporting is an activity which is only possible for most firms after they reach a critical minimum size. The evidence here, and in other studies, indicates that such a minimum size is about 100 employees. However such firms tend to be much more capital intensive than smaller firms and as labour intensive products are where Ghana's potential cost advantage lies, this link from size to capital intensity is a major constraint on their ability to compete successfully in the export market. As we will show there are virtually no exports from the sector where labour is intensively used.

It has been argued that the source of the problem is the lack of skills in Africa generally, of which Ghana's economy can be regarded as an example. There are four problems in believing that investment in skills will address the problems facing Ghana's manufacturing sector. The first is that the returns on those skills are low relative to the return on physical capital, Bigsten et al (2000). The second is that in the early 1990s, there is evidence of a decline in demand for relatively skilled labour. The third is that it is far from clear that, in so far as skills are scarce or in demand, they need to be produced in Ghana – skills are a largely tradable good. The fourth issue is

that low productivity does not prevent exporting, or any other activity being profitable, if wages are sufficiently low. Conversely, improved productivity that gets reflected in increased wages will not provide incentives for labour-intensive profitable exporting. There seems no basis for the usual assumption that investment in education and skills will enhance Ghana's ability to enter new export markets.

A common theme in policy discussion is the desirability of adding-value by processing agricultural raw materials. As we will show it is in the wood sector where exporting has been most successful. It is, however, not the case that such processing necessarily enhances net export earnings. It is quite possible to increase value-added while decreasing the amount of foreign exchange earned from exporting, if the inputs to the processing are not based on world market prices. There is a strong possibility that this is the case in the sales of some of the processed wood products. Increasing value-added is not an appropriate goal for export or trade policy. The goal is to increase foreign exchange earning and this can only occur if processing can be done efficiently within the country.

In this Report, we focus on the performance of the sector over the period 1991 to 1999. While some of the firms had been severely affected by the fall in the value of the cedi, clearly it was too early to see if the manufacturing sector had benefited. This Report provides a detailed background of how the firms in the sector had performed up to this major shock. We do this by providing a detailed account of the performance of the firms over the decade of the 1990s. We hope to be able to investigate the effects of the shock in a later Report.

1.2 Firm Characteristics and Firm Performance

Examining the characteristics of individual firms allows the links between the performance of firms and the performance of the manufacturing sector to be investigated. Firm-level information provides insights on issues, such as what characterises successful firms, which cannot be tackled by macro-level data. The characteristics of a firm may be related to firm performance in important ways. Ownership may have important implications for areas such as the incentive structure facing workers, the ability of firms to enter new markets, and access to finance or new technology. The importance of learning-by-doing can be investigated by examining

the relationship between firm age and performance. If older firms are more productive this may suggest that they can learn how to reduce their costs. Learning may also be important for exporting, as firms may become more efficient through their exposure to international markets and competition. Firm age may also be linked to investment behaviour. Younger firms may need to invest both more, and more often, in order to build up their capital stock. This capital stock may be of a newer vintage and thus embody more recent technology.

It will be shown that firm characteristics differ by sector. In general, sectors such as garments use more labour and less capital (they are less capital intensive) than other sectors. In many developing countries which have managed to grow rapidly, such as Mauritius and the economies of South East Asia, it has been labour intensive sectors which have driven rapid economic growth. In the context of Ghana, it is important to identify how sectors differ in productivity and capital intensity, and how these characteristics impact on firm performance. The relationship between firm performance and trade orientation may have important implications for policy.

Firm characteristics may impact on firm performance in two important ways. The first impact is on firm growth, measured by variables such as the number of people employed by the firm or the value of the output the firm produces. The second is on the productivity of the firm, or the success with which it transforms inputs into outputs. The profitability of a firm will depend both on its ability to grow and its level of efficiency. Firm growth may increase profitability through an increase in market share or a reduction in costs if it is able to exploit increasing returns to scale. Firm productivity can directly impact on increased profitability. As much investment is financed from profits the ability of firms to generate profits is a key part of their ability to generate long run growth. Thus growth may enhance the profits of the firm which may, in turn, enable it to grow in the longer term.

Growth and productivity are central issues for both African and Ghanaian manufacturing firms. Like many African countries, Ghana has a relatively small and limited domestic market. This domestic market provides little scope for firms to grow beyond a certain size. For firms to be successful they need to enter the international market through exports. In world markets, success is determined by a firm's ability to

turn inputs into outputs – its productivity – and also by the costs of the inputs – comparative advantage. In order to break into and succeed in these markets, firms need to invest in equipment and technology, to produce goods of the required quality, to produce new or innovative goods, to produce more goods, or to produce more cheaply. Thus, the export-investment nexus is central to firm success.

In the following sections these issues of productivity, investment and exports and their relationship to the characteristics of Ghanaian firms are examined, over the period 1991 to 1999. Although successful firm performance in itself is an important policy goal, the consequences of this performance are often more relevant. An ultimate goal of Ghanaian economic policy, as with many other African countries, must be to increase the demand for unskilled labour. Firm performance, in the manufacturing sector, impacts directly on this.

2. Sampling Issues

2.1 Wave 6 Sample Structure.

The sixth wave of the Ghana Manufacturing Enterprise Survey (GMES) visited and obtained useable data from 179 firms. It covered firms from a number of different sectors and locations, and of varying sizes. The sixth wave collected data for 1998 and 1999 and updates previous waves which stretch back to 1991. The original sample was based on a stratified sample of manufacturing firms throughout Ghana. The main stratifying characteristics were the sector, location and size of firms. The repeat surveys attempted to revisit the original firms to create a panel of firms, in order to follow their progress over time. If firms dropped out of the sample because they closed down, relocated or were unwilling to cooperate, they were replaced with firms of similar, size and location. Table 2.1 gives an overview of the sample of firms interviewed in Wave 6, broken down by size and sector. A micro firm is defined as one with less than 6 employees, a small firm is one with from 6 to 20, a medium one has from 20 to 75 and a large firm has more than 75 employees. Table 2.2 gives the breakdown by location and sector. Both tables compare the most recent sample with the original sample.

Table 2.1 Wave 6 Sample by Firm Size and Sector

		Food & Beverages	Textiles & Garments	Wood & Furniture	Metal, Machinery & Chemicals	Total
Micro	No. of Firms	7	12	5	5	29
	% all sectors	24%	41%	17%	17%	100%
	% all sizes	16%	34%	11%	10%	16%
	Round 1 firms in sample	7	9	4	5	25
Small	No. of Firms	14	12	9	11	46
	% all sectors	30%	26%	20%	24%	100%
	% all sizes	31%	34%	19%	21%	26%
	Round 1 firms in sample	12	8	6	10	36
Medium	No. of Firms	10	8	14	21	53
	% all sectors	19%	15%	26%	40%	100%
	% all sizes	22%	23%	30%	40%	30%
	Round 1 firms in sample	6	7	8	12	33
Large	No. of Firms	14	3	19	15	51
	% all sectors	27%	6%	37%	29%	100%
	% all sizes	31%	9%	40%	29%	28%
	Round 1 firms in sample	5	0	7	4	16
Total	No. of Firms	45	35	47	52	179
	% all sectors	25%	20%	26%	29%	100%
	% all sizes	100%	100%	100%	100%	100%
	Round 1 firms in sample	30	24	25	31	110

Micro < 6, small 6 - 20, medium 20 – 75, large > 75 employees.

Of the 179 firms sampled in the 1999 round, 110, or approximately 60 percent, were in the original sample. This overlap differs between size groups. 86 percent of micro firms sampled in the 1999 round were in the first round. This proportion decreases to 78 percent in the small category, 62 percent for medium firms and 31 percent for large firms. This relationship is only partly the result of firm turnover, it is mainly due to increased sampling of large firms as the surveys proceeded

More than half the firms in the sample are located in Accra, which is by far the most important location for manufacturing activity in Ghana. A third of firms are located in

Table 2.2 Wave 6 Sample by Firm Location and Sector

		Food & Beverages	Textiles & Garments	Wood & Furniture	Metal, Machinery & Chemicals	Total
Accra	No. of Firms	30	14	19	36	99
	% all sectors	30%	14%	19%	36%	100%
	% all sizes	67%	40%	40%	69%	55%
	Round 1 firms in sample	20	7	14	17	58
Cape Coast	No. of Firms	2	2	1	1	6
	% all sectors	33%	33%	17%	17%	100%
	% all sizes	4%	6%	2%	2%	3%
	Round 1 firms in sample	0	1	0	1	2
Kumasi	No. of Firms	11	17	19	12	59
	% all sectors	19%	29%	32%	20%	100%
	% all sizes	24%	49%	40%	23%	33%
	Round 1 firms in sample	8	15	7	11	41
Takoradi	No. of Firms	2	2	8	3	15
	% all sectors	13%	13%	53%	20%	100%
	% all sizes	4%	6%	17%	6%	8%
	Round 1 firms in sample	2	1	4	2	9
Total	No. of Firms	45	35	47	52	179
	% all sectors	25%	20%	26%	29%	100%
	% all sizes	100%	100%	100%	100%	100%
	Round 1 firms in sample	30	24	25	31	110

Kumasi, and the remainder are located in either Takoradi or Cape Coast. Almost 60 percent of firms in the sample are either in the large or medium size category. This over-represents the relative frequency of larger firms within the population of all manufacturing enterprises, which is dominated by smaller enterprises.

2.2 Representativeness of Sample

Due to the stratification procedures, large firms are over-sampled compared to their expected relative frequency in a random sample of manufacturing firms. A stratified sample survey is more appropriate than a random sample if firms within strata are relatively homogeneous but there is a great deal of heterogeneity between strata. This is certainly true of Ghanaian manufacturing firms where the strata is one of size. The results which follow will show that firm characteristics, such as labour productivity and capital-labour ratios, differ much more between than within strata. This stratified sample technique is also appropriate, given that evidence from previous surveys

suggests that larger firms undertake the majority of investment and have a higher propensity to export than the average firm. If we wish to investigate these aspects of firm behaviour we need a sample which over-samples such firms.

2.3 Selected Firm Characteristics

The Ghanaian Manufacturing Enterprise Survey (GMES) data contains a large amount of information on firm and entrepreneur characteristics. Tables 2.3 and 2.4 show mean values of some selected variables, by firm size and by sector for the 279 firms sampled in the period 1991-1999. The main points can be summarised as follows:

- There are substantial differences in legal status over the size range. 93 percent of micro firms, and 76 percent of small firms are either sole proprietorships or partnerships. In contrast, only 26 percent of medium firms and six percent of large firms have either of these types of ownership structure. The textile and garments sector has the largest proportion of sole proprietorships and partnerships (69 percent).
- State enterprises occur in all sectors except textiles and garments. However, there is some state ownership in firms across all sectors. Such ownership is positively related to size.
- Foreign ownership is also positively related to size. 43 percent of large firms have some foreign ownership, whereas foreigners own seven percent of micro firms. The relationship between the percentage of foreign ownership, (given that there is some), and size is U-shaped. Small and medium firms have a lower percentage of foreign ownership than micro and large firms.
- The incidence of foreign ownership is the lowest in the textile and garment sectors. 15 percent of firms in this sector have some foreign ownership. This is about half the incidence in the other sectors. Given that a firm has some foreign ownership, the percentage of foreign ownership is similar across sectors.
- The 5-15 years age group is the largest followed by the 5 years and less group. Larger firms tend to be older. 43 percent of large firms are older than 25 years, compared to only 9 percent of micro firms. This could be the result of

Table 2.3 Selected Firm Characteristics By Firm Size

Table shows proportion of firms in each category (unless otherwise specified)

	Micro N=43	Small N=83	Medium N=86	Large N=67	All N=279
Legal Status of Firm					
Solo or Partnership	0.93	0.76	0.26	0.06	0.46
LLE or Corporation	0.05	0.24	0.66	0.87	0.49
State Enterprise	0	0	0.03	0.01	0.01
Fully owned foreign subsidiary	0	0	0	0.01	0
Firm Ownership Characteristics					
Ghanaian private owners only	0.91	0.94	0.59	0.43	0.71
Any foreign ownership	0.07	0.05	0.28	0.43	0.22
% foreign ownership, if any	88.33	64.50	48.77	66.19	60.14
Any state ownership	0	0.01	0.09	0.09	0.05
Firm Age (in years)					
Age=5	0.44	0.40	0.17	0.10	0.27
5<age=15	0.33	0.36	0.33	0.22	0.31
15<age=25	0.14	0.20	0.24	0.24	0.22
>25age	0.09	0.04	0.25	0.43	0.21

Note: Firm size category is the size of the firm when first sampled.

Table 2.4 Selected Firm Characteristics By Firm Sector

Table shows proportion of firms in each category (unless otherwise specified)

	Food & Beverages N=62	Textiles & Garments N=62	Wood & Furniture N=76	Metal & Machinery N=79	All N=279
Legal Status of Firm					
Solo or Partnership	0.44	0.69	0.43	0.33	0.46
LLE or Corporation	0.52	0.29	0.54	0.58	0.49
State Enterprise	0.03	0	0.01	0.01	0.01
Fully owned foreign subsidiary	0.02	0	0	0	0
Firm Ownership Characteristics					
Ghanaian private owners only	0.69	0.81	0.75	0.59	0.71
Any foreign ownership	0.21	0.15	0.21	0.28	0.22
% foreign ownership, if any	62.45	58.00	59.81	60.10	60.14
Any state ownership	0.10	0.03	0.04	0.05	0.05
Firm Age (in years)					
Age=5	0.24	0.26	0.24	0.32	0.27
5<age=15	0.35	0.35	0.41	0.15	0.31
15<age=25	0.19	0.23	0.18	0.25	0.22
>25age	0.21	0.16	0.17	0.28	0.21

small and micro firms being more likely to go out of business or it may be that such firms grow and thus move into the larger size categories with time. These characteristics show that smaller firms (in the micro and small categories) are mostly sole proprietorships or partnerships and overwhelmingly owned by private Ghanaians. They are also, on average, younger than the larger firms (medium and large categories). These larger firms have some foreign ownership and thus we would expect these firms to be more active in the export market, and perhaps more productive due to the transfer of knowledge and technology through the foreign owners. They are also older, suggesting more stability and perhaps also learning. These characteristics give some indication of anticipated firm behaviour over the period.

3. Overview of Manufacturing Sector Performance 1991-1999.

During the course of their lives firms change size. Successful firms grow as they enter new markets, or dominate old ones. Unsuccessful firms shrink as more successful firms encroach on their markets, or if they do not keep pace with tastes, or technology. These changes are not only the result of decisions taken at the firm level. Often macroeconomic changes, through government policy such as economic reform, or changes in exogenous factors, such as the world economy, have lasting impacts on firm growth and survival. The pattern of firm performance, as measured by a number of variables is described in this section. These findings are then linked with various measures of productivity in order to explain the observed pattern of growth.

3.1 Employment and Output Growth

Firm performance can be measured in a number of different ways. In this Report four measures are used:

1. Real output. This is a measure of the amount of goods a firm produces. It has been deflated by a firm-specific price index in order to be directly comparable between years.
2. Real value added. This is output less raw materials and other costs (such as rent). It is a measure of how much value a firm adds to these inputs. Like real output, it too has been deflated.
3. Employment. This is the total number of people employed by the firm.

4. The real capital stock. This is a measure of the capital (machines, tools, other equipment etc.) used by the firm to produce output. It has been deflated, and depreciation and investment have been taken into account.

In order to understand the growth patterns present in the Ghanaian manufacturing sector, two different techniques have been used. In the first, or matched technique, the average growth rate between the set of firms common to two years of the sample is used to calculate an index that represents the growth pattern of an average firm. The second, or differenced technique, calculates the differences in variables and regresses these on time variables in order to calculate a growth index. This second technique is used in order to assess the importance of measurement error. Both techniques produce similar results.

Firm performance over the period 1991 to 1999 is shown in Figures 3.1 and 3.2. These show an increase in real output of between 30 and 50 percent for the period 1991 to 1994. Subsequent to this real output fell but stabilised towards the end of the 1990. Over the period as a whole, real output has increased by between 7 and 12 percent. Real value added has a similar pattern to output. It too grew rapidly in the early-90's but then contracted from 1995 to 1997 and expanded again in 1998 and 1999. However, over the period as a whole, real value added has changed little.

The pattern of employment confirms this inverted U-shape present in real output and real value added. Employment increased by between 10 and 20 percent in the early 1990's but subsequent to this has declined continuously to return to 1991 levels in 1999.

The real capital stock series is the only variable which has increased consistently during the period. As will be explained more fully later, this is the result of low depreciation rates rather than high investment.

These results taken together suggest an inverted U-shaped pattern for the Ghanaian manufacturing sector during the 90s. As documented by Teal (1999) the period from 1991 to 1995 was one of growth, particularly among medium sized firms. However, it seems as if this growth may have been short-lived, as by the end of the 1990s the

Figure 3.1 Real Output and Real Value Added 1991-1999

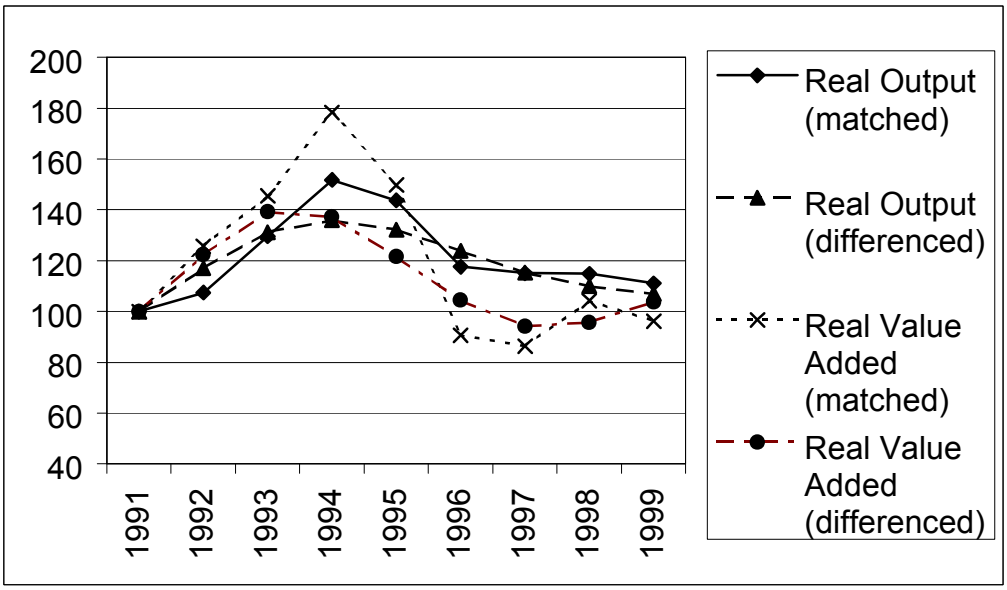
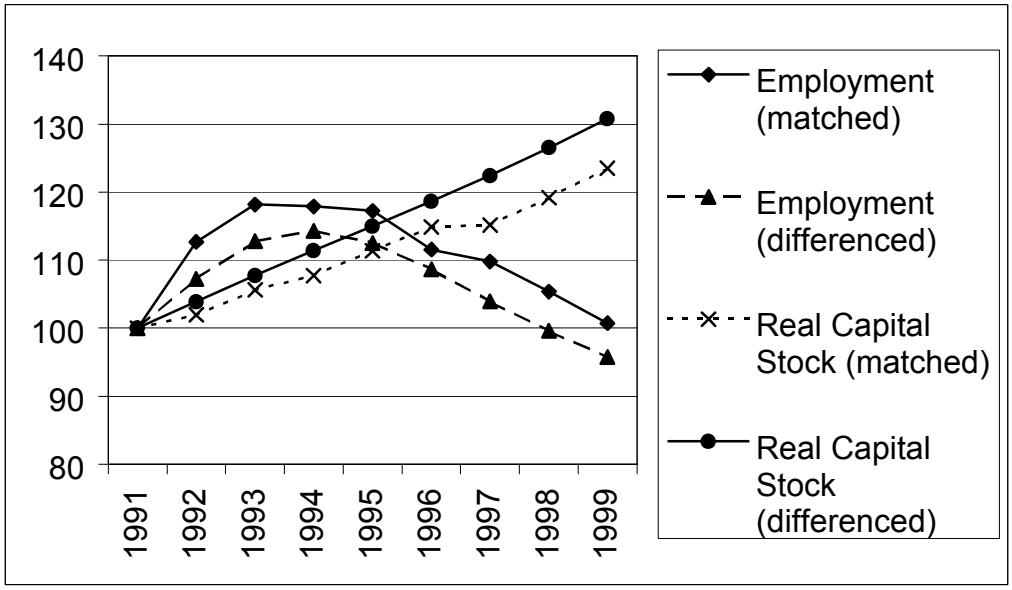


Figure 3.2 Employment and Real Capital Stock 1991-1999



average firm had returned to 1991 levels. Given this overall pattern, have certain sectors or size categories performed better or worse than others?

Table 3.1 investigates the performance of firms by size category. In the first half of the 1990s micro, small and medium firms experienced high growth in both real output and value added. Although large firms experienced a contraction in real output, real value added grew by about 20% for these firms over this period. Employment

Table 3.1 Changes in Output, Value Added, Employment and the Capital Stock, by firm size

	1991-1995	1995-1999	1991-1999
Micro Firms			
Real Output	50.5%	-26.6%	10.4%
Real Value Added	59.0%	-42.8%	-9.0%
Employment	30.9%	-18.8%	6.3%
Real Capital Stock	0.0%	3.6%	3.6%
Small Firms			
Real Output	64.9%	-53.2%	-22.9%
Real Value Added	36.3%	-50.3%	-32.2%
Employment	19.2%	-21.3%	-6.2%
Real Capital Stock	7.5%	10.5%	18.9%
Medium Firms			
Real Output	49.4%	4.0%	55.4%
Real Value Added	58.8%	-27.4%	15.2%
Employment	6.6%	-10.5%	-4.6%
Real Capital Stock	16.6%	9.6%	27.8%
Large Firms			
Real Output	-9.6%	-11.0%	-19.5%
Real Value Added	19.4%	-31.4%	-18.1%
Employment	20.7%	-6.6%	12.7%
Real Capital Stock	15.7%	16.8%	35.1%
All Firms			
Real Output	43.7%	-22.7%	11.0%
Real Value Added	49.7%	-35.8%	-3.9%
Employment	17.2%	-14.1%	0.7%
Real Capital Stock	11.3%	10.9%	23.5%

Note: The change in levels is calculated as the change in the index constructed using the 'matched' procedure. Firm size is the average of employment across the two periods being compared.
Micro < 6, small 6 - 20, medium 20 – 75, large > 75 employees.

increased for all size categories over this period and increased the most in micro firms, large firms and small firms respectively.

The second half of the 1990s is dramatically different to the first half. Output, value added and employment contracted in almost all cases. The only performance measure (excluding capital stock) to grow in any of the size categories, was real output for medium sized firms. The erratic changes in growth between the periods for micro and small firms suggest why we do not see many older firms in these categories. This variable behaviour means that these firms are likely to either increase in size and move into a larger size category, or to decrease in size and stop operating.

Over the period as a whole, medium sized firms have increased their output and value added by the most. This is largely due to their good performance in the early half of

the period. Micro firms are the only other firms to have increased their output during this period. Employment has grown the most in large firms, by about 12 percent, and the next most in micro firms, by about 6 percent. This employment growth amongst micro firms suggests that because of the high proportion of firms of this size in the sector, sector level employment is likely to have increased over the period.

The differences in performance between the early-90's and the late-90's, by sector, are graphed in Figures 3.3 to 3.5. All sectors, except wood and furniture, experienced a large increase in real output in the period 1991-1995. However, real output declined for all sectors between 1995 and 1999. The result, for the whole period, is that real output declined in all sectors except metal and machinery.

A similar result is evident for real value added. This measure experienced a large increase in all sectors during the early period but fell in the later period in all sectors except metal and machinery. Consequently, metal and machinery was the only sector to experience growth in value added for the period as a whole.

The change in employment was also positive for all sectors between 1991 and 1995. Between 1995 and 1999, only the metal and machinery sector increased employment. For the period as a whole this sector increased employment, as did the food and beverages sector.

These results help shed some light on the forces causing the inverted U-shape in firm performance. The good performance in the early 1990s seems to have been a result of good performance in all size categories and all sectors, particularly medium, small and micro firms for real output and real value added, and large, small and micro firms for employment. The poor performance in the second half of the 1990s seems to be common to all sectors. There is evidence though that the metal and machinery sector did not decline as much as the other sectors, for real output, and grew for real value added and employment. This sector is largely non-traded and thus protected from trade liberalisation. Amongst size categories, it was the medium and large firms that contracted by less, and in the case of employment, large firms actually increased

Figure 3.3 Real Output Changes, by Sector

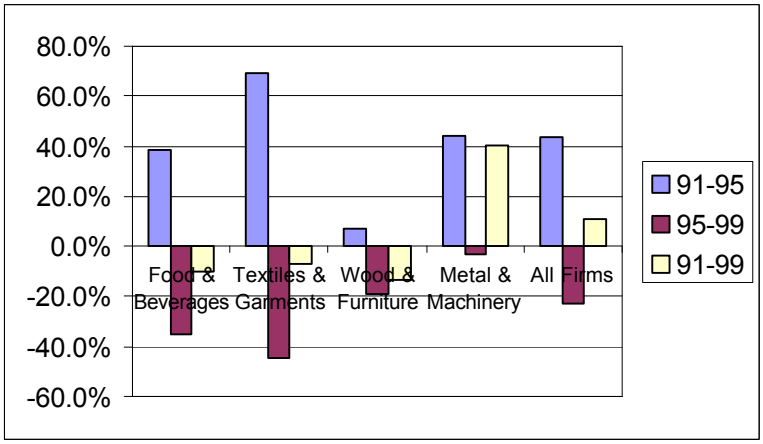


Figure 3.4 Real Value Added Changes, by Sector

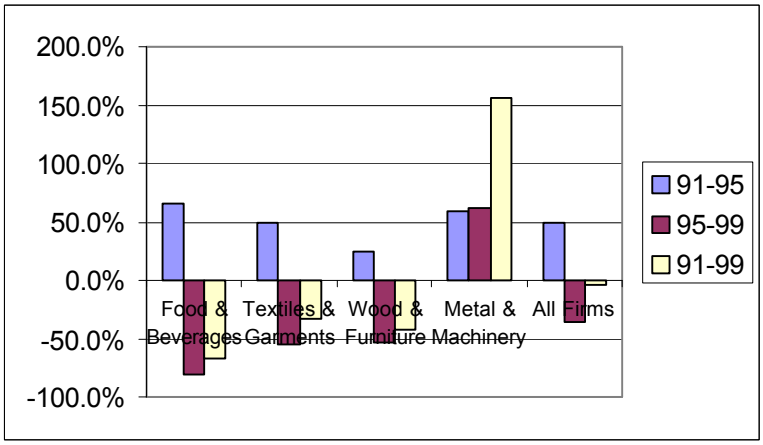
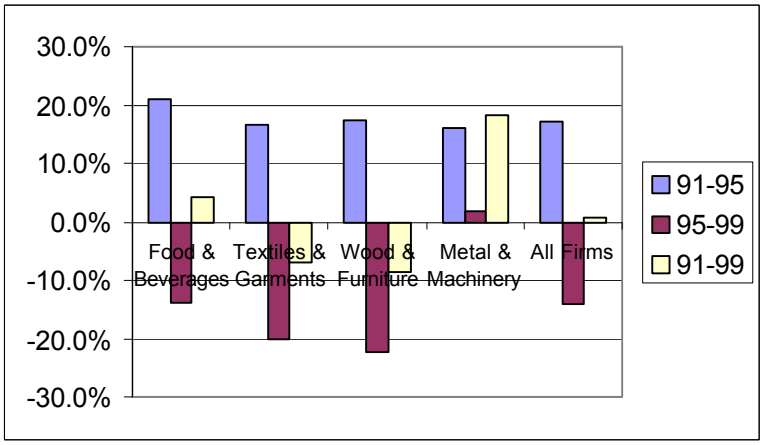


Figure 3.5 Employment Added Changes, by Sector



employment. It thus seems that although the poor performance in the second half of the 1990s was spread through the whole manufacturing sector, it was particularly acute in micro and small firms.

Having identified these changes during the 1990s, the next section examines productivity characteristics of the firms in an attempt to shed some more light on firm behaviour.

3.2 Labour Productivity and Capital Intensity

In order to examine firm productivity and its relationship to firm performance it is necessary to have measures of both the productivity of labour and the capital intensity of the firm. Table 3.2 shows how two measures of labour productivity – value added per employee and output per employee – vary by size and sector. There are substantial differences in labour productivity over size and across sectors. Aggregating over size groups, the food and beverages sector produces the most value added and most output per employee. Second is the metals, machinery and chemicals sector. Both productivity measures suggest that labour productivity is lowest in the textile and garments sector. The logarithmic difference between the highest and lowest productivity sectors (measured by value added per employee) is equal to 1.24, which corresponds to a very large difference in levels. The implication is that labour productivity in the food and bakeries sector is about 250% higher than in the textiles and garments sector. This suggests that the average worker in the food and bakeries sector produces 3-and-a-half times more value added than the average worker in the textiles and garments sector.

Aggregating across sectors, labour productivity increases with size (the bottom row of the table), if the micro sector is excluded. The higher productivity values in the micro category suggest that there are a number of more productive firms in this category than in the small category especially, in the textiles and garments and wood and furniture sectors.

Labour productivity is driven in part by the capital intensity of the firm. The bottom third of Table 3.2, shows differences in capital per employee by sector and by size. The rise in capital per employee across all size categories is much larger than the rise

Table 3.2 Real Value Added, Real Output and Capital Per employee, by Size and Sector

Real Value Added per employee	Micro	Small	Medium	Large	All size groups
Food and beverages	12.75	13.00	13.91	14.45	13.52
	61	*114*	*94*	*73*	*342*
Textiles and garments	12.46	11.87	12.45	13.7	12.28
	76	*154*	*95*	*23*	*348*
Wood and furniture	12.72	12.47	12.58	13.36	12.86
	29	*122*	*109*	*163*	*423*
Metal, machines and chemicals	12.86	13.01	13.43	14.15	13.4
	50	*117*	*162*	*92*	*421*
All sectors	12.67	12.53	13.12	13.81	13.02
	216	*507*	*460*	*351*	*1534*
Real Output per employee	Micro	Small	Medium	Large	All size groups
Food and beverages	14.26	14.73	14.83	15.51	14.83
	73	*131*	*98*	*80*	*382*
Textiles and garments	13.5	12.81	13.26	14.89	13.22
	77	*156*	*98*	*23*	*354*
Wood and furniture	13.53	13.21	13.52	14.34	13.74
	33	*132*	*117*	*169*	*451*
Metal, machines and chemicals	14.04	14.19	14.55	15.39	14.58
	50	*124*	*171*	*97*	*442*
All sectors	13.86	13.69	14.1	14.9	14.11
	233	*543*	*484*	*369*	*1629*
Capital per employee	Micro	Small	Medium	Large	All size groups
Food and beverages	12.44	12.66	14.16	15.51	13.55
	75	*133*	*84*	*77*	*369*
Textiles and garments	11.41	10.92	12.67	14.95	11.75
	75	*155*	*98*	*20*	*348*
Wood and furniture	11.96	11.35	12.99	14.44	12.98
	35	*128*	*116*	*165*	*444*
Metal, machines and chemicals	12.32	12.32	13.92	14.51	13.4
	42	*117*	*152*	*83*	*394*
All sectors	12	11.77	13.45	14.72	12.94
	227	*533*	*450*	*345*	*1555*

Micro < 6, small 6 - 20, medium 20 – 75, large > 75 employees

in labour productivity. Thus there is no evidence on the basis of these descriptive statistics that there are increasing returns to scale. As with labour productivity, capital per employee is highest in the food and bakeries sector and lowest in the textiles and garments sector. This suggests that although the food and bakery sector is more

productive per unit of labour, this labour also has access to more capital. There is thus the possibility that this higher productivity may be a result of higher capital intensity.

In comparison to the other sectors, the textile and garments sector has a very low capital per employee level. This suggests that relative to the other sectors it is more labour intensive. In many other developing countries that have developed successful manufacturing sectors, it is this sector which has been an early source of manufacturing exports. This is precisely because it is less capital intensive and uses the factor labour, which is cheapest and most abundant in the economy. A common feature across most sub-Saharan African countries is their lack of labour intensive manufacturing exports. Is this due to the inefficiency of the garment sector? Formal analysis of this question is presented below.

3.3 Firm Productivity

The close relationship between labour productivity and capital intensity means that labour productivity itself may not be a good measure of firm performance. Rather than comparing output with only one input, which is what the labour productivity measure does, it is desirable to obtain a measure that relates output to all inputs in the production process. This will give an estimate of the total factor productivity (TFP) of the firms. To aggregate the different inputs into a single index, a production function is estimated, which effectively aggregates the inputs using the estimated coefficients as weights. In practice, whether there are systematic differences in TFP across certain categories of firms is investigated by estimating a production function using as regressors both the inputs and the variables hypothesised to be related to differences in TFP. Analysis of TFP-differences then proceeds by examining the signs, magnitudes and levels of significance of the estimated coefficients on the latter set of variables.

Two forms of the production function are presented in Table 3.3. One seeks to explain gross output while the second uses value added. There are advantages and disadvantages to both measures. The advantage of the gross output measure is that it allows firms to have different efficiencies at transforming intermediate inputs (for example raw materials) into output. Its disadvantage is that the capital stock and raw materials tend to be highly correlated so that it can be difficult to know what the effect

of capital stock is on output. In contrast the value added production function, in which value added is defined as gross output less intermediate inputs, does not allow for the different efficiencies with which firms convert intermediate inputs into output. Such a procedure allows the effect of capital on output to be more easily identified. However it comes at a cost. The cost is that the resulting estimates for the effects of various factors on underlying efficiency may be too high. It is therefore desirable to present both estimates and see which results are robust to moving from the more general gross output equation to the value added measure.

The production functions are estimated over the period 1991 to 1999. These estimates are reported in Table 3.3. The first specifies the log of gross output as a function of raw material inputs, indirect costs, employment, and capital (all in logs), a number of variables which capture the human capital present in the firm (worker education, worker age and worker tenure), firm age, foreign ownership, an export dummy and a number of dummies for sectors, location and time period. The second model estimates value added as a function of all the previously mentioned variables except raw material inputs and indirect costs.

In the gross output specification, the coefficients on raw materials, indirect costs, employment and capital are all significant. The coefficient estimates suggest that a one percent increase in raw material inputs results in a 0.66 percent increase in gross output. Similarly a one percent increase in indirect costs, employment or the capital stock results in an increase in gross output of 0.17, 0.16 and 0.03 percent respectively. If all inputs are simultaneously increased by one percent, gross output increases by 1.02 percent. This suggests constant returns to scale.

In the value added specification the coefficients on employment and capital are highly significant. A one percent increase in employment results in a 0.9 percent increase in value added. A similar increase in the capital stock leads to a 0.18 increase in value added. A simultaneous increase of one percent results in a 1.08 percent increase in value added, suggesting a slight possibility of increasing returns to scale.

The measures of human capital in the firm suggest that worker education and tenure are significant factors influencing firm productivity. The results from the output

function suggest that a one percent increase in the average education of workers would result in a 0.01 percent increase in the level of gross output. The coefficient on worker tenure suggests an effect of similar magnitude.

Worker tenure and education are also found to be significant factors influencing value added. The results from the value added estimation suggest that a one percent increase in worker education and worker tenure results in a 0.04 percent and 0.02 percent increase in value added, respectively. Both specifications suggest that although worker human capital is a significant determinant of production, the magnitude of this effect is very small.

The estimates of the production function suggest that older firms are more productive. A ten year increase in age would increase gross output by about 0.04 percent and value added by 0.08 percent. This suggests that although firms may become better at producing with time, the magnitude of this improvement is small.

In both specifications, exports are an important factor contributing to productivity. A firm, which exports some of its output, produces on average 0.07 percent more output, and 0.38 percent more value added than a firm that does not export at all. There are two main explanations as to why this is the case. The first is that more efficient or productive firms may select themselves into the export market. Firms may have to be more efficient in order to compete in world markets, or in order to overcome the fixed costs, such as market research, associated with exporting. The second explanation is that firms may learn, and become more productive, through exporting. This could be the case if exporting is a mechanism for the transfer of technology or new ideas. It may also happen if the export market is highly competitive and firms are required to continually improve their product and production techniques in order to survive in this market.

Earlier analysis of labour productivity suggested that the food and beverages sector was about three-and-a-half times more efficient per unit of labour than the textiles and garments sector. These production function estimates allow this to be examined more

Table 3.3 Ghana: Production Functions 1991 - 1999

	Dependent Variable					
	[1] Log (Real Output)			[2] Log (Real Value Added)		
	Coefficient	Standard error		Coefficient	Standard error	
Log (Raw Materials)	0.66	0.009	***			
Log (Indirect Costs)	0.17	0.010	***			
Log (Employment)	0.16	0.017	***	0.90	0.041	***
Log (Capital Stock)	0.03	0.008	***	0.18	0.021	***
Log (Worker Education)	0.01	0.005	**	0.04	0.014	***
Log (Worker Age)	0.00	0.002		0.00	0.006	
Log (Worker Tenure)	0.01	0.004	*	0.02	0.010	**
Firm Age	0.0036	0.001	***	0.0081	0.003	***
Any Foreign Ownership	0.02	0.031		0.18	0.090	**
Any Exports	0.07	0.034	**	0.38	0.100	***
Food	0.19	0.076	**	0.53	0.236	**
Bakery	0.12	0.079		0.47	0.246	*
Textiles	0.14	0.093		0.30	0.284	
Garments	0.19	0.077	**	-0.34	0.234	
Wood	0.15	0.084	*	-0.33	0.259	
Furniture	0.17	0.075	**	-0.07	0.232	
Metal	0.16	0.074	**	0.36	0.231	
Machine	0.23	0.090	**	0.15	0.274	
Accra	0.01	0.042		0.17	0.125	
Kumasi	0.03	0.042		0.15	0.125	
Cape Coast	-0.11	0.068		-0.54	0.203	***
1992	0.07	0.044	*	0.15	0.127	
1993	0.01	0.044		0.18	0.127	
1994	0.09	0.043	**	0.58	0.122	***
1995	0.06	0.043		0.36	0.122	***
1996	-0.06	0.043		-0.02	0.123	
1997	-0.11	0.043	***	0.03	0.124	
1998	-0.04	0.045		0.20	0.130	
1999	-0.07	0.046		0.22	0.132	*
Adjusted R2	0.970			0.768		
N	1420			1368		

* indicates significance at the 10% level; ** at the 5% level; *** at the 1% level

Omitted categories are sector = chemicals and location = Takoradi

closely whilst taking into account different capital intensity as well as other characteristics. Both the gross output and the value added production functions suggest productivity differences between sectors. Each sector is compared to a base sector, in this case chemicals. The only sector which is significantly higher than this base sector in both specifications, is the food sector. This confirms the earlier findings that this is the most productive sector. Firms in this sector produce 0.19 percent more output and 0.53 percent more value added than firms in the chemical sector. Surprisingly, the output function suggests that the garments sector is as productive in terms of output as the food sector. However, analysis of the value added specification suggests that garments are less productive than the base sector and considerably less productive than the food sector. This analysis suggests that the low productivity of the textiles and garments sectors may be one factor constraining Ghanaian manufacturing growth through exports from these sectors.

The specifications suggest that location factors have little effect on production. The only location dummy which is significant is the Cape Coast dummy in the value added specification. This suggests that firms located in Cape Coast have a lower value added than similar firms located elsewhere.

A number of the time dummies are significant but only one is robust across specifications. This may be the result of changes in the sample between periods, and recall errors by respondents, in periods of high inflation. These results provide little evidence of an increase in productivity over the period.

4. Investment Behaviour and Constraints

4.1 Proportion of Firms Investing

Investment is a vital factor in understanding firm performance. Investment serves as a channel for technological transfer - it allows firms to develop new products or to make existing ones better. Expanding the plant and machinery is often a prerequisite for increasing production. Even in firms that only need to maintain existing production levels, equipment becomes worn down and must be replaced through investment. Hence it is not surprising that many commentators have stressed private investment as a key factor in providing the basis for economic growth and

development in Africa. For instance, the IMF (1993) estimates that during 1971-1991 there was a shortfall in trend output growth of 1.7 percent per year in SSA compared to all other developing countries, and that one third of this gap was attributed to insufficient investment levels.

One ubiquitous feature of African firm-level investment data is the prevalence of zero investments (e.g. Bigsten et al. 1999). This is also the case for the GMES. Table 4.1 shows the propensity to undertake any investment for the whole period by size and industry. Only 45 percent of all observations are non-zero investments, a proportion similar to what has been found in previous research on African firms (Bigsten et al, 1999). Examining differences across sectors, it is clear that the garments and textiles sector is less inclined to carry out investment than firms in other industries. This is largely driven by the low propensities to invest amongst the micro, small and medium firms in this sector, as large firms in this sector have one of the highest propensities to invest. As the size breakdown illustrates, large and medium firms are more likely to invest than small or micro firms. Only 27 percent of micro firms invested during the period, as opposed to 37 percent of small firms and 47 percent of medium firms. Among large firms, 68 percent carried out some investment during the period. These statistics suggest that investment propensities are positively related to firm size.

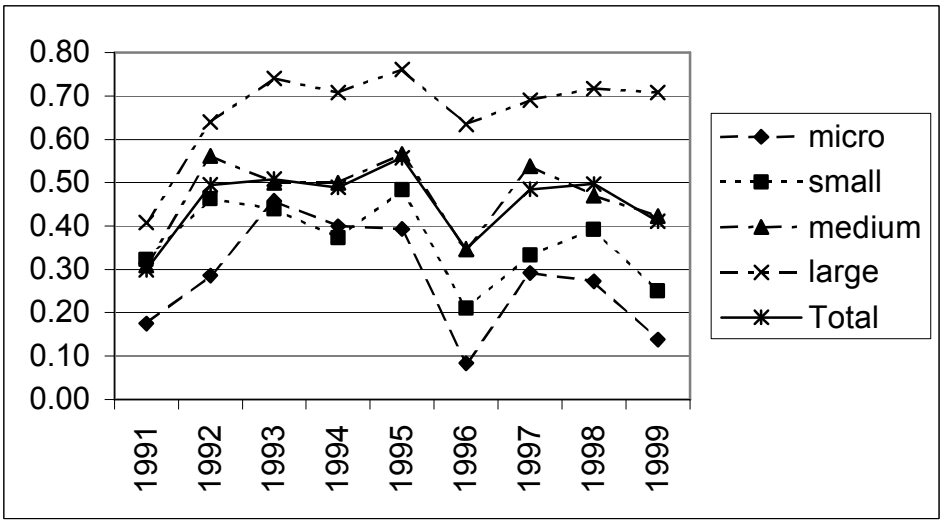
Table 4.1 Propensity to Investment 1991-1999, by Size and Sector

	Micro	Small	Medium	Large	All size groups
Food and bakeries	0.33	0.31	0.57	0.71	0.47
Number of observations	*75*	*133*	*100*	*85*	*393*
Textiles and garments	0.22	0.27	0.35	0.74	0.31
Number of observations	*79*	*158*	*97*	*23*	*357*
Wood and furniture	0.20	0.45	0.47	0.60	0.49
Number of observations	*35*	*130*	*118*	*166*	*449*
Metal, machines and chemicals	0.30	0.48	0.48	0.77	0.52
Number of observations	*50*	*122*	*176*	*96*	*444*
All sectors	0.27	0.37	0.47	0.68	0.45
Number of observations	*239*	*543*	*491*	*370*	*1643*

Figure 4.1 describes how the propensity to invest has changed over the period. The propensity to invest, among all firms, increased most dramatically between 1991 and 1992. Since then it has remained fairly stable for most of the period except in 1996,

when it fell almost to 1991 levels. This fall was largest amongst the micro, small and medium firms.

Figure 4.1. Propensity to Invest over Time, by Size



4.2 Investment Rates

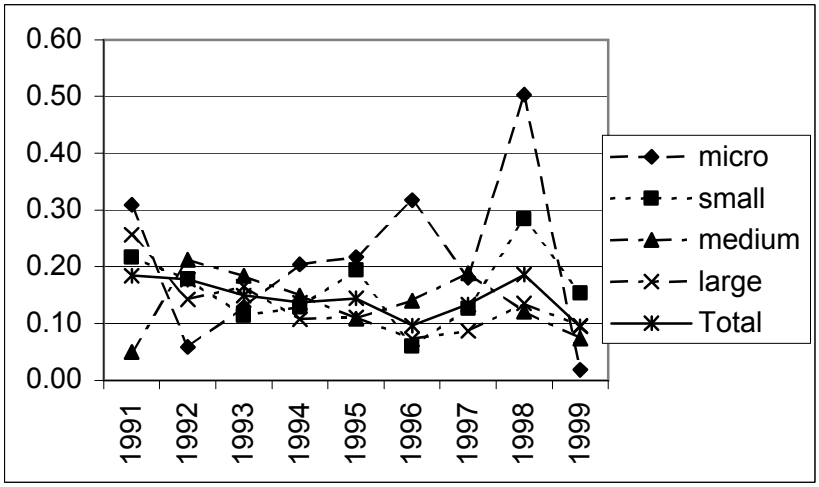
Table 4.2 shows the investment rate (the amount invested divided by the capital stock) if a firm invests. The average investment rate among investing firms is 14 percent. This investment rate is highest in the food and bakeries and textiles and garments sectors. There is a negative relationship between the investment rate and firm size: the average investment rate for micro firms is 0.20, and the corresponding number for small, medium and large firms is 0.16, 0.14 and 0.11 respectively. This finding, that the smallest firms are least likely to invest, but have the highest investment rate given that they do invest, is consistent with a case where small firms are constrained by indivisibilities or fixed sunk investment costs. Thus, smaller firms very often have to wait for long periods in order to accumulate enough money to invest, and they invest less frequently.

Figures 4.1 and 4.2 illustrate this investment behaviour. The investment rate for large firms has fallen since 1991 but has been fairly stable. The investment propensity (Figure 4.1) has increased over the period. This suggests that large firms are now investing more regularly than in 1991. This may be due to increased macroeconomic stability or access to sources of finance to pay for this investment. The average investment rate of medium firms has also fallen over the period, although the

Table 4.2 Average Investment Rates for Investing Firms, 1991-1999, by Size and Sector

	Micro	Small	Medium	Large	All size groups
Food and bakeries	0.14	0.22	0.16	0.16	0.17
Number of observations	*22*	*39*	*51*	*55*	*167*
Textiles and garments	0.33	0.20	0.14	0.06	0.18
Number of observations	*17*	*38*	*33*	*16*	*104*
Wood and furniture	0.16	0.15	0.15	0.12	0.14
Number of observations	*6*	*54*	*55*	*91*	*206*
Metal, machines and chemicals	0.16	0.11	0.13	0.09	0.12
Number of observations	*12*	*57*	*79*	*69*	*217*
All sectors	0.20	0.16	0.14	0.11	0.14
Number of observations	*57*	*188*	*218*	*231*	*694*

Figure 4.2. Investment Rates for Investing Firms over Time, by Size



propensity to invest has remained fairly constant. Among small and micro firms, the propensity to invest in the second half of the 1990s was lower than in the first half. The investment rates among these firms were very variable, especially for micro firms. This suggests that these problems of indivisibility and large fixed costs associated with fixed capital investment are becoming more problematic for smaller firms in Ghana. This may be the case because of a more competitive economic environment facing smaller firms and thus lower profits, or alternatively, access to finance for smaller firms may have become tighter. If this is the case, firms would be required to wait for profitable years, or booms in order to undertake investments.

4.3 The Determinants of Investment

Given the size-investment relationship described above it is useful to consider a number of investment equations in order to attempt to better understand the factors determining the decision to invest and the amount invested. Table 4.3 reports results from a probit regression modelling the decision to invest, and an ordinary least squares (OLS) regression modelling the investment rate for investing firms. The probit model is non-linear, so in order to facilitate interpretation, the estimated change in the probability of investment from a one-unit change in the explanatory variable, (everything else held constant), is reported.[2] Both regressions are based on the data for the entire period 1991-1999, and use as regressors the logarithm of employment, technical efficiency, firm age and dummy variables for location, year, industry and foreign ownership. Technical efficiency is measured as either the residual from a Cobb-Douglas production function, modelling value-added as a function of employment and physical capital, or from the gross output production function. This efficiency measure gives an indication of how much more or less efficient or productive a firm is, once a number of factors such as size, capital intensity, ownership and sector are controlled for.

In the probit regressions, reported in Columns [1] and [2], the coefficient on size is positive and significant at the one percent level. The estimated marginal effect is 0.34, indicating that the probability of investment of a firm with 100 employees is about 78 percentage points higher than that of a firm with 10 employees.[3] The marginal effect of technical efficiency is significantly different from zero in both specifications. This suggests that more efficient firms are more likely to invest.

Firm age is significant, and the magnitude of the coefficient estimate suggests that each additional year of firm age reduces the probability of investment by just less than one percent. The fact that young firms appear to invest more often than older firms suggests that the firm gradually builds up its business during several years after it has entered the market. One potential reason for such behaviour is that young firms are

[2] The probability is evaluated at the sample means of the regressors.
[3] This is calculated as 0.34 (ln100-ln10). It should be noted that this calculation is only an approximation and not exact because the marginal effects in the probit model are variable and dependant on the values of the regressors.

Table 4.3 Ghana: Investment Equations 1991 - 1999

	Probit		OLS	
	Decision to Invest (marginal effects#)		Dependent Variable = investment/ capital if firm invests	
	[1]	[2]	[3]	[4]
Log (Employment)	**0.34**	**0.34**	**-0.01**	**-0.02**
	(0.035)***	(0.036)***	(0.008)*	(0.008)**
Technical Efficiency (Output)	**0.18**		**0.00**	
	(0.093)*		(0.021)	
Technical Efficiency (Value Added)		**0.11**		**0.00**
		(0.033)***		(0.007)
Firm Age	**-0.0082**	**-0.0084**	**-0.0004**	**0.00**
	(0.003)**	(0.003)**	(0.001)	(0.001)
Any Foreign Ownership	**-0.09**	**-0.08**	**-0.01**	**0.00**
	(0.103)	(0.105)	(0.024)	(0.023)
Food	**0.25**	**0.33**	**0.00**	**0.12**
	(0.270)	(0.301)	(0.064)	(0.072)
Bakery	**0.36**	**0.46**	**-0.02**	**0.10**
	(0.278)	(0.310)	(0.068)	(0.076)
Textiles	**0.07**	**0.17**	**-0.07**	**0.03**
	(0.327)	(0.354)	(0.078)	(0.083)
Garments	**-0.11**	**-0.02**	**0.00**	**0.12**
	(0.267)	(0.297)	(0.066)	(0.073)*
Wood	**-0.24**	**-0.12**	**-0.04**	**0.09**
	(0.286)	(0.318)	(0.069)	(0.076)
Furniture	**0.18**	**0.25**	**-0.04**	**0.06**
	(0.263)	(0.294)	(0.063)	(0.071)
Metal	**0.38**	**0.46**	**-0.06**	**0.06**
	(0.263)	(0.295)	(0.063)	(0.071)
Machines	**-0.13**	**-0.09**	**-0.08**	**0.03**
	(0.323)	(0.348)	(0.079)	(0.086)
Accra	**-0.09**	**-0.11**	**0.00**	**0.02**
	(0.148)	(0.151)	(0.033)	(0.033)
Kumasi	**0.03**	**0.02**	**-0.01**	**0.02**
	(0.147)	(0.150)	(0.034)	(0.033)
Cape Coast	**-0.70**	**-0.65**	**-0.14**	**-0.12**
	(0.257)***	(0.262)**	(0.077)*	(0.075)
1992	**0.34**	**0.39**	**0.00**	**0.02**
	(0.151)**	(0.152)***	(0.037)	(0.037)
1993	**0.45**	**0.47**	**-0.06**	**-0.04**
	(0.153)***	(0.154)***	(0.037)	(0.037)
1994	**0.27**	**0.32**	**-0.04**	**-0.02**
	(0.149)*	(0.148)**	(0.037)	(0.036)
1995	**0.47**	**0.52**	**-0.03**	**-0.01**
	(0.149)***	(0.148)***	(0.036)	(0.035)
1996	**-0.14**	**-0.09**	**-0.07**	**-0.05**
	(0.152)	(0.152)	(0.039)*	(0.039)
1997	**0.25**	**0.28**	**-0.06**	**-0.03**
	(0.150)*	(0.151)*	(0.037)	(0.036)
1998	**0.29**	**0.34**	**0.03**	**0.04**
	(0.156)*	(0.158)**	(0.038)	(0.037)
1999	**0.07**	**0.07**	**-0.07**	**-0.07**
	(0.160)	(0.165)	(0.040)*	(0.040)*
R-Square			0.072	0.077
Adjusted R-Square			0.036	0.039
N (invdum = 1]	639	612		
N	1419	1367	609	583

figures in brackets are standard errors.; * indicates significance at the 10% level; ** at the 5% level; *** at the 1% level.
Omitted categories are sector = chemicals and location = Takoradi.
marginal effects of a 1% change in continuous variables on the probability of observing any investment
for dummy variables the marginal effect is of a discrete change from value = 0 to value = 1.
Measures of technical efficiency: these are taken from respective production functions, omitting non-significant variables

credit constrained and thus cannot borrow in order to buy all their capital in one go. Instead they need to generate their own finance to fund their investments. Given this relationship we would anticipate that younger firms have newer machinery and equipment and thus access to newer technology.

None of the sector dummies are significant, indicating that there are no sectoral differences in the probability of investing. The location dummies suggest that firms in Cape Coast are less likely to invest than firms in the other regions. The time dummies suggest that in most years, firms were more likely to invest than in the base year of 1991. 1996 was the only year in which the probability of investment was the same as in 1991. This is exactly the picture observed in figure 4.1.

Columns [3] and [4] of Table 4.3 show OLS results for the investment rate regression, based on the sub-sample of investing firms. The size coefficient is now negative and significant, which fits with the descriptive statistics shown in table 4.2 and the importance of sunk costs and indivisibilities in investment. The estimated coefficient on technical efficiency is not significant for either measure of efficiency. Thus although more efficient firms are more likely to invest, the amount they invest has little to do with their efficiency. None of the sector dummies are significant using both technical efficiency measures. There is some evidence that firms in Cape Coast invest a smaller amount than firms elsewhere. The period dummies suggest that in 1996 the investment rate was lower than in 1991. This is again the case in 1999. These values are however only marginally significant.

The results of the investment functions suggest that one of the most important factors influencing the probability of investment, and the amount of investment is firm size. Because capital equipment is often large, and cannot be built up piecemeal, and is also expensive, smaller firms do not invest as regularly as larger firms. However, when they do invest, the amount invested is, on average, relatively more than for larger firms. This size relationship is far more important than the sector the firm is in. The results also highlight the relationship between efficiency and investment. More productive, or efficient firms are more likely to invest. This relationship may be one

reason why these firms become or remain more efficient as investment allows them to maintain their capital stock and/or to invest in new machines and technology.

Although these results give us some indication of what factors are important for investment, they do not provide a full explanation of the investment process. There may be measurement problems with these investment variables that make it difficult for their effects to be modelled. Because investment rates are low, other factors which affect investment (for example, high capital costs and uncertainties about the future) and which cannot easily be measured, may be more important in determining investment than the factors included in the equation.

Investment, productivity and exports are closely related. The next section examines the third component of the trinity – exports.

5. Market Orientation and Exports

Manufactured exports have been a key factor in many developing countries which have managed to industrialise quickly and achieve sustainable higher levels of economic growth. It was manufactured exports in particular which formed the basis for the rapid growth of the Asian tigers after the Second World War. In Africa, Mauritius has managed to transform itself from a predominantly agrarian economy through the export of textiles and garments. This transformation has been accompanied by a substantial increase in growth, as well as an improvement in GDP per head. Given these examples, it is no surprise that many analysts emphasise exports as a key feature in reversing Africa's poor economic performance.

As in most sub-Saharan countries, manufacturers in Ghana remain focused on the domestic market. This market is limited in scope and firms with exclusive domestic focus are unlikely to grow beyond a certain size. Furthermore factors such as globalisation and World Trade Organisation agreements will result in increased import penetration in local markets. It is for these reasons that firms need to develop exports. What limits manufacturing firms entry into foreign markets, and how improvements in access to these markets can be gained, are thus central issues to policy making for the manufacturing sector in Africa.

5.1 Penetration of Export Markets

Table 5.1 shows the proportion of firms in the sample that carried out any exporting over the period 1991-1999. In total, only 18 percent of firms exported in this period. This includes regional exports. Over the period 1993 to 1999, regional exports accounted for about 20 percent of total exports. The incidence of exporting is highest in the wood and furniture sector and among larger firms. The strong positive relationship between size and exporting may be due to a number of factors. Firms may face large fixed costs in entering the export market. These would be costs such as establishing an overseas supply network, market research in foreign markets, or specific product design for overseas markets. It could also be costs such as installing new equipment to produce new products, and similar to investment, larger firms may be better able to finance these costs.

Table 5.1 Propensity to Export and Export Intensity, 1991-1999, by Size and Sector

	Micro	Small	Medium	Large	All size groups
Food and bakeries	0	0.02	0.08	0.34	0.10
	76	*132*	*99*	*86*	*393*
Textiles and garments	0.01	0.06	0.12	0.30	0.08
	79	*157*	*99*	*23*	*358*
Wood and furniture	0	0.09	0.27	0.64	0.34
	33	*130*	*120*	*171*	*454*
Metal, machines and chemicals	0.02	0.09	0.10	0.40	0.15
	50	*123*	*179*	*98*	*450*
All sectors	0.01	0.06	0.14	0.49	0.18
	238	*542*	*497*	*378*	*1655*
Export Intensity if a firm exports					
Food and bakeries	--	12.5	6.5	42.4	33.5
	0	*2*	*8*	*29*	*39*
Textiles and garments	25.0	61.1	50.4	20.3	46.1
	1	*10*	*12*	*7*	*30*
Wood and furniture	--	53.4	64.3	69.3	67.0
	0	*12*	*31*	*109*	*152*
Metal, machines and chemicals	16.0	30.6	18.7	13.5	17.6
	1	*11*	*18*	*39*	*69*
All sectors	20.5	46.1	43.3	51.4	48.6
	2	*35*	*69*	*184*	*290*

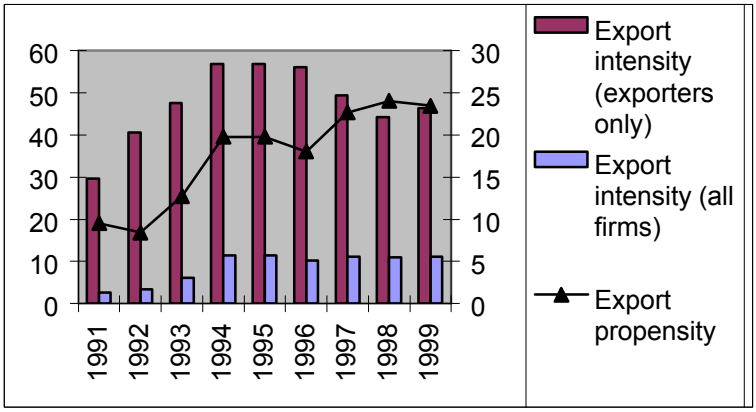
Note: Figures in italics indicate the number of firms in each category.

Given that a firm exports, how much of its output does it export? Table 5.1 presents the percentage of total output exported, if a firm does export. This is broken down by

sector and size. On average, exporting firms export about half their output. This is highest in the wood and furniture sector and lowest in the metal, machines and chemicals sector. Interestingly there is not a linear relationship between the amount exported and size. In the textile and garments sector, and the metal, machinery and chemical sector, small and medium firms export a larger proportion of output than large or micro firms. This may indicate that fixed costs are an important consideration for these smaller firms, but less important for large firms. If this is the case, small and medium firms would have to export a higher proportion of output in order to reduce average costs. Larger firms would be able to spread the increase in fixed costs between the domestic market and the foreign market and therefore would not have to export as large a proportion of output in order to recoup these costs.

Figure 5.1 graphs the proportion of firms exporting, as well as the percentage of output exported, if a firm exports, and the percentage of output exported for the whole sample (exporters and non-exporters).

Figure 5.1 Export Propensity and Intensity Over Time



Note: Export intensity is graphed on the left hand axis, export propensity on the right.

The number of firms in the export market has risen during the 1990, although this may be a result of a changing sample. In 1991 less than ten percent of firms exported some of their output. By 1999 close to a quarter of firms participated in the export market. This increase in participation in the export market has been accompanied by an increase in the proportion of output exported. In 1991, firms that exported, exported on average 30 percent of their output. In 1999, firms that participated in the export market sent on average about 45 percent of their output abroad. This increase

in export participation as well as export intensity has meant that in the sample the proportion of total output exported has risen from 2.69 percent in 1991 to 11.12 percent in 1999.

5.2 The Determinants of Exports

In order to better understand the determinants of exports, a probit regression is used to model the decision to export as a function of technical efficiency, firm age, dummy variables for location, industry, time period and foreign ownership, and size, measured as the number of employees. These results are reported in Table 5.2. In line with the summary statistics reported earlier, these suggest that larger firms are more likely to export than smaller ones. A firm with 100 employees is 100 percentage points more likely to export than one with only 10 workers, indicating the very important role firm size plays in exporting. This emphasises the role of factors such as fixed costs in the export decision.

Firm level efficiency (measured both ways) is found to be a significant determinant of exports. This positive relationship may be because more efficient firms select themselves into the export market, or that firms may become more efficient through learning associated with exporting, or a combination of both these. This is the other side of the relationship found in the production functions – that exporting firms are more efficient. This in turn is related to investment, as more efficient firms are more likely to invest, which in turn is likely to boost productivity and exports.

Firm age is found to have a negative and significant impact on the probability of exporting. A one year increase in age reduces the probability of exporting by about one and a half percent. This may be because recently established firms are more outward orientated than older firms. Alternatively, this may be because younger firms have more advanced capital equipment and are able to produce goods for the export market. This does suggest that these factors may overshadow the impacts of learning-through-exporting, if there are any. The industry dummies suggest that firms in the wood sector, and firms in the machinery sector are much more likely to export than those in other sectors. If these two sectors are compared, the wood sector is even more likely to export than the machinery sector. The high probability of exporting in

Table 5.2 Ghana: Export Equations 1991 - 1999

	Probit - Decision to Export (marginal effects#)	
	[1]	[2]
Log (Employment)	**0.44**	**0.44**
	(0.049)***	(0.050)***
Technical Efficiency (Output)	**0.3**	
	(0.127)**	
Technical Efficiency (Value Added)		**0.18**
		(0.051)***
Firm Age	**-0.02**	**-0.01**
	(0.004)***	(0.005)***
Any Foreign Ownership	**0.15**	**0.12**
	(0.123)	(0.128)
Food	**-0.35**	**-0.16**
	(0.322)	(0.378)
Bakery	**-0.78**	**-0.53**
	(0.475)	(0.514)
Textiles	**0.16**	**0.32**
	(0.366)	(0.417)
Garments	**-0.13**	**0.04**
	(0.329)	(0.384)
Wood	**1.78**	**1.99**
	(0.339)***	(0.397)***
Furniture	**-0.17**	**0.02**
	(0.313)	(0.370)
Metal	**-0.14**	**0.02**
	(0.314)	(0.372)
Machines	**0.70**	**0.89**
	(0.359)*	(0.409)**
Accra	**0.33**	**0.29**
	(0.198)*	(0.203)
Kumasi	**0.23**	**0.18**
	(0.207)	(0.211)
Cape Coast	**0.23**	**0.20**
	(0.344)	(0.355)
1992	**-0.16**	**-0.18**
	(0.243)	(0.247)
1993	**0.17**	**0.14**
	(0.231)	(0.232)
1994	**0.22**	**0.18**
	(0.219)	(0.221)
1995	**0.2**	**0.21**
	(0.219)	(0.219)
1996	**0.12**	**0.12**
	(0.219)	(0.221)
1997	**0.39**	**0.4**
	(0.214)*	(0.217)*
1998	**0.33**	**0.35**
	(0.223)	(0.226)
1999	**0.35**	**0.37**
	(0.225)	(0.232)
Log likelihood	-409.41	-389.89
Number of exporters	245	235
N	1421	1369

Notes: figures in brackets are standard errors; * indicates significance at the 10% level; ** at the 5% level; *** at the 1% level; Omitted categories are sector = chemicals and location = Takoradi; # marginal effects of a 1% change in continuous variables on the probability that the firm exports; for dummy variables the marginal effect is of a discrete change from value = 0 to value = 1. Measures of technical efficiency: these are taken from respective production functions, omitting non-significant variables.

the wood sector can be explained through comparative advantage. Ghana has a relative abundance of natural resources (wood in this case) and labour. The capital-labour ratio of this sector (Table 3.2) is the lowest among large firms. This sector makes use of both these abundant factors.

In terms of the time period dummies, the only significant dummies are for 1997. Firms were more likely to export in this year than in 1991. There is some evidence that the probability of exporting has increased towards the end of the 1990s. Although these values are not significant, their magnitudes are larger than in the early half of the period.

The micro data on exports suggest that although comparative advantage is an important factor in the export decision, other firm specific factors also matter. Firm size is a significant determinant of export probability due to the fixed costs associated with exporting. The age of the firm is also significant and negatively related to export probability. This suggests that younger firms may have access to newer technologies which allow them to produce for the export market. These factors may overshadow the learning-through-exporting process if it exists. The other crucial factor related to both exporting and investment is firm level efficiency. Firms which are more productive than others, controlling for factors such as size, capital intensity and sector, are more likely to invest and participate in the export market. Investment and export participation are surely related and if export participation leads to higher productivity either through learning or through exposure to fiercer competition or better technology, then these two aspects are self perpetuating. It is this virtuous association, which makes understanding productivity, investment and exports and the firm characteristics which determine these, paramount.

6. Summary and Conclusions

The performance of the Ghanaian economy has greatly improved since the implementation of the Economic Recovery Programme (ERP). Between 1984 and 1996 real GDP per capita growth averaged 2.0 per cent per annum. This figure compares with a fall of 1.6 per cent per annum in the period from 1970 to 1984. The

level of per capita income at the end of the twentieth century remained below its level in 1970.

The results presented in this report suggest that the manufacturing sector has not performed as well as other parts of the economy. Data from the Ghanaian Manufacturing Enterprise Survey (GMES) show that during the first half of the 1990s, real output, real value added and employment all increased significantly amongst all sectors and size categories. However, this increase was not sustained for the second half of the 1990s. The period from 1995 to 1999 saw a decline in output, value added and employment for firms in general. This decline was common to all size categories although medium and large firms did not contract by as much as small and micro firms. All sectors, bar one, experienced a contraction in output, value added and employment. The exception – the metals, machinery and chemicals sector – experienced an increase in real value added and employment during the period. There is little evidence that the better performance of the metals, machinery and chemicals sector is a result of higher productivity as it is no more productive than other manufacturing sectors. Surprisingly, the most productive sector – food – experienced a contraction in value added and output over the 1990s.

These results suggest that it is not differences in productivity between sectors which have influenced performance but rather the trade orientation of the sector. The metals, machinery and chemicals sector is predominately non-traded and thus protected from trade liberalisation and competing imports. Furthermore, because of its domestic orientation, it has benefited from the growth experienced in the rest of the economy and managed to avoid the costs of imported competition. The other traded sectors face import competition, which has increased due to, amongst other things, ongoing economic and trade reform. Although this reform seems to have benefited firms in the early 1990s, this effect seems to have worn off by the latter half of the period. The fact that there is little evidence of productivity increases in the sample as a whole suggests that firms have not responded to this competition by increasing productivity.

There is abundant evidence of the links between exporting and productivity. The data from the GMES shows that firms which engage in exporting are significantly more productive than firm which do not. Firms may have not improved productivity

because they are not engaged in the export market and thus cannot learn-by-exporting. More than half the firms in the sample do not export. This probably overstates export participation because the survey over represents larger firms which are more likely to export. Firms may not export if they face high fixed costs to begin exporting or are not productive enough to make it into the market. Although the propensity to export has increased over the sample period, this may be predominantly a result of a change in the sample structure, rather than a fundamental change in firm behaviour.

Alternatively, firms may not have increased productivity because they lack the finance to invest in newer or more productive machinery. Investment allows for the replacement of old and worn out machinery and the expansion of capacity. Another important aspect of investment is that it allows for the range of goods produced to be expanded, or the quality of goods to be improved. It is also a useful channel for the transfer of technology. Investment, like exporting, is closely related to efficiency, as more efficient firms are more likely to invest.

A third explanation as to why Ghanaian manufacturing firms have performed, on average, poorly over the second half of the 1990s is that they may be producing using the wrong input mix. This would be the case if Ghanaian firms were capital intensive relative to their competitors, and that capital was relatively more expensive in Ghana than in the competing country.

Improving firm efficiency should be a fundamental part of Ghanaian industrial policy. This may be achieved in a number of ways. The reduction of import tariffs makes intermediate imports and thus final products cheaper. Tariff reduction also encourages competition in final products and thus forces producers to become more efficient. The improvement of physical infrastructure such as roads, ports, the water and electricity supply, and telephones may also improve efficiency and reduce the costs associated with entering the export market. Needless bureaucracy and complicated tax systems also reduce efficiency.

Much of the hard work of economic reform has been done in the past twenty years. The challenge for Ghanaian economic and industrial policy is to sustain the momentum.

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Appendix A – Firm Growth Rate Calculations

Table A.1 Firm Growth Rate Calculations: All Firms

Changes in Logarithmic Mean

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	138	132	124	165	143	162	132	134
Real Output									
t1	Mean	16.58	16.71	16.97	17.51	17.46	17.54	17.72	17.73
t2	Mean	16.65	16.92	17.14	17.46	17.28	17.52	17.72	17.70
Change	%	0.07	0.21	0.17	-0.05	-0.18	-0.02	0.00	-0.03
Real Value Added									
t1	Mean	15.45	15.79	15.99	16.57	16.40	16.36	16.54	16.72
t2	Mean	15.70	15.94	16.21	16.41	16.01	16.31	16.74	16.64
Change	%	0.26	0.16	0.23	-0.16	-0.40	-0.05	0.21	-0.08
Employment									
t1	Mean	2.82	3.02	3.13	3.27	3.32	3.38	3.48	3.44
t2	Mean	2.95	3.07	3.13	3.27	3.27	3.37	3.44	3.40
Change	%	0.13	0.05	0.00	-0.01	-0.05	-0.02	-0.04	-0.04
Capital Stock									
t1	Mean	15.52	15.62	15.69	16.09	16.14	16.48	16.59	16.63
t2	Mean	15.54	15.65	15.71	16.13	16.18	16.48	16.62	16.67
Change	%	0.02	0.04	0.02	0.03	0.03	0.00	0.03	0.04

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	125086	134336	162074	189891	179759	147068	143951	143690	138897
Real Value Added	47977	60291	69810	85569	71845	43461	41413	49998	46126
Employment	42.4	47.8	50.1	50.0	49.7	47.3	46.6	44.7	42.7
Real Capital Stock	226874	231262	239614	244423	252617	260569	261284	270366	280152

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	107.4	129.6	151.8	143.7	117.6	115.1	114.9	111.0
Real Value Added	100.0	125.7	145.5	178.4	149.7	90.6	86.3	104.2	96.1
Employment	100.0	112.7	118.2	117.9	117.2	111.5	109.8	105.4	100.7
Real Capital Stock	100.0	101.9	105.6	107.7	111.3	114.9	115.2	119.2	123.5

Table A.2 Firm Growth Rate Calculations: Food & Beverages Sector inc. Bakeries

Changes in Logarithmic Mean

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	28	25	26	38	33	37	30	29
Real Output									
t1	Mean	17.30	17.42	17.61	18.19	17.86	18.01	18.45	18.51
t2	Mean	17.36	17.62	17.87	18.06	17.59	17.94	18.42	18.49
Change	%	0.06	0.20	0.26	-0.13	-0.27	-0.07	-0.03	-0.01
Real Value Added									
t1	Mean	15.85	16.29	16.38	17.20	16.74	16.75	17.06	17.23
t2	Mean	16.16	16.42	16.98	16.89	16.00	16.50	17.18	17.14
Change	%	0.31	0.13	0.61	-0.31	-0.74	-0.25	0.12	-0.09
Employment									
t1	Mean	2.62	2.82	2.95	3.01	3.00	3.27	3.56	3.56
t2	Mean	2.75	2.88	3.01	2.98	2.91	3.30	3.52	3.52
Change	%	0.12	0.05	0.06	-0.04	-0.09	0.03	-0.04	-0.04
Capital Stock									
t1	Mean	16.39	16.63	16.47	16.16	16.26	17.11	17.60	17.62
t2	Mean	16.41	16.63	16.49	16.20	16.26	17.13	17.62	17.69
Change	%	0.02	0.00	0.01	0.04	0.00	0.01	0.02	0.06

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	179554	189887	227220	285835	249117	181821	169282	163520	161250
Real Value Added	79253	103960	117494	188929	130841	33923	25402	28523	25950
Employment	29.1	32.7	34.4	36.6	35.2	31.9	32.9	31.5	30.3
Real Capital Stock	647859	663460	662910	671797	698755	700729	710120	727019	772389

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	105.8	126.5	159.2	138.7	101.3	94.3	91.1	89.8
Real Value Added	100.0	131.2	148.3	238.4	165.1	42.8	32.1	36.0	32.7
Employment	100.0	112.5	118.3	125.7	121.1	109.6	113.0	108.4	104.3
Real Capital Stock	100.0	102.4	102.3	103.7	107.9	108.2	109.6	112.2	119.2

Table A.3 Firm Growth Rate Calculations: Textiles & garments

Changes in Logarithmic Mean

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	36	37	32	33	28	36	31	32
Real Output									
t1	Mean	15.11	15.22	15.75	16.00	16.01	16.18	16.34	16.30
t2	Mean	14.97	15.79	16.02	15.98	15.59	16.02	16.41	16.37
Change	%	-0.13	0.57	0.27	-0.02	-0.43	-0.16	0.07	0.07
Real Value Added									
t1	Mean	14.20	14.63	14.86	14.92	14.87	14.93	15.22	15.44
t2	Mean	14.34	14.87	14.94	14.90	14.21	14.88	15.55	15.50
Change	%	0.14	0.24	0.08	-0.02	-0.66	-0.05	0.32	0.06
Employment									
t1	Mean	2.28	2.59	2.72	2.59	2.61	2.89	2.79	2.73
t2	Mean	2.37	2.69	2.67	2.59	2.64	2.78	2.78	2.63
Change	%	0.09	0.10	-0.02	0.00	0.01	-0.11	-0.01	-0.10
Capital Stock									
t1	Mean	13.79	14.06	13.97	14.04	14.33	14.90	14.87	14.84
t2	Mean	13.83	14.08	13.99	14.08	14.36	14.88	14.91	14.88
Change	%	0.04	0.03	0.02	0.03	0.03	-0.01	0.03	0.04

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	11942	10342	16235	20596	20182	11596	9727	10417	11135
Real Value Added	5413	6152	7629	8243	8069	2711	2583	3422	3640
Employment	15.6	17.1	18.7	18.3	18.2	18.5	16.4	16.2	14.5
Real Capital Stock	30059	31201	32008	32541	33592	34697	34229	35292	36778

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	86.6	135.9	172.5	169.0	97.1	81.4	87.2	93.2
Real Value Added	100.0	113.7	140.9	152.3	149.1	50.1	47.7	63.2	67.2
Employment	100.0	109.1	119.7	116.8	116.6	118.2	104.9	103.6	93.0
Real Capital Stock	100.0	103.8	106.5	108.3	111.8	115.4	113.9	117.4	122.4

Table A.4 Firm Growth Rate Calculations: Wood Products & Furniture

Changes in Logarithmic Mean

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	38	35	33	55	49	44	38	38
Real Output									
t1	Mean	16.95	16.93	17.27	17.82	17.80	17.57	17.75	17.82
t2	Mean	16.93	17.16	17.34	17.65	17.65	17.57	17.83	17.70
Change	%	-0.02	0.23	0.07	-0.17	-0.15	0.01	0.08	-0.12
Real Value Added									
t1	Mean	16.00	16.10	16.56	17.10	17.05	16.62	16.66	16.87
t2	Mean	16.12	16.38	16.65	16.89	16.56	16.49	16.91	16.68
Change	%	0.12	0.28	0.10	-0.20	-0.48	-0.12	0.25	-0.18
Employment									
t1	Mean	3.38	3.45	3.61	3.82	3.95	3.79	3.98	3.88
t2	Mean	3.46	3.54	3.59	3.83	3.86	3.81	3.87	3.82
Change	%	0.08	0.09	-0.01	0.01	-0.09	0.02	-0.11	-0.06
Capital Stock									
t1	Mean	16.05	16.05	16.09	16.82	16.96	16.89	17.10	17.08
t2	Mean	16.05	16.10	16.12	16.87	17.00	16.90	17.13	17.10
Change	%	0.00	0.05	0.03	0.04	0.04	0.01	0.03	0.02

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	124108	121089	149249	159666	132613	112686	113467	122578	107287
Real Value Added	53259	59463	76063	83403	66352	34233	30038	37693	30774
Employment	67.2	72.6	79.1	78.0	78.8	71.3	72.8	65.1	61.3
Real Capital Stock	215224	214763	224816	230825	241075	251608	253913	261696	267358

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	97.6	120.3	128.7	106.9	90.8	91.4	98.8	86.4
Real Value Added	100.0	111.6	142.8	156.6	124.6	64.3	56.4	70.8	57.8
Employment	100.0	108.2	117.8	116.1	117.3	106.2	108.5	96.9	91.3
Real Capital Stock	100.0	99.8	104.5	107.2	112.0	116.9	118.0	121.6	124.2

Table A.5 Firm Growth Rate Calculations: Metal & Machinery

Changes in Logarithmic Mean

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	36	35	33	39	33	45	33	35
Real Output									
t1	Mean	17.10	17.57	17.36	17.70	17.80	18.21	18.34	18.29
t2	Mean	17.50	17.38	17.47	17.85	17.86	18.31	18.20	18.25
Change	%	0.40	-0.20	0.11	0.16	0.07	0.10	-0.14	-0.04
Real Value Added									
t1	Mean	15.79	16.33	16.21	16.62	16.40	16.94	17.15	17.30
t2	Mean	16.27	16.30	16.40	16.55	16.71	17.14	17.27	17.21
Change	%	0.48	-0.03	0.19	-0.07	0.31	0.19	0.12	-0.08
Employment									
t1	Mean	2.94	3.17	3.19	3.33	3.30	3.48	3.47	3.53
t2	Mean	3.15	3.12	3.19	3.33	3.30	3.47	3.48	3.55
Change	%	0.21	-0.05	0.00	0.00	0.00	-0.01	0.01	0.02
Capital Stock									
t1	Mean	16.03	16.11	16.34	16.74	16.36	16.83	16.69	16.97
t2	Mean	16.05	16.17	16.36	16.75	16.40	16.83	16.74	16.99
Change	%	0.02	0.06	0.02	0.01	0.04	0.00	0.05	0.02

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	196898	275336	221201	245846	284052	302843	333917	288671	276026
Real Value Added	60640	89862	87120	104085	96510	126514	151126	169084	155470
Employment	53.4	64.7	61.8	62.0	62.0	62.1	61.4	62.0	63.1
Real Capital Stock	108555	110690	117625	120207	121744	126709	126798	133510	136832

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	139.8	112.3	124.9	144.3	153.8	169.6	146.6	140.2
Real Value Added	100.0	148.2	143.7	171.6	159.2	208.6	249.2	278.8	256.4
Employment	100.0	121.2	115.7	116.1	116.1	116.4	115.0	116.1	118.2
Real Capital Stock	100.0	102.0	108.4	110.7	112.2	116.7	116.8	123.0	126.0

Table A.6 Firm Growth Rate Calculations: Micro Firms

Changes in Logarithmic Mean

average employment between the two periods used to classify firm

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	26	17	11	17	18	19	13	18
Real Output									
t1	Mean	15.01	15.00	14.79	15.31	15.22	15.26	14.97	14.74
t2	Mean	14.96	15.05	15.26	15.34	15.04	15.16	14.82	14.91
Change	%	-0.04	0.05	0.47	0.02	-0.19	-0.10	-0.15	0.17
Real Value Added									
t1	Mean	13.59	13.90	13.61	14.22	14.03	14.12	13.98	13.97
t2	Mean	13.88	13.94	14.15	13.99	13.63	13.91	14.02	14.13
Change	%	0.29	0.04	0.54	-0.23	-0.40	-0.21	0.05	0.16
Employment									
t1	Mean	1.07	1.14	1.12	1.36	1.27	1.29	1.19	1.16
t2	Mean	1.21	1.31	1.25	1.23	1.26	1.25	1.11	1.10
Change	%	0.15	0.17	0.13	-0.13	0.00	-0.04	-0.09	-0.07
Capital Stock									
t1	Mean	13.24	12.91	13.56	13.50	13.28	13.34	12.56	12.78
t2	Mean	13.26	12.91	13.54	13.51	13.29	13.33	12.58	12.80
Change	%	0.02	-0.01	-0.02	0.00	0.01	-0.01	0.02	0.02

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	5460	5226	5489	8044	8218	6697	6039	5159	6028
Real Value Added	1661	2138	2229	3435	2641	1578	1245	1304	1511
Employment	3.3	3.8	4.5	5.1	4.4	4.4	4.2	3.8	3.6
Real Capital Stock	10080	10299	10206	10047	10081	10163	10023	10228	10446

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	95.7	100.5	147.3	150.5	122.7	110.6	94.5	110.4
Real Value Added	100.0	128.8	134.3	206.9	159.0	95.0	75.0	78.5	91.0
Employment	100.0	114.5	133.7	151.2	130.9	130.4	124.9	113.9	106.3
Real Capital Stock	100.0	102.2	101.2	99.7	100.0	100.8	99.4	101.5	103.6

Table A.7 Firm Growth Rate Calculations: Small Firms

Changes in Logarithmic Mean

average employment between the two periods used to classify firm

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	50	50	54	62	49	58	45	39
Real Output									
t1	Mean	15.59	15.57	15.97	16.40	16.44	16.03	16.22	16.19
t2	Mean	15.72	15.89	16.14	16.35	15.95	16.02	16.14	16.19
Change	%	0.12	0.32	0.17	-0.05	-0.49	-0.01	-0.08	0.00
Real Value Added									
t1	Mean	14.44	14.62	14.91	15.43	15.10	14.68	14.84	15.06
t2	Mean	14.75	14.82	15.17	15.12	14.50	14.70	15.07	15.06
Change	%	0.31	0.20	0.26	-0.31	-0.60	0.02	0.23	0.00
Employment									
t1	Mean	2.30	2.32	2.41	2.33	2.42	2.39	2.38	2.41
t2	Mean	2.43	2.39	2.39	2.34	2.36	2.34	2.33	2.33
Change	%	0.13	0.06	-0.01	0.01	-0.06	-0.04	-0.05	-0.08
Capital Stock									
t1	Mean	13.85	13.86	13.91	14.11	13.95	14.21	13.98	13.96
t2	Mean	13.86	13.88	13.93	14.12	13.99	14.19	14.01	14.01
Change	%	0.01	0.03	0.02	0.01	0.03	-0.01	0.03	0.06

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	12525	14062	18600	21672	20650	10583	10473	9652	9662
Real Value Added	4295	5612	6735	8495	5855	2335	2379	2916	2910
Employment	10.9	12.2	13.0	12.8	13.0	12.1	11.6	11.1	10.2
Real Capital Stock	4537	4600	4731	4821	4879	5039	4966	5106	5393

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	112.3	148.5	173.0	164.9	84.5	83.6	77.1	77.1
Real Value Added	100.0	130.7	156.8	197.8	136.3	54.4	55.4	67.9	67.8
Employment	100.0	112.5	119.6	118.0	119.2	111.6	107.1	102.0	93.8
Real Capital Stock	100.0	101.4	104.3	106.3	107.5	111.1	109.4	112.5	118.9

Table A.8 Firm Growth Rate Calculations: Medium Firms

Changes in Logarithmic Mean

average employment between the two periods used to classify firm

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	42	44	40	49	41	42	34	39
Real Output									
t1	Mean	17.19	17.20	17.46	17.67	17.56	17.83	17.65	17.91
t2	Mean	17.33	17.36	17.72	17.57	17.65	17.79	17.75	17.81
Change	%	0.13	0.16	0.26	-0.10	0.09	-0.03	0.10	-0.10
Real Value Added									
t1	Mean	16.22	16.39	16.51	16.78	16.66	16.86	16.64	17.03
t2	Mean	16.46	16.45	16.82	16.70	16.42	16.79	16.86	16.87
Change	%	0.24	0.06	0.30	-0.07	-0.23	-0.07	0.22	-0.17
Employment									
t1	Mean	3.45	3.59	3.64	3.62	3.65	3.69	3.58	3.63
t2	Mean	3.62	3.54	3.59	3.63	3.60	3.68	3.59	3.58
Change	%	0.17	-0.05	-0.05	0.01	-0.05	-0.02	0.01	-0.05
Capital Stock									
t1	Mean	16.93	16.77	16.67	16.78	16.94	17.14	17.28	17.49
t2	Mean	16.96	16.83	16.70	16.82	16.97	17.16	17.31	17.51
Change	%	0.03	0.06	0.03	0.04	0.03	0.02	0.03	0.02

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	73045	82632	95836	120994	109098	118462	114520	125668	113491
Real Value Added	29144	36280	38320	49988	46269	35546	32978	40334	335732
Employment	33.8	39.5	37.6	35.8	36.0	34.1	33.6	34.0	32.3
Real Capital Stock	74732	76968	81341	84056	87169	89537	90934	93805	95495

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	113.1	131.2	165.6	149.4	162.2	156.8	172.0	155.4
Real Value Added	100.0	124.5	131.5	171.5	158.8	122.0	113.2	138.4	115.2
Employment	100.0	117.0	111.4	106.0	106.6	101.0	99.4	100.6	95.4
Real Capital Stock	100.0	103.0	108.8	112.5	116.6	119.8	121.7	125.5	127.8

Table A.9 Firm Growth Rate Calculations: Large Firms

Changes in Logarithmic Mean

average employment between the two periods used to classify firm

		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
	N	20	21	19	37	35	43	40	38
Real Output									
t1	Mean	19.81	19.82	20.05	20.18	19.94	20.30	20.38	20.54
t2	Mean	19.79	19.97	19.88	20.14	19.88	20.31	20.42	20.44
Change	%	-0.02	0.15	-0.17	-0.04	-0.07	0.01	0.05	-0.10
Real Value Added									
t1	Mean	18.76	18.82	19.33	19.31	19.15	19.13	19.19	19.39
t2	Mean	18.87	19.18	19.10	19.32	18.85	19.09	19.41	19.22
Change	%	0.12	0.36	-0.22	0.01	-0.29	-0.04	0.23	-0.17
Employment									
t1	Mean	5.07	4.99	5.27	5.27	5.25	5.35	5.37	5.39
t2	Mean	5.09	5.11	5.32	5.28	5.20	5.38	5.30	5.40
Change	%	0.01	0.12	0.05	0.01	-0.04	0.03	-0.06	0.01
Capital Stock									
t1	Mean	19.73	19.58	19.95	19.70	19.75	20.29	20.23	20.33
t2	Mean	19.73	19.63	19.96	19.78	19.80	20.32	20.28	20.37
Change	%	0.01	0.05	0.02	0.08	0.05	0.02	0.05	0.04

Implied Growth Pattern 1991-1999 ('000 Cedis, 1991 prices)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	671289	660147	761932	631257	606879	566897	572610	599405	540059
Real Value Added	256941	286827	391118	303570	306706	216544	208034	254896	210464
Employment	190.1	192.8	216.5	227.0	229.5	219.3	226.1	211.9	214.3
Real Capital Stock	1384047	1395227	1461160	1483772	1600972	1675311	1710340	1794941	1869297

Index (1991=100)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real Output	100.0	98.3	113.5	94.0	90.4	84.4	85.3	89.3	80.5
Real Value Added	100.0	111.6	152.2	118.1	119.4	84.3	81.0	99.2	81.9
Employment	100.0	101.4	113.9	119.4	120.7	115.3	118.9	111.5	112.7
Real Capital Stock	100.0	100.8	105.6	107.2	115.7	121.0	123.6	129.7	135.1