MANAGEMENT CHARACTERISTICS, PRACTICES, AND PERFORMANCE IN THE SMALL SCALE MANUFACTURING ENTERPRISES: JAMAICAN MILIEU

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ABSTRACT

MANAGEMENT CHARACTERISTICS, PRACTICES, AND PERFORMANCE IN THE SMALL SCALE MANUFACTURING ENTERPRISES: JAMAICAN MILIEU

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The level of managerial capability among proprietors in the small-scale manufacturing enterprises is an area of concern for researchers and policy makers. This dissertation examines this area by making interfirm comparison of Jamaican small-scale enterpises with respect to the level of efficiency with which available resources of labor, capital, and raw materials are utilized. The measure is commonly called technical efficiency, a name given by Michael Farrell who developed the conceptual and computational technique.

The study is enriched with a rigorous examination of (a) the subsector's recent performance in employment, training, and production within the prevailing economic environment, and (b) the managerial characteristics and practices portrayed by proprietors in the subsector.

Flow data collected by enumerators twice a week over a year were used to analyze the technical efficiency measure. Data for the descriptive profiles of the economic scene and managerial attributes were collected in Jamaica by the author using a single-visit comprehensive survey questionnaire early in 1980. In all the

analysis, special emphasis is given to the tailoring and woodwork enterprise groups.

Both LP and OLS techniques are used to analyze the technical efficiency achieved relative to the frontier production curve. Variables important in explaining differences in relative technical efficiency are identified using the OLS technique also.

The findings show that the subsector is growing in the number of enterprises, the average size of the labor force and generally in the levels of product demand. It contributes 3.5 percent to GDP, employes 30,000 people, and produces 4,500 trained apprentices every year.

The percentage of proprietors who follow approved management practices is, however, usually low. For example, very few proprietors keep adequate records, separate business and nonbusiness money or engage in marketing efforts at all.

The important findings of this study is, however, the wide differences in relative technical efficiency found among firms. Firms in the subsector scored on average less than 50 percent in efficiency of what they are expected to achieve.

Differences in efficiency are explained by variables such as record keeping, apprenticeship duration, marketing effort, educational background, and amount of supervision.

DEDICATION

To my wife Abeba and our two children Alem and Ziada. Your perseverance in love, patience, and constant encouragement made the completion of this study possible.

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CHAPTER I

INTRODUCTION

1.0 Background Information

The objective of this dissertation is to examine proprietor characteristics, managerial practices, and sources and levels of management performance variations within the small-scale manufacturing subsector in Jamaica. Particular emphasis will be given to the relationship between business performance and differences in management characteristics and practices. The analytical tools that will be used to examine the above relationships are the usual statistical tools such as simple correlation as well as the use of nontraditional aspects of linear programming and regression models.

The field survey was done at the end of the first quarter of 1980. It was financed by the small-scale off-farm employment survey network conducted by Michigan State University in a number of developing countries in collaboration with host institutions. The general study on management characteristics and practices is based on a randomly selected sample of enterprises in the small-scale manufacturing subsector. Specific and detailed analysis of business performance and resource efficiency levels will focus, however, on two subgroups of the sample: wearing apparel and woodwork.

Through the use of the analytical tools mentioned earlier, a number of performance measures will be utilized to determine the relative efficiency position of enterprises. Both linear programming (LP) and a regression model will be used to explain the inter-enterprise variations in such performance levels. Particular emphasis will be given to a measure of performance which was first developed by Farrell (1957): technical efficiency (vs. allocative or price efficiency). He used the term economic efficiency to describe the combined measure for both. Briefly, by technical efficiency (in the normative or economic sense) of a firm, "one usually means its success in producing as large as possible an output from a given set of inputs" (Farrell, 1957, p. 254). A more complete description would be "the degree to which producers are achieving the greatest possible output given available resources and techniques" (Pachico, 1980, p. 1). By allocative or price efficiency, Farrell means "a measure of the extent to which a firm uses the various factors of production in the best proportions, in view of their prices" (1980, p. 254). In other words, allocative efficiency refers to the degree a proprietor succeeds in equating factor prices with their respective marginal value products. Technical efficiency is independent of factor prices while allocative efficiency fundamentally requires specific input (and output) prices and contextual or operational assumptions such as the objective function of the proprietor.

Efficiency depends mainly on the effectiveness with which inputs are organized. Therefore, the role of the manager, the decision maker and controller of the resources and economic activities, is very crucial for the attainment of higher levels of efficiency. It primarily hinges on the ability and motivation of the proprietor to organize effective work schedules, cut waste in inputs and outputs, maintain machinery and tools, cultivate harmonious employee-employer relationship and do an effective work of marketing (see Yotopoulos and Lau, 1974, p. 222). The effectiveness of any of these managerial functions will vary, of course, due to economic, social, and policy environments.

Historically, economic efficiency was almost taken to be synonymous with allocative efficiency rather than a joint measure both for technical and allocative efficiencies (Pachico, 1980).

In many developing countries, the government is increasingly becoming directly involved in the planning, promoting, and controlling the direction of economic development also of the private sector. In many instances, such involvement is a deliberate exercise of power based on a fundamental philosophical conviction of what the role of the state should be in the private economic pursuit of its nationals. In other instances, however, such involvement is imposed by economic constraints, such as the need to allocate scarce resources among competing ends (e.g., foreign exchange). Governmental involvement is particularly common in agriculture and in small-scale industries by setting up programs, agencies, and institutions. After pointing out the importance of the small-scale industry sector in a developing economy, both Petrof (1980) and Nelson (1980) make strong points why governments in developing countries should be actively involved in the promotion and development of small-scale nonfarm enterprises.

Petrof (1980, p. 55) says, "Since most of the programs and policies to stimulate small business must be of a long-term nature, it follows that in most instances they can be pursued only through the involvement of the government." Nelson (1980, p. 2) adds that government can help in removing handicaps of "lack of production skills, capital, and expertise in cost control, accounting, marketing, and management." From a slightly different angle, private business investment decisions, and the economic criteria used will, as Schultz (1980) says, determine not only the rate of development but also its direction and sustainability. Thus, government involvement can facilitate development efforts by encouraging economic choices consistent with long-term national development goals and criteria. The objective of this dissertation is not, however, to rationalize or advocate government involvement in economic spheres, but to try to provide some possible policy hints once it is already involves or plans to be involved in providing services such as credit, technical assistance, management advice, and economic information.

Thus, from a policy point of view, it would be economically desirable to identify areas of technical inefficiency among enterprises and try to increase their output without the need for additional scarce resources. Better still, if the causes of such inefficiencies could be identified, then programs and services could be provided to raise the general management level of all proprietors. Herdt and Mandac (1981, p. 379) say that, "knowledge of what factors are responsible for technical inefficiency will improve the possibility of their removal through extension education and similar means."

However, it is not easy to identify specific managerial characteristics and attributes that would help distinguish between poor entrepreneurs and good ones. Questions such as the following have always occupied the upper-most positions in the minds of economic development and social change students: Who are good entrepreneurs? What specific characteristics, attributes, and variables sets them apart from the rest of the population? Where or how do they get their entrepreneurial talents? What is their distribution among the population at large? And how do social, cultural, and economic environments affect their numerical magnitudes (i.e., their supply), their economic effectiveness and their pivotal role to influence, train, and motivate future entrepreneurial generations?[1] Many people have written diverse theories and models describing specific qualities of individuals and cultural or social environments that are conducive for entrepreneurial developments. Suffice it to say here that some have tried to identify supply of entrepreneurs with specific traits (Stogdillis, 1948) or specific behaviors (DeCarlo and Lyons, 1980, and Greenfield et al., 1981) exhibited by individuals. Others have tried to find conducive environments for the supply of entrepreneurs not so much on the individual as on the culture or

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[1]Since they believe entrepreneurial talent to be inherited or innate, some would object to the idea of individuals being influenced, trained, or motivated by others to acquire entrepreneurial qualities.

society (McClelland, 1961). Still others such as Kilby (1971) have emphasized the rooted psychological attitudes of individuals and society as a critical determinant of the supply of good entrepreneurs, thus limiting the role of later education and training. Others such as Leibenstein (1969), Harris (1970), Papenek (1967), Leff (1979), and Schultz (1980) have convincingly argued, however, that there is no supply shortage of entrepreneurs. After presenting a lucid description of the issue, Leff (1979, p. 60) concludes,

> These analytical interests, however, should not divert attention from an important fact: earlier theoretical concerns that lack of entrepreneurship would prove a serious barrier for economic development have turned out to be much exaggerated. Not only was a serious identification problem overlooked, but the various responses we have discussed permitted the impact of entrepreneurial constraints to be relaxed at the micro and industry level.[1]

While it is not consistently followed, the literature makes a distinction between management and entrepreneurship (see Leff, 1979, p. 47, for a similar view). Morris (1967, p. 281) says, "The Manager

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[1]What Leff calls identification problem and responses relaxing entrepreneurial constraints include,

1. The supply of entrepreneurship that seems to be highly elastic given favorable incentives from healthy product demarkets;
2. The emergence of a new institution, called the "Group," which is large-scale family concern involving extensive vertical integration of procurement, production, marketing and sometimes financing (from its own banking systems) of several product lines; and
3. Government actions such as
    a. tariffs, and pricing and resource controls that reduce risk and raise returns; and
    b. the creation of public corporations that pioneer in investment ventures where private investment (domestic and foreign) was not forthcoming.

is to be distinguished from the entrepreneur who introduces innovations and upsets routine management." DeCarlo and Lyons (1980) also raise a question as to whether creative type activities (entrepreneurship) are different from maintaining (i.e., management) type activities.[1] Thornton (1964) describes management functions as the "day-to-day execution of the main plan" while "entrepreneurship consists of conceiving the main objectives of organization and its method of operation, assembling its resources, making the basic managerial arrangements and periodically reviewing the fundamentals" (p. 286). Thus, entrepreneurship is commonly associated with the ownership or provision of business funds for specific goals and the willingness to assume concomitant risks (Knight, 1921).

While Frank Knight (1921) articulated the relationship between risk and the entrepreneur, Schumpeter (1934) was the person who greatly expounded on the role of the entrepreneur. Schumpeter's characterization of the innovative role includes (1) introduction of a new good or service, (2) introduction of a new method of production, (3) opening of new markets, (4) finding a new source of supply, and (5) carrying out a new organization of any industry. In short, the above list seems to say that entrepreneurship is what businessmen do; however, the key word there is "new" and it is this

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[1]They go on to suggest that the desire just to achieve may be an end itself leading to business failures which may not be due to lack of ability but due to shifting interests. Surely, such behavior must depend on the size of the current asset, the number of outside opportunities and the seriousness of a failure in the new venture.

distinguishing mark which separates the innovative from the follower entrepreneur.

Theodore Schultz (1980, p. 437) rejects "the idea of entrepreneurs as risk bearers and getting reward under uncertainty." In fact, his arguments of the entrepreneurial activities are opposite to those of Schumpeter. He does not subscribe, for example, to Morris' (1967) idea that an entrepreneur "introduces innovations and upsets routine management" in an equilibrium situation. Schultz argues that the entrepreneur is required only when routine activities are changed--when there is disequilibria, to bring the system back to equilibrium. If there is a "stationary economy," he says, "then it does not need entrepreneurs and in fact does not have entrepreneurs" (p. 443). Furthermore he adds, ". . . in a stationary (static) economy there are no entrepreneurs and there is risk;" therefore, bearing risk is not specific to entrepreneurs only (p. 441).[1] In the United States today, he counters that research and development (R & D) is carried out by the public where 70 percent of all the basic research is funded by the Federal Government and in agriculture it is 75 percent. Hence, the private sector contribution to R & D is much less than expected.

The question, then, is: do entrepreneurs spur static economic systems into higher levels of growth through their innovative and enterprising tendencies for new opportunities and profitable

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[1]Contrary to what the above statements may indicate, Schultz actually endorses Frank Knight's elaboration on risk and entrepreneurship.

ventures of investment? Or do they sit back and wait until the system has been disturbed by some force (e.g., policy, law, nature, etc.) such that a dynamic situation opening new areas of business opportunities are created? In Schultz's analysis, of course, there are no special groups called entrepreneurs to sit back in a static situation--everybody is a potential entrepreneur. (And thus by implication there is no shortage of entrepreneurial supply.)

Other issues that have been areas of controversy over the years are whether management abilities are innate and/or learned and whether management can be considered as one of the input factors of production in the neoclassical microeconomic analysis. Schultz (1980) strongly believes in the possibility of training or making individuals more aware of their opportunities by investing in education, health, and experience. He characterized outlays on such areas as investment in human capital. Others would argue that such management abilities, at least the entrepreneurial aspect of it, cannot be acquired through learning (see Kieruff, 1975). On a different aspect, Johnson (1964, p. 120) says that technically speaking management is one of the "nonconventional" inputs (e.g., like technological advance) which should not be "quantified and treated as factors of production." Slater (1980, p. 521), on the other hand, says that the management variable should be included in our models as "a factor of production" and specifically, as a measurable input.

Finally, some people make a distinction too between the returns to management and entrepreneurship. Salary is usually associated with the return for managerial service, while profit

(Thornton, 1964), or supernormal profit (Bain, 1969, and Makary, 1981) and rent (Schultz, 1980) are due to the entrepreneurial input.

With respect to the overall role of management, there is less tendency for disagreement. Dillon (1980) lists eight definitions of (farm) management before he presents his own. He describes management as "the process by which resources and situations are manipulated by the farm manager in trying, with less than full information, to achieve his goals" (p. 258). Since this definition of the managerial role explicitly introduces elements involving a dynamic (versus static) process, active (versus passive) manipulation, uncertain (versus certain) environment, goal (versus profit) orientation and a direct confrontation of situations and resources, Dillon thinks his definition is superior to the others he cited there. Although all of the definitions have one central theme running in all of them--to make business decisions that are consistent with resource endowment and the overall objectives of the firm--Dillon's version gives proprietors more scope or responsibility to show their differential managerial capabilities and expertise in decision making. For this reason, his characterization of the managerial process is relatively more realistic and highly relevant to the thinking of policy intervention.

The main management functions are to perform strategically the basic economic decisions of what, when, where, and how of production, finance, and marketing. In order to effectively carry out these decisions, it is commonly accepted now that the basic management functions should follow a systematic problem-solving routine. This routine involves the identification of problems, searching and analyzing alternative solutions, and eventually making choices, acting upon them, and evaluating the results (Johnson, 1976). Within these broad decision areas, however, some people stress certain issues or facets of the managerial role than others; for example, some people's approach tend to emphasize the human aspect of it--the planning, organizing, staffing, directing, and motivating the human capital required for a successful business performance (Koontz and O'Donnell, 1972). Whether one facet or issue is stressed more than others, the aim is still the same: the efficient use of resources (economic or otherwise) to attain particular ends.

What is the relevance of the foregoing discussions to this dissertation and what are the implications for formulations of policy recommendations? The overall objective of this dissertation is the comparative analysis of management endowments and practices and their effect on factor efficiencies. A clear understanding of the concepts involved in the analysis is vital to the successful development of the inquiry. For example, it is important for the recommendations that may come out of it whether one is constrained by the belief that there must be certain social or cultural preconditions that need to be met before the subsector can develop. Equally, a narrow belief that individuals cannot sharpen their entrepreneurial abilities or inclinations and widen their scope of awareness through literacy, extension, general education, seminars and mass-media programs will have very little to contribute to a technical assistance program. On the other hand, this is not to say that such programs are necessary to have a successful individual entrepreneur.

For the objectives of this dissertation, the positions espoused are the following:

1. The owner/operator of a small-scale manufacturing enterprise is both the entrepreneur and the manager; furthermore, at the small-scale family business level, all the managerial roles are essentially performed by this one person, the owner/operator[1] (Vincent, 1962).

2. No weight is given to the view that entrepreneurs or managers are "born, not made."

3. On the other hand, while the training and education of individual proprietors are very important for the growth of the subsector, the existing economic, social, and political environments are also important for the participation of individuals as entrepreneurs; thus, improvements in these areas could greatly minimize the importance of the so-called shortage of entrepreneurial supply (Leff, 1979).

4. With respect to the technical question of whether a management variable can be incorporated explicitly in a production function model, any specification that will show a differential contribution by management attributes _per se_ are useful; thus, management

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[1]The entrepreneur/manager or the owner/operator will be referred to as the proprietor henceforth.

proxy variables such as number of hours spent on specific management activities can be included in the model to get a better specification.

1.1 Problem Setting

Jamaica has a population of 2.2 million and an area of about 4,400 square miles. It is the largest (excluding Guyana) and most populous English-speaking country in the Caribbean.

Among the chief contributors to its 1980 gross domestic product were manufacturing (15 percent), agriculture (9 percent), mining and quarrying (9 percent), and tourism (5 percent).[1] The importance of the tourism sector lies not so much on its percentage contribution to GDP as on the liquid foreign earnings it readily provides.

Due to external investment funds flow (mainly in mining and tourism), cheaper world prices for oil, relatively trained human power and a relative political stability, many of the sectors in the economy registered high rates of growth in the fifties and sixties. Girvan and colleagues (1980) point out that in the fifties foreign trade increased eightfold, while nominal GDP and per capita national income grew by about sevenfold. In the sixties GDP increased at about 6 percent per year in real terms (GOJ, 1979b, p. 17).[2] The

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[1]The largest contributors were production of government services (20 percent) and distributive trade (15 percent), i.e., wholesale and retail (Government of Jamaica, 1981d).

[2]All Government of Jamaica publications will be cited henceforth as GOJ.

next decade was marked, however, by a pervasive decline almost in all sectors.

1.1.1 The Economic Scene: The Last Half of the Seventies

In the seventies, the flow of external funds continually declined either due to certain investment phases having been completed (e.g., mining and tourism) or other prospective ventures were becoming less attractive to investors (e.g., manufacturing and agriculture); the highly import-based economy was battered by the ever-rising cost of energy; and political friction, coupled with unprecedented political awareness and economic expectation, had created an atmosphere of instability, uncertainty, and frustration. The cumulative effect of all these contributed to a crippling shortage of foreign exchange funds, diminished domestic investment sources, created noticeable reduction in resource productivity, induced serious loss of human power from the country and resulted in dangerous unemployment problems.

Between 1975[1] and 1980, real aggregate and per capita GDP fell by about 13 percent and 11 percent respectively; unemployment rose from 21 percent to 27 percent; the consumer price index almost doubled and the Jamaican dollar fell by almost 50 percent in its exchange rate against the U.S. dollar (see Table 1). Among the sectors that showed sizeable decline between 1975 and 1980 (at a 1974 constant prices) were manufacturing (-26 percent), construction

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[1]The 1974-75 period was chosen as the base in order to make the description here comparable with the special management study survey and to avoid the unprecedented oil price increase in the early 1970s.

TABLE 1.--Economic indicators, 1975-1980: Jamaica

Indicators	1975	1976	1977	1978	1979	1980	1975-1980 Net Change
1. GDP (in real terms)[a]							
a. In millions (J$)	2,154.7	2,012.8	1,900.3	1,973.4	1,933.6	1,848.0	-14.2
Change (%)[c]	-0.7	-6.6	-1.6	-0.3	-2.0	-5.4	-12.9[d]
b. Per Capita (J$)	950.4	932.7	914.7	912.4	899.3	850.7	-10.5
Change (%)[c]	-0.7	-4.9	-1.9	-0.3	-1.4	-5.4	-11.1[d]
2. Contribution (%) to GDP by "productive" Sectors and Annual Change (%) in Each Sector[b]							
a. Manuacturing (%)	18.4	18.7	17.7	16.9	16.3	14.9	-19.0
Change (%)[c]	2.3	-5.0	-6.8	-4.9	-5.2	-12.8	-26.1[d]
b. Agriculture (%)	7.7	7.9	8.6	9.5	9.0	8.7	13.0
Change (%)[c]	1.4	-4.1	7.9	9.3	-6.8	-7.1	-2.4[d]
c. Mining/Quarrying (%)	7.2	6.2	7.4	7.5	7.6	8.8	22.2
Change (%)[c]	-21.4	-19.8	18.4	1.3	-1.5	11.3	-10.5[d]
d. Construction (%)	9.8	8.4	6.7	7.0	6.7	5.2	-46.9
Change (%)[c]	-1.3	-20.0	-20.8	3.6	-5.9	-26.5	-53.2
3. Unemployment (%)	20.9	24.2	23.5	26.0	31.1	26.8	28.2[d]
4. Consumer Price Index Year-to-Year Change (%)[c]	15.6	8.1	14.1	49.4	19.8	28.6	228.2[d]
5. Exchange Rate (J$1 = US$ __)	1.10	1.10	1.10	0.72	0.61	0.56	-49.1[d]
6. Net Foreign Reserves (J$ million)	56.7	-181.4	-196.0	-447.4	-758.5	-811.8	-2,238.4[d]

Sources: A. All of 1980 figures, Government of Jamaica, 1981b.

B. Entries 1 and 2, Government of Jamaica, 1980c.

C. Entry 3, Government of Jamaica, 1981d.

D. Entry 4, Government of Jamaica, 1981a.

E. Entry 5, Government of Jamaica, 1979b.

F. Entry 6, Girvan _et al._, 1980.

[a]In constant prices (base year = 1974).

[b]Since enterprises with a labor force of only 10 or more are covered in the Department of Statistics annual economic survey, that portion of the manufacturing contribution generated by smaller enterprises (less than 10 labor force) is probably a simple estimate. The official figures are usually revised in coming years, too.

[c]These are year-to-year percentage changes in the gross domestic product value of a sector at constant prices.

[d]Net cumulative change over the years.

(-53 percent), distributive trade, i.e., wholesale and retail, (-34 percent), mining (-10 percent) and transportation and communication (-12 percent). On the other hand, mining had shown some revival by 1980, increasing by 4 percent and agriculture (which fell by about 2 percent) would have shown a much better result if it had not been for the floods of 1979 and the hurricane of 1980 (GOJ, 1981e, p. 14).

Between the two periods, the population and the labor force grew at rates of 1.3 percent and 3.5 percent, respectively. The corresponding rates of change for the percentages of the labor force employed and unemployed were -1.2 percent and 5.0 percent respectively. The official[1] average unemployment rate for the period is 25.5 percent (see Table 1).

The general conclusion to draw from the above picture is that the period was a time of great economic difficulties, which easily poisoned the political and social life of the country. It is against this economic background that the small-scale manufacturing subsector will be examined in this dissertation.

1.1.2 The Manufacturing Sector

The industrial sector which is based on an import-substitution scheme was greatly promoted in the past through the provision of various industrial incentives. Some of these incentives included extended tax holidays, raw material importation under duty-free concessions and domestic market monopolies (Davies et al., 1979, and Chen-Young,

[1]Since the definition for labor force includes "persons not actively seeking work" (GOJ, 1981b, p. 14.2), the official figures are not likely to be underestimated.

1967). The main objectives of the scheme under the different incentive laws were to reduce importation of consumer items, increase employment, and eventually produce for export under a sound industrial base.

The incentive measures did not deliver, however, the full expected results. Although the manufacturing sector grew in real terms by about 9 percent in the fifties and by 5.5 percent in the sixties,[1] the corresponding employment growth in all sectors in the sixties was only 0.5 percent (GOJ, 1978, p. 17); part of the reason for this low growth in employment was the highly capital intensive technique of production in mining which was the major source of growth for the economy.

In the seventies, the manufacturing sector was in serious trouble. Between 1975 and 1980, not only did its output decline in real terms by about one-fourth, but its share of GDP fell also from 18.5 percent to 15 percent (GOJ, 1980c, p. 15, and 1981b, p. 1.9). The reason its share of GDP did not fall in proportion to its percentage decline of output is due to the fact that other sectors, particularly construction and distributive trade, showed worse records (-53 percent and -34 percent, respectively). The main problem in the seventies was, of course, the shortage of foreign exchange funds to meet import demands whose cost was escalating due to the rising cost of oil and other goods. This resulted in severe restrictions on the importation of raw materials, spare parts, and equipment.

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[1]Calculated from data provided by Girvan et al. (1980), p. 135.

The inescapable outcome was high production cost, dissatisfied labor force, loss of production, and dwindling (external) markets.

As a result of the poor competitive position of the larger manufacturing enterprises (due to high production costs), the unabated rural-urban drift of unskilled labor force and the desire and need to expand local expertise and productive participation, the GOJ started a few years ago to pay serious attention to the small-scale manufacturing sector. This was emphasized in the 1978-82 five-year plan document (GOJ, 1979b, p. 47). It was pointed out there that to utilize more domestic resources, check the rural-urban migration, spread (geographically and socially) the benefits from available employment opportunities, and to effectively exploit the low capital-labor ratio required there, the small-scale industrial or manufacturing subsector (SSI) should be given special policy attention.[1] The list of beneficial aspects accruing to the SSI sector may not, of course, be limited only to the points indicated above; one can also add factors such as the low human capital investment per worker, service provision to the lowest economic strata of society, the development of technical and managerial skills, the social urban integration of the unskilled labor force and the creation of development linkages between the SSI and other sectors, particularly agriculture (see also Anderson and Leiserson, 1980, p. 227; a more comprehensive coverage is given in Chuta and Liedholm, 1979, pp. 2-16).

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[1]Compared with many developing countries, the SSI in Jamaica was not really neglected. This was particularly true in the area of financial services, although there were some problems even here too (see Fisseha and Davies, 1981, p. 117).

1.1.3 The Small-Scale Manufacturing Subsector (SSI)

Typical of many developing countries, information concerning both the small-scale nonfarm enterprises (SEE), in general, and small-scale manufacturing enterprises (SSI), in particular, were usually not available in Jamaica. The industrial statistical figures produced by the Department of Statistics survey works usually refer to the larger manufacturing enterprises which have a labor force of 10 or more people. Thus, they include only about 2 percent of the firms in the small-scale manufacturing subsector (SSI) which is defined as enterprises with a labor force of 25 or fewer people[1] (Fisseha and Davies, 1981, Table 6; and Davies et al., 1979, Table 4). These 2 percent included in the formal surveys employ about 10 percent of the total labor force employed in the SSI. The overall share of the SSI in the total manufacturing sector employment is nearly 40 percent (Fisseha and Davies, 1981, p. 1).[2] More will be said later on the contribution of the SSI subsector to the economy.

Consistent with the problems that were highlighted earlier for the whole economy, the whole SSI (and the SSE for that matter), have had its share of rough times over the last few years (Fisseha and Davies, 1981). Even then, a high proportion (20 percent) of the

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[1]For a complete definition of the small-scale nonfarm enterprises (SSE) and the small-scale industrial enterprises (SSI), see Davies et al., 1979, pp. 1, 14-15.

[2]Since all the firms in the SSI are not included in the Department of Statistics formal survey works, their share of employment and production are probably rough estimates.

enterprises are recent entrants (between 1 and 2 years old) into the subsector. Also, the relative percentage share of the employed labor force in the SSI has been growing over the same period compared to that of the larger manufacturing firms.

The indications are that on balance the size of the subsector must have been growing over these difficult times. Such relative growth is influenced by many factors among which is the deteriorating economic picture in manufacturing, as well as in many other sectors of the economy. Thus, the SSE, in general, and the SSI, in particular, may have been serving as a catch-all reservoir of displaced labor from the rest of the economy.

What is important and interesting, however, is that during this difficult period, there were small enterprises from all types of enterprise groups that were growing or at least not declining in spite of the common constraints they were facing (see Fisseha and Davies, 1981, p. 35). Thus, one is tempted to inquire: what are the reasons that some enterprises managed to minimize or completely avoid business declines, while others, seemingly in the same situation, could not? Could it be related to some internal management skills or behavior, or was it due to external factors including pure luck and circumstances beyond management's control?

From a policy point of view, and particularly to a government that is trying to encourage and aid the subsector, the answers to such questions are extremely important. For, if by improving the level of management practiced, production costs could be cut, improved production techniques applied, and better marketing schemes followed, then such steps could mean the difference between business failures and successes. Furthermore, if certain management practices and characteristics could be shown to be systematically related to general areas of efficiency or excellence, then steps could be taken to promote such practices and minimize the effects of the undesirable ones. Technical aid programs could be instituted that would improve planning or management decision-making processes and increase overall resource productivity. The aim of this dissertation is to contribute information towards the realization of such general objectives vis á vis the prevailing managerial attributes, practices, and behaviors whose cumulative effect shows in the overall performance levels of each business.

1.2 Objectives

The overall objective of this dissertation is part of the Small-Scale Industries (SSI) broader project research objectives.[1] More specifically, the dissertation has four major objectives:

1. A description of the recent economic picture of the Jamaican SSI enterprises in order to get a more complete picture of the subsector;
2. An examination of the managerial practices and characteristics with the view of identifying those

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[1]The important project objectives were: (1) to provide a complete descriptive profile of the small-scale manufacturing (SSI) subsector, (2) determine its significant contributions to the rest of the economy, (3) establish a benchmark of data bank against which the subsector may be analyzed in the future, and (4) identify areas of weaknesses and strengths of the subsector and accordingly submit policy recommendations consistent with available resources and prevailing constraints.

which are most important as sources of variations in relative technical efficiency measures;

3. An analysis of relative technical efficiency variations among enterprises using new models of resource efficiency measures; and
4. An identification of program recommendations based on the outcome of the study.

Thus, based on the above objectives, this dissertation will take a closer look at the economic picture of the SSI subsector over the last few years, examine the levels and kinds of managerial practices followed there, and analyze the inter-enterprise differences with respect to the effectiveness with which resources are utilized. It will conclude by suggesting program recommendations.

1.3 Dissertation Organization

The plan of presentation followed in this dissertation will be as follows: Chapter 2 will cover the review of the research methodology, giving special emphasis to comparison of resource productivity measures between the traditional approach and the Farrell method, and a historical development of extensions and empirical applications of the Farrell method. Sampling design is also elaborated in this chapter.

Chapter 3 gives an overview of the Jamaican small-scale non-farm enterprises (SSE), in general, and of the small-scale manufacturing subsector (SSI), in particular. Topics such as economic contributions, historical growth patterns, terms of trade and persistent current problems of the SSI group are discussed here.

Chapter 4 will present the dominant features of managerial characteristics and practices in the SSI subsector. This is a comprehensive chapter covering crucial management variables ranging from proprietor geographical mobility to investment patterns of profit earned in the business.

In Chapter 5 the identification and description of the relevant production inputs, the determination of both the "average" and the frontier production functions for each enterprise group, the construction of the relative technical efficiency indices and the relationship between these indices and crucial management variables discussed in Chapter 4 are covered.

The final chapter concludes by presenting the findings of the present study, program recommendations consistent with the findings, and suggested areas of further research both to refine and expand the present study.

CHAPTER 2

RESEARCH METHODOLOGY

2.1 Introduction

This chapter will relate the traditional measures of resource efficiencies, such as labor productivity, to the newer technique or what is called here the Farrell method. Extensions and applications of the Farrell method will also be presented. It concludes by describing the exact analytical technique to be used here and the sampling methodology employed for the survey.

2.2 Conceptual Framework

The efficiency with which resources are utilized in the productive and distributive processes has always been at the heart of economic analysis, both at the micro and macro levels. Marginal analysis, which is the main tool in neoclassical economics, has been dominant in resource utilization studies in the past, so much so that the allocative or price efficiency which it measures was sometimes used as if it indicated overall economic efficiency, i.e., including technical efficiency, see below (see Marshak and Andrews, 1944, p. 145; Pachico, 1980, p. 4).

Marginal analysis usually assumes the existence of perfect competition, perfect knowledge, and perfect divisibility of inputs. In reality, however, imperfect markets exist for inputs and outputs;

there is always a world of uncertainty whose effect can only be minimized by incurring increasingly higher information costs; and the indivisibilities inherent in input and output sets limit one's choices of economic alternatives. Given all these common constraints (some face them to a greater extent than others), proprietors will respond differently to different economic situations. Such differences in responses and the accompanying outcomes depend on the degree of market imperfections, miscalculations of benefits and costs, and upon the desired goals to be achieved.

By taking the above sources of variations to the extreme, some people have placed themselves in a position of functional immobility: Pasour (1981, p. 136), for example, claims "In terms of the perfect market norm, then, efficiency is a chimera--the entrepreneur is never efficient since he is never omniscient." This could be true if efficiency is taken to mean in the absolute sense or the best ever possible under given productive system. Cheung (1974, p. 71), on the other hand, goes to the opposite extreme by stating that under traditional economic assumptions, individuals are always efficient since "every individual is asserted to behave consistently with the postulates of constrained maximization," and therefore, "economic inefficiency presents a contradiction in terms. Even outright mistakes are traceable to constraints of some type." Behaving in any one of these extreme positions would assume away a number of relevant economic issues and problems. In the real world situations, people don't adhere to any of these two views. Instead, they accept that the world is far from the perfect market norm and this gives the possiblity for seeing differences in business performances among proprietors. The imperfect norm then "calls for a shrewd and wise assessment of the realities (both present and future) within the context of which the decision must be taken" (Kinzner, 1980, p. 6).

One measurement of performance differences is the efficiency with which all resources are utilized in the business. There are two approaches, as already indicated, to measure resource efficiences: technical efficiency and allocative efficiency (see Section 1.0 for full description). The latter requires input and output prices, while the former does not.

In the next two sections, historical problems, developments, and unresolved issues with respect to resource efficiency (particularly technical efficiency) will be briefly discussed. It must be noted that resource efficiency is only one indicator of business performance. Although they ultimately depend on the level of efficiency with which resources are used, other performance measures, such as economic profitability or return to the business give a much more complete picture of the survivability of the firm. Still others, such as the debt-equity ratio, rate of return to investment, working capital position, and other financial ratios indicate different aspects of business performance (though in a limited sense). However, they are not completely adequate for inter-firm or inter-industry comparison; furthermore, the new technique developed by

Farrell can be applied on them to make them comparable across firms and across industries or between two periods of time for the same firms and industries. (In any nonidentical comparison of economic entities, the question of heterogeneity of subjects is a very crucial and so it is with the newer technique of Farrell too.)

2.2.1 Traditional Methods of Input Productivity Analysis

Before Farrell (1957) came up with his overall resource efficiency measure consisting of technical and allocative or price efficiencies, people were comparing whole sectors, industries, regions, and even countries using partial productivity measures. This was done by dividing the quantity of a single factor into the total production, however it may be measured. In fact, the concept of "technical" efficiency was not widely used as we know it today. With respect to allocative efficiency, however, there was no problem as to what it meant and how to apply it. As was said earlier, it was, and still is, the main tool of factor uses analysis relative to factor market prices.

Schickele (1941) seems to be the first person to use the words technical efficiency, although he actually meant partial or average productivity of individual inputs: ". . . efficiency can readily be expressed in terms of input-output ratios . . . the efficiency which is measured by physical input-output ratios, I shall call 'technical' efficiency" (p. 185). (From the discussion, it is unlikely that Schickele was referring to output coefficients when he wrote "input-output" ratios, instead of output-input ratios as it is conventionally done today.) Schickele had two other concepts of efficiency:

1. "Entrepreneurial" efficiency: "It refers," he said, "to the combination of productive agents devised for the purpose of maximizing income over cost in an individual firm," (p. 185); this would be what is conventionally called today returns to the household firm or to the entrepreneur or just management earnings.

2. "Social-economic" efficiency which referred to "the maximization of social net product," as opposed to individual benefits or gains (p. 186).

Other people also used the meaning of efficiency in the sense of factor productivity. For example, Johnston (1951, p. 808) says, "The term 'labor efficiency' means the ratio between the amount of available labor and the farm output." Heady and Strand (1955) used efficiency in the average productivity sense, but then recognized that it was unsatisfactory as long as it did not account for all agricutlural inputs: "All the Midwest [of the U.S.A.] for example, appears to be efficient relative to all the Southwest when groups are broad and the productivity ratio is value of output divided by physical units of labor or land," (p. 524); then they add, "One of the best measures of average resource productivity and efficiency is the relation of production to all resources used in farming. . . . Aggregate productivity of all resources is measured together . . . output for each $1 annual input of labor and capital" (p. 531).

Heady and Strand (1955) are not the only ones to realize the deficiency in the average productivity measures of individual factors.

Many others realized the weakness of such measures and attempted to correct the problem by trying to get "total productivity" through the use of index numbers by somehow weighting all inputs used (see Working, 1940; Malenbaum, 1941; Hirsh, 1943; more recently, Martin, 1956; Paglin, 1965; and Kendrick, 1961). None came with a satisfactory solution because the problem of aggregation or "adding up" has always made such efforts either extremely difficult or else outright inappropriate.

The main cricitism against the traditional average factor productivities, such as output per unit of labor or capital, is that they are (in light of the failure to construct acceptable input indices) partial average productivity measures. Each such measure compares output with only one input at a time, without the explicit recognition of the possible changes in the other inputs. Thus, it is possible that any increase in average productivity for labor, say, could simply be brought about by substitution of more capital for it (see Chuta and Liedholm, 1979, p. 34), a process if "pushed beyond a certain point, will lower the price efficiency" of an industry or firm (Farrell, 1957, p. 263). In his extensive review on the construction of indices as found in Kendrick's (1961) book, Domar (1962) commented, "If efficiency is understood in the usual sense of a ratio of the actual to some potential output, or of the proximity to some optimum, clearly the index measures neither" (p. 599). Lau and Yotopoulos (1971, p. 940) add, "The simplest--and most naive--measure of economic efficiency is a partial productivity index, usually that of labor although occasionally of land."

The danger with substituting average labor productivity measures for efficiency is that an inappropriate technique of production (e.g., capital intensive) may be recommended based on such erroneous measure. (See Chuta and Liedholm, 1979, p. 34, where such measures may be usefully employed but for a different use). White (1978) says the view that high capital-labor ratios as in the DCs are also correct for the LDCs was propagated because "the identification of efficiency with 'productivity' (i.e., labor productivity) by many international study groups and productivity missions in the 1950s and 1960s helped to contribute to this view" (p. 30). Such a belief would naturally lead to the conclusion that "efforts to provide assistance to small- and medium-size firms are suspect on efficiency [productivity] grounds" (Bailey, 1981, p. 202). Finally, after labeling the usual dichotomy between capital-intensive and labor-intensive approaches to investment as confusing and inappropriate, Bhalla (1981, p. 19) says,

> What is more realistic is an optimal degree of total factor intensity . . . it is only an optimisation of output per unit of all inputs that would lead to cost minimization . . . not so much the capital intensity or labour intensity of productive operations, nor the maximization of labour productivity.

It is against such reservations against factor productivity and index problems that Farrell (1957) came up with his concept of efficiency measurement which is consistent with economic theory and also free of any indexing problems. "It is the purpose of this paper," he wrote, "to provide a satisfactory measure of productive efficiency

--one which takes account of all inputs and yet avoids index number problems--and to show how it can be computed in practice" (p. 253).

2.2.2 The Farrell Method of Production-Efficiency Analysis

The newer technique of efficiency measurement to be discussed in this section was first developed by Farrell in his seminal article of 1957. He and Fieldhouse wrote another article in 1962 making the technique more flexible to handle more complex problems. This important analytical tool was never taken up by his followers until almost a decade later when Aigner and Chu in 1968 and Timmer in 1970 developed the concept further. Over the last few years, however, the number of professional articles appearing on the subject have been quite numerous.

As he pointed out himself, Farrell was not the first to come up with the idea of technical efficiency. Debreu (1951) had a similar conceptualization when he wrote his article "Coefficient of Resource Utilization." A number of people in agricultural economics also had some notion of it earlier. In his article on American agricultural efficiency, Schultz (1947) has ten years earlier (relative to Farrell's) said,

> The concept of efficiency is applicable to different input-output relationships depending upon the conditions set by the problem. In a certain "technical" setting it may be employed to determine, for example, how to produce the most corn on an acre of land regardless of the cost of the inputs. . . . (p. 646). (Emphasis in the original.)

Heady and Strand (1955) were also touching upon it very closely when they were using the amount of output value per one dollar of all-input expenses. So they say "Aggregate productivity of all inputs is measured together. The method cannot indicate which resource is used in excess, however, and which one is used in too small quantities" (p. 531). Furthermore, according to Schultz, when efficiency concept was applied in farm management (i.e., in the economic or evaluative sense), then it was equivalent to the first order conditions for profit maximization and thus was identical with Farrell's allocative efficiency.

It was Farrell, however, who gave the concept concrete base of theoretical validity, computational technique, and operational legitimacy by using it himself on U.S. agriculture. In addition, Heady and Strand's approach uses the amount of output per unit of isocost value while Farrell's is the opposite, namely the amount or ratio of inputs per unit of isoquant value.

The definition of production functions in neo-classical economics gave Farrell the starting base for his concept of technical efficiency. The failure of many people to come up with a satisfactory measure of efficiency, according to Farrell (1957) was ". . . partly due to a pure neglect of the theoretical side of the problem" (p. 253). He adds, "When one talks about the efficiency of a firm one usually means its success in producing as large as possible an output from a given set of inputs" (p. 254). This is the definition of a frontier production function as opposed to an average one. Henderson and Quandt (1980), for example, say,

> The production function differs from the technology [i.e., all the available technical information] in that it

> presupposes technical efficiency and states the maximum output obtainable from every possible input combinations. The best utilization of any input combination is a technical, not an economic, problem" (p. 66).

Thus, the reference point for Farrell's technical efficiency measurement is what is possible under the prevailing or existing techniques of production, in the frontier sense.

Farrell, and other people who applied the model after him, made the practical distinction between efficiency in the absolute or engineering sense and what is realizable under practical conditions. He called the former the "postulated standard of perfect efficiency" or the "theoretical function" and the latter an "empirical function based on the best results observed in practice." Farrell opted for the second concept because (1) the engineering production function (say for a plant output) would be difficult to accurately specify under variable environments, (2) the theoretical function may be an unobservable one (except being estimated from a sample of firms), and (3) the engineering or theoretical function would "likely be wildly optimistic" in light of human errors and frailties to achieve it. And he concludes, "If the measures are to be used as some sort of yardstick for judging the success of individual plants, firms, or industries, . . . it is far better to compare performances with the best actually achieved than with some unattainable ideal" (p. 255). Thus, Farrell's technical efficiency measure is a relative one, relative to the best in a sample of firms generating an estimate of the efficient or frontier production function.

What is the relationship of this frontier production to the production function of the industry or the single firm? Aigner and Chu (1968) say that the frontier production function is, in fact, the industry production function: "This maximum output applied not only to the particular firm of interest; conceptually it holds for all other firsm in the industry. We might call the function so defined the industry production function" (p. 828). This industry production function is different from an industry's aggregate production function which shows the relationship between aggregate output and the aggregate inputs used. Aigner and Chu also think that although the form of the production function of each firm is the same as the frontier (industry) production function, it is possible some of the parameters may differ. However, such difference in the parameter values will not be such that a firm's production function lies above that for the industry. Otherwise, there would be an "obvious conflict with theory" (p. 829). Furthermore, such a possibility cannot be entertained by supposing the industry production function is, in some sense, "average." They ask, "Average in the sense of what? a conditional median? a mean? or, a mode? More importantly, average about what? about output? about some inputs? about technology? or about something else?" (p. 829). The theoretical conceptualization also on the same ground rules out appeals to such concepts as "firm of average size" and "average technology." One can still speak, however, of "output on the average" from a given set of inputs, or "average" firm production function from aggregate industry production function (i.e., if firm level data are not available) or average function for the industry's aggregate production function using firm level data.

How about exogenous random disturbance or statistical "shocks" that would be confounded with the (management controllable) factors affecting efficiency? Farrell himself was fully aware of this problem. However, because of the difficulty involved in the statistical conceptualization and analysis of the error term composed both of a one-sided error (indicating management controllable inefficiency) and a two-sided one (indicating uncontrollable random effects), there was nothing that he could do at that time except to hope that ". . . if the errors are small compared with the variation in efficiencies, this bias will be negligible" (p. 263).

2.2.2.1 Graphical presentation of the Farrell method.--The key in Farrell's approach is that the relative efficiency among firms can be measured by simultaneously comparing the amount of each input used to produce one unit of output. Thus, one value or index representing each firm's level of relative efficiency from the use of all the relevant inputs would be generated. Farrell's method can best be described using a graph. Although any number of inputs can conceptually be used for diagramatic presentation, only two inputs will be considered here. He made two explicit assumptions in his presentation: (1) a frontier production relationship of constant returns to scale and (2) a convex downward sloping isoquant curve. He later relaxed the first assumption.

The logic behind Farrell's approach can be explained using a Cobb-Douglas (average) production function (although his LP result is actually a frontier one). If the production system is characterized by two inputs and one output, then the production function is,

$$y = F(X) \tag{1}$$

where,

y = output

X = vector in inputs.

Specifically for two inputs in a deterministic model:

$$y = a\ k^{\alpha} l^{1-\alpha} \tag{2}$$

where,

y = output

k = capital used in production

l = labor used in production

a = the shift constant

α = elasticity of output with respect to capital

$1-\alpha$ = elasticity of output with respect to labor.

Constant returns to scale then implies,

$$F(nX) = a(nk)^{\alpha}\ (nl)^{1-\alpha} = a\ n^{\alpha+(1-\alpha)}\ k^{\alpha} l^{1-\alpha}$$

$$= n\ (ak^{\alpha} l^{1-\alpha}) = nF(X) = ny \tag{3}$$

Thus, multiplying each of the inputs by n (where n is any positive number) results in multiplication of the output by the same magnitude.

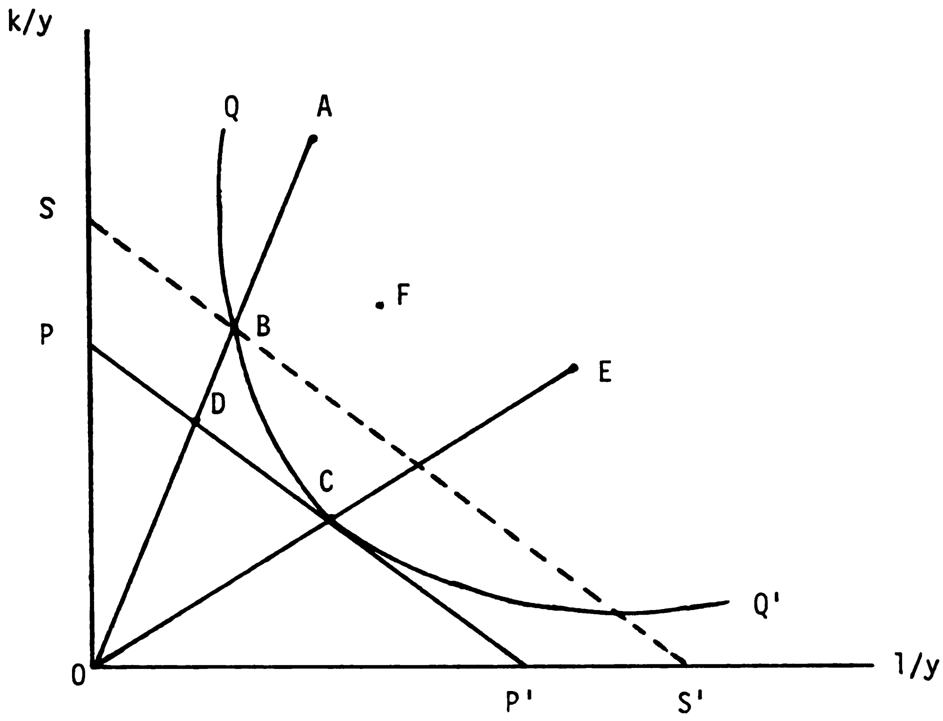
If n = 1/y, then

$$y/y = a(k/y)^{\alpha} (l/y)^{1-\alpha} = 1 \text{ unit of output.} \qquad (4)$$

The corresponding unit isoquant is drawn in Figure 1.

In a two-factor frontier production, Farrell's unit isoquant can be drawn by simply joining adjacent points of factor ratios such that the isoquant does not have a positive slope and no point lies between it and the origin. Farrell used linear programming (LP) algorithm to construct his unit isoquant. In a survey article on frontier production functions and their relationship to efficiency measurement, Forsund, Lovell and Schmidt (1980) say, "Farrell's approach is non-parametric in the sense that he simply constructs the free disposal convex hull of the observed input-output ratios by linear programming technique" (p. 9).

Since the isoquant is drawn (at least in Farrell's model) from a frontier production function, only technically efficient firms (such as B and C) will have their factor ratio on the isoquant curve itself; ratios for the less efficient firms (such as E and F) will lie



where

QQ' = An envelope of best or efficient unit isoquant

A,B,C,E, and F = Scatter of sample firms in the input/output ratio space

k/y = Amount of capital per unit of output

l/y = Amount of labor per unit of output

PP' and SS' = Factor price ratios (isocost curves).

Figure 1. Farrell's Unit Isoquant.

on the opposite side of the unit isoquant curve from the origin (O). No observation will be found between the origin and the unit isoquant.

Technical inefficiency is then measured as follows: Firm A is technically less efficient than Firm B, which uses the same technique of production, since the former uses more of both inputs for one unit of output than B. The index of inefficiency[1] for Firm A would then be measured by the ratio OB/OA. This is to say, only OB/OA (<1) amount of each input used by A would have been necessary to produce one unit of output and thus make Firm A as technically efficient as Firm B. Looking at it from a different angle, Firm A should have produced OA/OB (>1) amounts of the product with the level of inputs it is using. Similarly, the measure of technical inefficiency for Firm E is OC/OE. Thus, such a measure can be called the index of technical inefficiency with its values ranging from 1 for the most efficient firms (such as Firms B and C) to anywhere between 0 and 1 for the inefficient firms (such as A, E, and F).

It is clear that to measure technical efficiency, the prices of inputs and outputs are not required. They are necessary, however, to measure allocative efficiency which is not the primary interest of this dissertation. While each firm could have a separate set of prices, Figure 1 shows common factor prices, represented by the budget line PP', faced by all firms.

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[1]Both "index of inefficiency" and "index of efficiency" will be used in the discussion depending on the emphasis given to the measurement in the context.

Allocative efficiency implies that factors of production are used up to the point where their market prices (including any incidental expenses) are equal to the value of their marginal products and each dollar of factor expense on any one input brings in the same returns in production as in any other input. These two conditions imply that the ratio of factor prices is equal to their marginal productivity ratio which is the same as the slope of the isoquant curve QQ'. This equality would hold along the ray OE for any parallel movement of the isoquant as long as the two factor prices did not change or if they change, they do so in equal proportions.

Therefore, any firm that lies on the line OE would be allocatively efficient--but only if it falls on the isoquant curve would it be technically efficient as well. Hence, Firms C and E are allocatively efficient but of the two, only Firm C is technically efficient. By this criteria, Firms A, B, and F are allocatively inefficient.

The index of allocative inefficiency for B (and for A) is given by OD/OB. In other words, by not combining resources in the proper proportion, B is incurring a higher private cost of production per unit of output as represented by the broken budget line SS' than is necessary as shown by the budget line PP'. It fails to fulfill the first order conditions for profit maximization or cost manimization, although it is technically efficient. With respect to E, the case is the reverse (a parallel movement of both the isocost and the isoquant would still result in a point of tangency at E). Firms such as A and F are neither technically nor allocatively efficient. Thus, technical efficiency is independent not only of the factor prices faced, but of the factor proportion used.

Finally, Farrell measures economic efficiency (which in his approach is the product of technical and allocative efficiencies) as OD/OB for B (since OB/OB = 1) and OD/OA for A since

$$OB/OA \times OD/OB = OD/OA. \tag{5}$$

It is not necessary that an observation such as B actually exist in order to measure the efficiency levels such as for A. Any firm can be compared with its corresponding hypothetical efficient firm that has the same technique of production or factor ratio.

2.2.2.2 Advantages and disadvantages of the model.--Compared with the traditional methods of "efficiency" (productivity) analysis, the Farrell technique is consistent with the concept of production function or frontier; it accounts for "all" inputs used in production without the indexing number problem; it can accommodate firms using "different" production techniques; and compared even with other models based on it, the Farrell method has the advantage that it does not require an explicit specification of the functional form for the frontier production.

The major disadvantage of the technique lies in the fact that the frontier unit isoquant is determined by a sub-set of supporting observations in the sample. These sub-set of observations are the ones that lie on the unit isoquant itself. This makes the technique particularly susceptible to extreme observations and measurement errors which will bias the isoquant optimistically. Collecting more observations will not improve it; it would be like collecting more observations "to make" a sample range value narrower. The second disadvantage of the model is the restrictive assumption of constant returns to scale, although it can be handled using cumbersome calculations (Forsund et al., 1980, p. 9).[1] A third disadvantage of the model is that being a nonparametric approach, no statistical estimation is possible. It will be seen later that extensions to the Farrell method have taken care of some of these shortcomings.

2.2.2.3 Farrell's inefficiency index and management.--Since a firm's measure of technical inefficiency is constructed relative to the set of firms from which the isoquant is estimated, Farrell's technique in a way measures the efficiency of management against a realizable standard. This is possible, however, if the inputs are correctly measured both with respect to quality and quantity. As Farrell says, however, it is not possible to completely isolate the input effect from the management effect: "Thus the technical efficiency of a firm must always, to some extent, reflect the quality of its inputs, it is impossible to measure the efficiency of its management entirely separately from this factor" (p. 260).

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[1]One easy way to handle this problem would be to divide the observations (if there are enough of them) into a number of size groups and then compare a group's production frontier with another group's (Farrell, 1957, p. 259).

Other writers too (see, for example, Page, 1980, and Pachico, 1980) equate management efficiency with technical efficiency. Pachico (1980, p. 4) says, "Differences among firms in their abilities to be technically efficient are essentially differences in management." Page (1980, p. 319) speaks of his objective as being to "clarify the relationship between technical (or managerial) efficiency, the choice of technique and economic performance." Shapiro and Muller (1977, p. 293) also say, "If policy makers know why some farmers are better managers (i.e., why there are technical efficiency differentials), they might have firmer grounds for choosing among such an array of programs." Similarly, Tyler (1979, p. 478) makes the same fundamental relationship between "firm specific measures of technical efficiency" and the "exercise of managerial capabilities." Finally, Page (1980) and Shapiro and Muller (1977) have equated Leibenstein's (1966) X-efficiency or "organizational slack" with technical efficiency. Leibenstein (1977) has maintained, however, that they are distinct concepts. His argument runs,

> Two underlying neoclassical notions are retained in the notion of T. E. [Technical Efficiency]: the notion of maximizing decisions and the view of the firm as a unified and integrated decision making unit in the same sense in which an individual can be such a decision making unit (p. 313).

The second point raised by Leibenstein is not applicable in the case of small-scale enterprises, which are usually completely run and controlled by the proprietor. The first point of maximizing decisions will be covered later in this dissertation with respect to proprietors' goals, opportunities, and constraints.

A much more fundamental issue is raised though by the fact that the level of inefficiency measured by the index includes other unmeasured sources of efficiency variation besides management capabilities (see last part of Section 2.2.2 here). For example, proprietors may have different stock of knowledge, they may face different techniques of production (so that the frontier function would not then be common to all), and random disturbances could cause or contribute to deviations from the frontier production function. All these are valid points and their effect will depend mainly on two factors: (1) the extent of their presence in the sample or population and the attempts made to control them, and (2) the degree of accuracy present in identifying and measuring the variables. For the purpose of this study, it is expected that there would be fewer sources of extreme variation among small-scale enterprises of the same type, such as tailoring, than, say, in larger manufacturing or in agriculture. In fact, among the enterprises picked for this study, it is unlikely that there would be great variations in the technique of production that would cause the common unit isoquant to have a significantly different shape. With respect to the differences in the stock of information or technical knowledge among proprietors, they are assumed here to be part of management's characteristics and attributes and to the extent that they can be measured, they will be used to help explain sources of inefficiency. As for the "residual" deviation being entirely associated with technical or managerial inefficiency (which was suggested by Heady (1946) ten years earlier), no satisfactory way has been found to handle it in the frontier production function technique. Attempts have been made (see, for example, Afriat, 1972; Richmond, 1974; Greene, 1980a; and Aigner et al., 1977) to isolate the random effect of the residual from the systematic variation due to management; however, models that employ this conceptualization require certain (usually computationally convenient) assumptions about the residual or one-sided error term. Since such assumptions may not reflect the underlying distribution, they are not fully satisfactory. A more acceptable alternative is to minimize measurement errors and to control (or incorporate) as many important exogeneous variables as possible in the model. In this, the technique is no different from many stochastic models used in economic analysis. Pachico (1980, p. 8) also says, "Hence, the very usefulness of frontier production function analysis is to identify first, the best practice firms, and secondly, what characterizes them as a group." And the more refined data one uses, the closer one gets to making exact indexing of individual differences from the frontier function.

Finally, with respect to the allocative or price efficiency of the firm, it was said earlier that it was the main tool of analysis for "economic" efficiency in the past. Farrell says that not only is price efficiency estimation very complex, but its use is also much limited. The reason is, of course, that it is very difficult to discover the exact prices of inputs. Even when discovered, it is very likely that they may be related to some future prices. A firm's price efficiency will "provide a good measure of its efficiency in adapting to factor prices only in a completely static situation" (Farrell, 1957, p. 261). Further, he adds, "Thus price efficiency is a measure that is both unstable and dubious of interpretation; its value lies in leaving technical efficiency free of these faults, rather than in any intrinsic usefulness" (p. 261).

Just as Leibenstein (1966) has argued that the loss to society from X-efficiency is more than from misallocation of resources, both Timmer (1970) and Pachico (1980) think that there is a greater wastage of resources from technical inefficiency than from allocative inefficiency. Noting the fact that technical inefficiency has received much less theoretical attention in the economic literature, Timmer (1970, p. 99) says that it is, relative to allocative inefficiency, "potentially more important quantitatively (in terms of wasted resources)." Hence, due to its relatively limited potential importance, the problem of getting correct prices and problems of interpreting the results, no attention is given to allocative inefficiency in this study.

2.2.3 Extensions to the Farrell Model

While employing the basic model outlined by Farrell, many people have extended the technique to accommodate some of the points raised in the last section. Most of these extensions are summarized in a survey article on frontier production functions by Forsund, Lovell, and Schmidt (1980). The most important ones will be summarized briefly here.

As Forsund et al. (1980) said, frontier production studies can be classified according to the way the frontier or function is specified or estimated: (1) Parametric or nonparametric function of inputs, (2) deterministic or random fronteir function, and (3) statistical frontiers; finally, two other approaches (developed by Lau and Yotopoulos, 1971, and Toda, 1976, 1977) which do not require the frontier approach will be briefly mentioned.

Farrell's original model is deterministic and nonparametric. The frontier was completely and without the disturbance term determined by the best observed firms and there was no need to estimate parameters.

2.2.3.1 Deterministic parametric models.--Aigner and Chu (1968) extended Farrell's model by making it parametric but at the expense of specifying a functional form. Timmer (1970) introduced a probablistic element into their model. Aigner and Chu's basic model is cast in a homogeneous Cobb-Douglas production function (without an error or disturbance term). For a model with two inputs and one output, the functional form would be (note the number of inputs can be as many as one wants):

$$y = \alpha_0 k^{\alpha_1} l^{\alpha_2} \qquad (6)$$

where,

y = output

k = capital used

l = labor used

α_0 = shift constant

α_1 = output elasticity with respect to capital

α_2 = output elasticity with respect to labor.

Converting the model into log linear:

$$\ln (y) = \ln(\alpha_0) + \alpha_1 \ln(k) + \alpha_2 \ln(l) \qquad (7)$$

or,

$$Y = A + \alpha_1 K + \alpha_2 L \qquad (8)$$

where,

ln = natural logarithm operator

Y = log value of average production function

K,L = log values of capital and labor respectively

A = log value of α_0.

The model is then converted into a frontier production (and designated by $\hat{y}$) by requiring that all n observations (y_i's) lie on or below the efficient or frontier production function ($\hat{y}_i$'s) such that for each enterprise i,

$$A + \alpha_1 K_i + \alpha_2 L_i = \hat{Y}_i \geq Y_i \quad i = 1, \ldots, n \tag{9}$$

or,

$$A + \alpha_1 K_i + \alpha_2 L_i - U_i = \hat{Y}_i - U_i = Y_i \tag{10}$$

and,

$$U_i \geq 0$$

where,

$\hat{Y}_i$ = the technically efficient production level

Y_i = actual or observed output

U_i = the difference between the frontier and the observed (log) values.

Since the aim is to have all the observations lie on or below the frontier function, an infinite number of values for A, α_1 and α_2 will satisfy the equation, thus producing a large number of unrealistic and impossible frontier functions. So, consistent with Farrell's model that firm efficiency be judged against the best in the sample, the values of the parameters are limited to those values that make the frontier curve closer to the observed values by requiring that the sum of the (positive) errors (ΣU) be minimum.[1]

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[1]In order to make the outcome (or values of the parameters) somewhat comparable with the results of an OLS average production function, one could have minimized U^2 (using quadratic programming), but the squared errors would accentuate any extreme values or errors in measurement (Timmer, 1971).

The programming problem then becomes:

$$\text{Minimize } \Sigma U \tag{11}$$

Subject to

$$A + \alpha_1 K + \alpha_2 L \geq Y \tag{12}$$

and

$$A, \alpha_1, \alpha_2 \geq 0. \tag{13}$$

(For ease of writing, the i's have been dropped. Note also that the parameters are the unknowns here.) Summing equation 10 over all n enterprises and solving for ΣU:

$$\Sigma A + \alpha_1 \Sigma K + \alpha_2 \Sigma L - \Sigma U = \Sigma Y \tag{14}$$

$$\Sigma U = \Sigma A + \alpha_1 \Sigma K + \alpha_2 \Sigma L - \Sigma Y \tag{15}$$

Since ΣY is constant for any given sample, it can be dropped from the equation without affecting the minimum value of ΣU; any set of α_1 that minimizes ΣU for any constant will do so for any other constant including zero (see Timmer, 1971, p. 780). After dividing and expanding Equation 15 by the number of enterprises, n, the full model becomes,[1]

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[1]This LP model represents an hypothetical firm (sample-Firm) with three activities (the unknown parameters) n constraints (observed outputs from n firms) and the nonnegativity constraints (for the parameters). The known coefficients (C_i's) in the objective function are the sample means of capital and labor.

Minimize

$$A + \alpha_1 \bar{K} + \alpha_2 \bar{L} \tag{16}$$

Subject to

$$\begin{aligned} A + \alpha_1 K_1 + \alpha_2 L_1 &\geq Y_1 \\ &\vdots \\ A + \alpha_1 K_n + \alpha_2 L_n &\geq Y_n \end{aligned} \tag{17}$$

and,

$$A, \alpha_1, \alpha_2 \geq 0 \tag{18}$$

The model can then be solved using simple LP model and once A, α_1, and α_2 have been estimated, they can be used to compute the attainable maximum output $\hat{Y}$ for any given set of K and L of an enterprise. The observed Y is compared with the predicted frontier value $\hat{Y}$. The index of efficiency for the enterprise is then the ratio between the actual Y and the predicted $\hat{Y}$ or $Y/\hat{Y}$ which will always be between 0 and 1 inclusive: $0 \leq Y/\hat{Y} \leq 1$. (Except for the convenient form of the ratio lying between 0 and 1, there is no theoretical problem why the one-sided disturbance term U cannot be used as a measure of efficiency instead of the ratio.)

All efficient enterprises will have a ratio of 1 or U equal to 0. Depending on the sizes or levels of inefficiency, the rest will have ratios less than one.

The advantage of this parametric LP model compared with Farrell's is that it uses a simple mathematical form to determine the frontier (unless one has only two inputs in which case the graphical approach could be used); also it accommodates nonconstant returns to scale, i.e., $\alpha_1 + \alpha_2$ is not required to add up to 1. The disadvantage of the model is that the number of observations that can fall on the frontier function are limited by the number of parameters to be estimated. Forsund et al. (1980) say, ". . . there will in general be only as many technically efficient observations as there are parameters to be estimated" (p. 10). Furthermore, there can be no statistical estimation made on the parameters as there is no distribution assumed for U.

2.2.3.2 Deterministic statistical frontiers.--Aigner and Chu's model of Equations 6 and 10 can be written as:

$$y = a_0 \, k^{\alpha_1} \, l^{\alpha_2} \, e^{-U} \qquad (19)$$

where,

U = a one-sided error term

e = base of natural logarithm

All other variables are as given earlier.

To convert this into a statistical form, all that is required would be to make an assumption about the distributions of U and between U and the inputs.

When the model is converted into a log linear, it becomes:

$$\ln(y) = \ln(\alpha_0) + \alpha_1 \ln(k) + \alpha_2 \ln(l) - U \qquad (20)$$

or as before,

$$Y = A + \alpha_1 K + \alpha_2 L - U \qquad (21)$$

where,

$U \geq 0$ and thus $0 \leq e^{-U} \leq 1$.

By assuming that the observations on U are independently and identically distributed (iid) and that the inputs are independent of U (i.e., exogenous), many people have specified a number of distributions for U (and thus for e^{-U}). Afriat (1972) assumed a two-parameter beta distribution for e^{-U} and suggested a maximum likelihood method for estimation. Richmond (1974) showed that this amounts to a gamma distribution for U. Schmidt (1976) has also shown that Aigner and Chu's LP model would be maximum likelihood if U has exponential distribution.

The usefulness of such an approach is that the efficiency indices (or e^{-U}) can then have statistical properties such as mean and variance. The disadvantage with the model is that the maximum likelihood estimation of the parameters (that determine the functional form of the distribution) depend on what distribution is assumed for U. Forsund et al. (1980) say, "This is a problem because there do not appear to be good a priori arguments for any particular distribution" (p. 11). Furthermore, unless one specifies a particular statistical distribution for U (e.g., a gamma distribution as Greene, 1980a, did), Schmidt says that the maximum likelihood estimates will not be consistent and asymptotically efficient. But then, if such a choice is not based on the underlying distribution of the data, it becomes a convenient, if not an arbitrary, choice just for statistical convenience.

2.2.3.3 Corrected ordinary least squares (COLS).--In this model, which was first suggested by Richmond (1974), the constant or intercept term is "corrected" by the mean of the disturbance error, U. If $\overline{U}$ is the man of U, the model in the last section would become,

$$Y = A-\overline{U} + \alpha_1 K + \alpha_2 L - (U - \overline{U}) \tag{22}$$

where,

U still satisfies $U \geq 0$

and the mean of the new error term $(U-\overline{U}) = 0$.

The new error term will satisfy all the necessary conditions, except normality. Ordinary least squares (OLS) can now be used to get consistent estimates of $(A-\overline{U})$, α_1 and α_2. Given the right distribution for U, the value of $\overline{U}$ can be estimated from higher order (second, third, etc.) central moments of U.

One possible outcome or disadvantage of this approach is that some of the observations will fall above the "frontier" curve and this is not only contrary to the initial conceptualization, it will also give an inconvenient base for making individual technical efficiency indices. Furthermore, the size of the correction factor or mean of U, $\bar{U}$, depends on what distribution is assumed for U. For example, the mean of a one-parameter gamma distribution is equal to the variance of the distribution; hence, the corrector factor is the variance of the distribution. However, if an exponential distribution is assumed for the same observations, then the mean is the positive square root of the variance of the observations. Thus, one gets two totally different corrector factors for the same set of observations (unless the variance is equal to 1).

One simple approach, suggested and proved to provide consistent estimate of "A" by Gabrielson (1975) and Greene (1980a), is not to correct the constant term as above, but to shift it up such that all the observations are below the frontier and one is on it. Thus, for the average production function, the function is raised to a frontier one by raising "A" such that only one observation lies on it and the remaining are below it. That is, all the residuals are greater than zero, but one is zero.

A second approach (suggested by Aigner et al., 1977) to handle the stochastic frontier problem would be to consider the residual U to be composed of two parts: (1) symmetric or random elements that are beyond the control of the proprietor affecting U, and (2) systematic or one-sided effects (inefficiency) which are under the control of the proprietor. The old model of Equation 19 would be written now as:

$$y = a_o k^{\alpha_1} l^{\alpha_2} e^{(V-E)} \tag{23}$$

or in log linear,

$$Y = A + \alpha_1 K + \alpha_2 L + (V-E). \tag{24}$$

The frontier would then be,

$$Y = A + \alpha_1 K + \alpha_2 L + V \tag{25}$$

where,

V = a random element with symmetric distribution

E = "efficiency disturbance" or a one-sided effect, showing technical inefficiency.

In this format observations can fall above or below the frontier production function. However, there is no way to decompose or isolate that part of U due to firm specific technical inefficiency and that due to random effects beyond management's control. Aigner et al. (1977) say, ". . . it is not possible to decompose individual residuals into their two components, and so it is not possible to estimate technical inefficiency by observation" (p. 14). It is useful though, to estimate mean inefficiency over the sample. For that purpose, either maximum likelihood or the corrected ordinary least squares (COLS) can be used to estimate the parameters. In any case, the distribution of U must be specified to make the necessary statistical statements.

2.2.3.4 Nonfrontier models.--Finally, there are two models that do not use the frontier approach (i.e., they don't force a one-sided error) which can be used to compare simultaneously both technical and price efficiency between groups of firms. The inefficiencies can also be individually compared between the groups.

The first one which uses the constrained profit function was developed by Lau and Yotopoulos (1971) and Yotopoulos and Lau (1973). It can be used to test equal price efficiency, equal technical efficiency, and equal economic efficiency between groups of firms. The main problem here is that it cannot be used to test firm-by-firm efficiencies and also it requires detailed input prices, even for the technical efficient check. Furthermore, since it uses a constrained profit function, the production function must be of the Cobb-Douglas type in order to derive such a profit function. Forsund et al. (1980) say, "This practically restricts use of the model to a homogeneous Cobb-Douglas specification" (p. 18).

The second model was developed by Toda (1976, 1977) and uses a cost function. Its main use is to check price efficiency. It is not restricted to any functional form as the Lau and Yotopoulos model. Again, this model is ill-equipped to handle firm-to-firm comparison.

In conclusion, the models that seem to have less conceptual, computational, and functional limitations are the original technique developed by Farrell, the extension to it of a parametric format developed by Aigner and Chu and the corrected ordinary least squares (COLS). This is particularly true if the comparison is made on firm-by-firm basis. For comparing firms in the same industry (e.g., small vs. large ones), the Lau and Yotopoulos model and the Toda model seem well suited. Timmer's probabilistic modification is useful too.

2.2.4 Empirical Applications of the Models

A number of studies have employed either the basic Farrell model (either modified ala Aigner-Chu or Timmer or as it is) or the constrained profit function of Lau and Yotopoulos. Some of the most relevant ones will be briefly mentioned here. For the sake of completeness, Toda's application of his own model, the cost function, will also be mentioned.

All the studies that will be mentioned here refer to the efficiency or frontier production function. Empirical studies dealing with functional models attempting to explain sources of inefficiencies will be mentioned under relevant sections later in Chapter 5.

The distribution of the applications mentioned here between agriculture and nonagricultural firms is about the same. Except Page's (1980) study in Ghana, none of the studies deals with small-scale industries.

Farrell (1957) himself used his model on U.S. agriculture to compare efficiency indices among 48 states. His 1950 observation on each state consisted of aggregate outputs and inputs and thus each state was a "farm firm." He tested the inclusion of a number of inputs and their explanatory power of the residual from the frontier. He found substantial differences in efficiencies among the states.

Aigner and Chu (1968) modified Farrell's model, as already discussed earlier, and used Hildebrand and Liu's (1965) 1957-1958 data on the U.S. primary metal industry. Again, their 28 observations were state aggregations. Although their main interest was to develop a model, rather than test one empirically, they found that good use of capital was highly associated with "good" management.

Timmer (1971) introduced a subjective probability element into the Aigner-Chu model and applied again to agriculture in the 48 states. In order to introduce the probability element, he discarded (a few at a time) the most efficient firms until the model was stable with respect to the values of the parameters. His 384 observations consisted of 48 cross-sectional contiguous state values of 8 years (1960-67). He found that firms (states) at the frontier were more capital intensive and hence, the marginal productivity of labor was higher there than elsewhere. Also, the frontier firms were technically efficient, but less price efficient compared with the nonfrontier ones. His final conclusion is that 75 percent of the states were within 10 percent of the efficient or frontier production function levels.

Tyler (1979) used both the original Farrell model and the parametric Aigner and Chu (1968) modification. Using 1971 data, he examined both Brazilian plastic and steel industries. He had 16 cross-sectional observation for the first group and 22 for the second. He found widespread inefficiencies in both industries: for example, the Farrell model showed that 50 percent of the plastic firms were below 70 percent of the efficient frontier; the Aigner-Chu model also showed about three-fourths of the firms in this industry were below 60 percent of the frontier production level.

Using 1971-73 data, Page (1980) examined efficiency indices and other topics on three industrial groups in Ghana: logging, sawmilling, and furniture manufacturing. He used the Aigner-Chu model as modified by Timmer (i.e., by discarding efficient observations until the model [parameters] were stable). He discovered that on the average, firms were achieving 70 percent of the predicted frontier level. Furthermore, he found that in all the 28 logging, 36 sawmilling, and 11 furniture manufacturing firms, frontier firms showed greater capital productivity than average (OLS results) firms. He concludes that this shows ". . . improvements in technical efficiency are capital augmenting."

Two authors used the contrained profit function (nonfrontier approach) of Lau and Yotopoulos (1971). Using 1977 cross-section farm data, Leddin (1980) used it in Ireland to compare 23 small-sized and 26 medium-sized farms. He found that both were price efficient, but the medium-sized farms were more technically efficient. Trosper (1978) also used the model on American Indian ranch farms compared with non-Indian ranchers. He used 1967 data for 43 ranches. He concluded that there was no difference in technical efficiency between the two groups. As was indicated earlier, Lau and Yotopoulos' model which they applied on agriculture in India compares efficiency between groups and not between individual farms.

Finally, Toda (1976), who developed the cost function, applied it to eight industrial sectors in the Soviet Union. He used 1958-71 time series aggregate data of variables. He found there were significant differences between the shadow and actual prices in each sector. He concluded from this that there were price inefficiencies in all the sectors. This was particularly so with respect to capital usage.[1]

2.3 Analytical Models Used in This Study

Consistent with the objectives stated earlier, the models used in this dissertation will serve two purposes: (1) to measure enterprise technical efficiency performance with respect to the frontier production function, and (2) to explain the variations in efficiency performance among enterprises. Altogether, two types of models will be used to construct two frontier functions: (1) the linear programming model, as elaborated by Farrell, Aigner and Chu, and Timmer; and (2) the corrected or shifted ordinary least squares (COLS) technique. The need for more than one curve is necessary both for comparative purposes and because the COLS has statistical properties that one can make some hypothesis testing of the parameters. For purpose of comparing frontier firms with those on the

[1]There are a number of other studies that used the frontier approach to examine efficiency differences among firms and the degree to which such differences are a function of certain management variables. However, because it was felt that the above review is adequate for a sample and because some of the studies were conducted on specialized firms, e.g., regulated firms, they have not been included here.

average production function, one can simply use the results of the Linear Programming (LP) model and compare it to the results of the Ordinary Least Squares. This will help to compare the factor marginal productivities of firms at the frontier with those represented by the average production function or the OLS curve.

The variables used and their measurements are fully described in Chapter 5. It will be noted there that the effect of particularly two variables on the production functions will be examined: (1) the weighted average age of an enterprise equipment, and (2) the level or capacity utilized of fixed capital. The former is based on the assumption that newer capital equipment is more productive either because it embodies new technological progress or the older machines may be less efficient due to simple wear and tear. To account for this, each firm will have a single vintage indicator variable constructed from the age and purchase price of each equipment. Adjusting for the level of capital equipment utilization is based on the rationale that since efficiency relates achieved production to available resources, firms producing at substantially less than full capacity will appear less efficient than those which are producing at higher levels of capacity. This will be so only if the overcapitalization initially resulted from nondemand related factors, (e.g., hoarding of capital to beat inflation). Another reason to use capacity adjusted capital is to treat it equally with labor where only the actual labor flow has been included, thus excluding idle and holiday hours. Such an approach will avoid the underestimation of factor productivities. However, since under capacity production can result from inefficient management, a regression model with capacity unadjusted capital will also be checked.

2.4 Sampling Design and Scope of Study

The small-scale nonfarm enterprise (SSE)[1] survey project in Jamaica was a collaborative effort between the University of the West Indies (U.W.I.) and Michigan State University. It was sponsored by the Small Enterprise Development Corporation (SEDCO) which was changed into the Small Industrial Finance Company (SIFCO) late in 1980.

The University of the West Indies (U.W.I.) participated through one of its bodies the Institute of Social and Economic Research (I.S.E.R.) where the project was housed. Michigan State University participation included on field personnel and computer data analysis in East Lansing.

The survey field work started in late August 1978 and ended May 1980. The survey project was divided into three main phases, plus some special studies. The objectives of the three phases are given in the first two project reports (Davies et al., 1979; and Fisseha and Davies, 1981). A brief summary of each will be presented here.

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[1]The definition of an SSE employed in the study is those enterprises that employ 25 people or fewer including the proprietor and household members. Thus, a better word to use would be a work force or labor force of 25 or fewer. This definition excludes enterprises in transport, hotel, and higgling activities; it also excludes chain stores (see Davies et al., 1979, p. 1).

2.4.1 Overall Survey Project Design and Scope

The aim of the first phase of the project (Phase I) was both to identify and describe the small-scale nonfarm enterprises (SSE) in Jamaica and to prepare a sampling frame for subsequent studies. It described the number, composition, location, and size distribution of these enterprises, as well as additional information on the size and composition of labor force, the number and kind of machinery used and the workshop structure housing these enterprises.

Close to 9,500 enterprises (3,500 manufacturing and 5,900 nonmanufacturing, i.e., distribution and services) were contacted during this phase. The sample design used was a two-stage stratified sampling. The first stage of stratification was at the parish (i.e., administrative area or province) level; thus, including the metropolitan Kingston, the whole country of 14 parishes was covered. The second level of stratification was the population size distribution of cities, towns, and localities within these parishes.

There were four population size strata.[1] (These strata are sometimes referred to as locations here and in the project reports.)

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[1]The general sampling methodology is given in Davies et al., 1979, p. 9-13. The population size strata or locations consisted of the following:

1. Greater than 100,000 (Kingston only)
2. 20,000 - 100,000 (the Major Towns: Montego Bay, Spanish Town, and May Pen)
3. 2,000 - 20,000 (the Smaller Towns: about 60 rural towns)
4. 2,000 or below (about 2,250 rural localities or Enumeration Districts called here EDs).

For the purposes of the 1960 and 1970 population census surveys, Jamaica was divided by the Department of Statistics into such

The percentage of sampling coverage for each stratum is as follows: 100 percent coverage of the areas in the first two strata; 50 percent coverage of the third stratum consisting of 60 smaller or rural towns; and 4 percent from the last stratum which had about 2,250 enumeration districts or EDs. For all the localities that fell in the sample, a street-by-street canvassing of areas was conducted to complete the Phase I questionnaire. The compiled list of enterprises was the sampling frame for the subsequent Phase II survey.[1] The rest of the information has been reported in Davies et al. (1979).

The aim of the Phase II part of the survey was to describe the socioeconomic characteristics and constraints of the small-scale manufacturing subsector (SSI). Data were collected for a sample size of 710 enterprises randomly selected from the list compiled in Phase I.[2] The main topics covered in this phase were descriptions of the proprietors and the enterprises, identification, and classification of major problems faced by the subsector and some explanation on managerial practices and characteristics. This phase was a single visit (one-shot) survey and the idea was to collect policy-oriented

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Enumeration Districts (EDs). The boundaries and physical sizes of these EDs were clearly defined in special maps which were used in the survey.

[1]As already indicated, close to 9,500 enterprises were enumerated and described; to do this, about 25 enumerators and four field supervisors were directly involved.

[2]Because it was assumed there would be problems of business closures (failure), site changes, refusals, migration, and even wrong addresses, an initial sample size close to 1,000 was picked. A weighting procedure among strata and among enterprises within stratum was used to pick the sample.

data in a shorter time. The report for this Phase has been already completed (Fisseha and Davies, 1981).

The third phase dealt with the collection of flow data on inputs and outputs for 13 months. Data for the first month were discarded as it would have been less reliable during this intial learning and adjustment stage. Close to 300 enterprises were selected for this Phase from the Phase II respondents in a similar procedure as employed in the Phase II survey; by the end of this twice-a-week visit of longitudinal study, the number of respondents with adequate amount of data was close to 200.

Out of the Phase II respondents, a sample of 80 was randomly selected for the management study of this dissertation. A two-to-three hour management questionnaire was administered by the author on each enterprise at the end of its flow type study (the Phase III) in April and May, 1980. Thus, the detailed analysis on management practices and characteristics and a historical profile of the SSI presented in the first four chapters will employ the data from these 80 respondents.

The relative business efficiency analysis in Chapter 5 employs information both from the flow data for the construction of the frontier production functions and from the one-shot management questionnaire to analyze causes of inefficiency. The number of cases used to construct the frontier production functions for tailoring (i.e., tailors and dressmakers) and woodworks are 50 and 29 respectively. Garment manufacturing from tailoring and lumber production from woodworks are excluded in the analysis.[1]

Since it is generally believed that memory recall could be a problem with respondents, data for the flow questionnaire were collected twice a week by asking respondents for the previous three or four days only.[2] Either on respondents expressed preference or for administrative purposes, some respondents were visited only once a week and they were also asked for the previous three or four days only; during the data cleaning and preparation process, the data base for this particular group were updated to reflect full weekly flow of inputs and outputs. Similarly, data for missing half weeks for both groups of respondents were adjusted by using an enterprise's own half-week mean values for a specific yearly quarter within which the missing period happened to fall.

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[1]It was not possible to keep distinct the functions of the cabinet maker and the carpenter in woodworks; the majority in the sample are, however, mainly cabinet makers.

[2]One of the reasons for collecting the single visit management survey data at the end of the Phase III survey (the twice-a-week visit) was to see how annual values for certain variables compare under the two systems of data collection. The general conclusion is that the one-shot management survey tended (1) to underestimate moderaly the annual values for firm labor hours and value of production and (2) to overestimate grossly all expenses. However, only 55 percent of the proprietors were able to give the complete information (i.e., both expenses and income). The rest (ranging from 15 percent in the urban areas to 51 percent in the rural) said they cannot supply the information, i.e., they can't tell.

CHAPTER 3

THE SMALL-SCALE MANUFACTURING SUBSECTOR IN JAMAICA

3.0 Introduction

This chapter will deal with three main topics: (1) a review of the static environment wihin the small-scale nonfarm enterprises (SSE), i.e., including those that are nonmanufacturing enterprises;[1] (2) an examination of the dynamic changes that have been taking place over the years in the small-scale manufacturing enterprises (SSI); and (3) a description of the persistent problems that have been hindering production and growth in the subsector. These topics will be analyzed both at the locational (strata) and industrial (enterprise group) levels. Emphasis will be placed on the garment and woodwork industries since the model used in Chapter 5 is applied to the them. In this study garmet refers to tailoring and dressmaking only and will be referred also as wearing apparel (exclusive of footwear).

The static descriptions will specifically deal with (1) the size, type composition, and geographical spread of the small-scale nonfarm enterprises (SSE), and (2) the contributions to employment,

[1]The small-scale nonfarm enterprises was defined earlier as those that employ 25 people or fewer. This definition does not include enterprises involved in transport activities, hotels, higgling, and chain stores (whose combined employment exceeds 25).

worker training and production particularly by the small-scale manufacturing enterprises (SSI), a subdivision of the SSE. In describing the static characteristics of the SSE, a brief review will also be made of the salient findings observed in the first two project surveys (Davies, et al., 1979, and Fisseha and Davies, 1981). Such brief review of the SSE and particularly of the SSI from the earlier findings (surveys) will hopefully make the description of their static characteristics more meaningful and complete. The discussion will sometimes be cast in an urban-rural[1] dichotomy; and some parameters derived from the SSE and SSI groupings will be compared with those found in the large-scale establishments.

The dynamic changes that will be discussed in this chapter deal with the global or industry demand (mainly during the last half of the 1970), labor force size, number and composition of machinery and the market prices of key inputs and outputs. Inasmuch as change in industry demand may be reflected in the changes of either the number of firms in the industry or the output size of individual enterprises, these two indicators will also be fully discussed.

Finally, certain problems associated with production, marketing, and employment will be examined and their interactions noted. In all of these discussions, emphasis at the enterprise group level will be given to wearing apparel and woodwork; this will minimize the amount of review necessary on these industries in Chapter 5.

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[1]Rural is used here according to U.N. definition of localities with population size of 20,000 or fewer.

3.1 Contribution of the Small Scale Nonfarm Enterprises (SSE)

The first section here starts by discussing the size, scope, and composition of the small-scale nonfarm enterprises (SSE) (i.e., including those that are in the nonmanufacturing subsector). This will be followed by describing the employment[1] and training contributions of the SSE and the SSI subsector. Finally, the economic contribution (i.e., to GDP) of small-scale manufacturing enterprises (SSI) is briefly presented.

3.1.1 Scope and Composition of the SSE

There are nearly 38,000 small-scale nonfarm enterprises in Jamaica about 65 percent of which are in the nonmanufacturing group (Table 2); their combined employment of 80,000 people are also shared in an indentical manner between the two groups of enterprises. The overwhelming majority (96 percent) of the enterprises in both groups have a labor force size of five or fewer people. A complete percentage distribution of all the enterprises are given in Table 1 and Appendix I of the Phase I report (Davies et al., 1979).

In each of the subsectors, the majority of the enterprises are found in the rural areas or localities with population sizes of 20,000 or fewer: 81 percent and 84 percent, respectively, for manufacturing and nonmanufacturing enterprises. Altogether, nearly 90 types of enterprises were identified during the Phase I survey. They

[1]The term labor force, work force, and employment of an enterprise will always include all the people working in it. This includes proprietors, family workers, permanently hired, apprentices, etc.

TABLE 2.--Important characteristics of the small-scale nonfarm enterprises in Jamaica

Variable	Subsector Grouping		Both Groups
	Manufacturing	Nonmanufacturing	Jamaica
1. Enterprise number	13,340	24,400	37,740
2. Employment	29,360	50,000	79,360
3. Employment/enterprise	2.2	2.1	2.1
4. Percentage of enterprises with work force ≤ 5	93.8	96.9	95.8
5. Number of machines per enterprise	1.1	0.5	0.7
6. Percent of machines that are powered	51.0	93.9	78.7
7. Percent of enterprises keeping records	9.1	20.1	16.2
8. Percent of enterprises with permanent workshop	70.0	97.3	87.6
9. Percent of enterprises in rural areas	81.2	84.2	83.1
10. Percent of employment in rural areas	67.5	77.4	73.9
11. Percent of enterprises accounted by the largest two industries	72.8	85.8	78.3

SOURCE: Compiled from the Phase I report (Davies et al., 1979).

were later classified into nine major enterprise groups or industries (see the Phase I report, Davies et al., 1979, p. 14).

Except for craft work and auto repairs (and possibly a few of the other manufacturing categories), no distinct pattern of nationwide geographical distribution exists among the SSE enterprises. Kingston naturally accounts for a very large number of the auto repairs and manufacturing enterprises. With respect to craft enterprises, however, although a fairly large number are found in Kingston, the majority are found in the rural areas of three parishes (St. Andrew, St. Catherine, and St. Mary) and in the tourist towns of Ocho Rios and Montego Bay and their surrounding areas.

At the national level of aggregation, the average number of machines per enterprise for all enterprises is less than one. This average is one for manufacturing enterprises, however. Nearly 75 percent of the machines are powered; again, there is a difference for the manufacturing enterprises where the percentage there is only about 50. On the average, about one-fourth of all the enterprises have at least one powered machine. The distribution giving rise to such an average ranges,however, from 1 percent in craft to more than 90 percent for metal work. The average number of workers per machine (whether powered or nonpowered) for all enterprises ia about two. The corresponding average for powered machines alone is four.

3.1.2 Contribution to Employment

As indicated earlier, expect for the Phase I survey, all subsequent phases and the special studies have as their subject matter only manufacturing enterprises. For this reason, the emphasis for the rest of this review will be on the manufacturing sector and particularly on the small-scale industrial or manufacturing subsector, whose acronym here is SSI.

Toward the end of 1978, at the time that the project census of small-scale nonfarm enterprises (SSE) was conducted, the total labor force in Jamaica was about 940,000. This was out of a population of 2.1 million. By the end of 1980, the labor force had grown close to one million, i.e., an increase of 6.4 percent over 1978 (GOJ, 1980c, p. 14.3). For these two points in time, the average rates of unemployment were 26 percent and 27 percent (GOJ, 1981d, p. 3).

In 1978, the manufacturing sector accounted for about one-tenth of the total labor force and had a 21 percent rate of unemployment.[1] Of those employed in manufacturing, a little more than 40 percent were found in the small-scale manufacturing subsector (SSI). Between 1976 and 1980, the total employment in large manufacturing establishments had been continually falling. For example, this decline in 1976/77 and in 1977/78 was 7 percent and 8 percent, respectively (Fisseha and Davies, 1981, p. 2 and GOJ, 1978a, p. 1). At the same tine the SSI subsector was growing, both in absolute and relative terms. Thus, during the 1976/77 period, its labor force grew by 12 percent (Fisseha and Davies, 1981, p. 2) improving its

[1]The Department of Statistics annual labor force survey includes sectoral unemployment rates too (GOJ, 1981d, p. 83).

relative share from 36 percent to 40 percent of the total employment in manufacturing.

The average per enterprise employment figures both for the SSE and the SSI are 2.1 and 2.2, respectively. Both for the SSE and the SSI, enterprises in the urban areas employ almost twice as many people per enterprise as their counterparts in the rural areas (i.e., localities whose population is 20,000 or fewer). For example, in the urban areas the average employment for a SSI enterprise is neary four, while the corresponding figure for the rural areas is only two. About two-thirds of the SSI enterprises are one-person (the proprietor) operations, although proprietors as a whole account for fewer than 50 percent of the labor force there. In the case of the small-scale nonfarm enterprises (SSE) as a whole, however, the corresponding percentage both for enterprises and proprietors is about the same, 50 percent.

At the national level, the proportion of SSE enterprises with a labor force size between 10 and 25 is less than 1.5 percent; the corresponding proportion just for the SSI subsector is about 2 percent. The corresponding figures for the urban and rural SSI groupings are 7 percent and 0.8 percent, respectively.

About half of the labor force in the SSE consists of the proprietors or owners (in the urban areas, however, this number falls close to one-third). Permanently hired (actually "permanent" job or piece workers) and family members account respectively for about one-fourth and one-fifth of the larbor force--a large number of the family workers (26 percent) are found in the nonmanufacturing

TABLE 3.--The employment picture in small-scale enterprises (1979-80)

Item	Location		
	Urban	Rural	Jamaica
1. The SSE			
a. Average employment per enterprise	3.3	1.9	2.1
b. Proprietors as percent of total employment	35.7	58.2	51.0
c. Hired workers (%)	43.7	13.1	24.3
d. Apprentices (%)	7.7	3.4	4.3
e. Family members (%)	12.9	25.3	20.3
2. The SSI (averages)			
a. Workers per enterprise	3.8	1.8	2.2
b. Labor force age (years)	29.6	36.6	33.3
c. Females in labor force (%)	14.7	43.0	32.0
d. Apprentices trained per enterprise	13.3	2.3	4.2

Source: The Phases I and II reports (Davies et al., 1979, and Fisseha and Davies, 1981) except the last entry which comes from the management study survey (1980).

subsector as opposed to 12 percent in the SSI subsector. Apprentices represent only 4 percent of the SSE labor force, although the percentage goes as high as 10 percent for the SSI group.

The number of workers in the SSI labor force who are hired on a "permanent" basis is small; only 22 percent of all the skilled workers are paid on time rate. The rest are paid as job workers or on the basis of piece rate. The case for the apprentices is, however, the reverse: more than 80 percent of them are paid on time rate.

SSI females represent nearly half (49.3 percent) of the proprietors, but only about one-third (32 percent) of the labor force. Their share in the SSI labor force ranges from 14.7 percent in the urban areas to 45.0 percent in the rural localities (where more than 80 percent of the enterprises are found). The high proportion of females (it is close to 60 percent among the proprietors) in the rural areas is due to the large number of dressmakers and straw craft makers there, activities almost entirely dominated by women.

The average age of the labor force (including the proprietors) is about 33 years. If the proprietors are excluded, the average drops to 27 years. Except for the unskilled groups, males are generally older than females. The average age for the "permanently" hired (i.e., including job or piece rate workers) is 28.5 years with a median of 25. In the case of this group, however, the mean number of years worked in an enterprise is nearly four years. The average age of apprentices is only 20 and the median is 18.3 years. They have also worked in the enterpsie for a mean period of 2.5 years (median is 2).

3.1.3 Contribution to Worker Training

One of the important contributions by the SSI enterprises is the training of apprentices for future skilled workers and proprietors. It will be noted in the next chapter that more than three-fourths of the proprietors acquired their skill through some kind of participation in an apprenticeship scheme. The average duration of their apprentice training was about 21 months.

The national visibility of apprentices is insignificant in the SSE: they account for only 4.3 percent of the labor force there. Their share of the labor force in the SSI, however, rises to 10 percent. It is even more significant to note that each SSI has trained about four (the median is 2) apprentices on the average. Since the average age of a SSI enterprise is about 13 years, this amounts to training one apprentice every three years by each enterprise. The highest rate of apprentice training occurs in the urban areas, although the average enterprise age there is only 8 years.

Among the important enterprise groups, those that show the highest rate of apprentice training are woodwork (8 apprentices per enterprise), repairs (6), metal works (6), shoemaking (5), garment (3), and craft (3). Foods has the lowest rate for apprentice training with an average of less than one per firm.

If the average number of months of apprenticeship for each proprietor in a given industry is taken as a proxy for the usual duration of apprenticeship training, then the major industries rank as follows: auto repairs--three and one-quarter years; woodwork--

three full years; metal works--a little under three years (33 months); garments and shoemaking--each one and one-half years; and craft work--only two months. The policy implications of such depth and breadth of training will be discussed in the concluding chapter.

3.1.4 Contribution to Gross Domestic Product (GDP)

During the survey year, the SSI subsector generated about J$148 million to Gross Domestic Product (GDP) at purchasers prices compared to $682 million for all manufacturing sector, and $4,289,000,000 for the whole economy (see GOJ, 1981e, p. 13). Thus, the SSI subsector contributed about 3.5 percent to GDP or about 21.7 percent that of the manufacturing sector as a whole. The SSI contribution to GDP of 3.5 percent is quite high compared to the 2.9 percent contribution by Sierra Leone's SSI enterprises, particularly since the Sierra Leone study includes also enterprises that employ between 25 and 50 people, compared to the Jamaican study with a labor force of 25 or fewer only (see Chuta, 1977, p. 50).[1]

Given their large number, the contribution by the Jamaican SSI enterprises to GDP is relatively modest. This is not surprising

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[1]For example, if enterprises with employment sizes of up to 50 had been studies, it is likely that the contribution to GDP by the Jamaican SSI would have risen to about 30 to 35 percent. This would have been impressive given that the level of industrial development in Jamaica is quite high.

since the average annual value of production in the subsector is about J$10,000. In fact, about 45 percent of the SSI contribution comes from about 800 firms (only 5 percent of the total) with a gross annual value of production ranging between J$50,000 and $325,000. About 45 percent of the SSI contributions also comes from the rural areas--the EDs along contribute about a third of the total. Of that contributed by the urban enterprises, about 30 percent comes from Kingston whose enterprises average about $26,000 a year in value of production. The corresponding annual value of production for the remaining locations (strata) are $44,000, $15,000, and $5,000, respectively for the Major Towns, the Rural Towns, and the EDs.

The manufacturing contribution to GDP by the SSI subsector must be seen relative to its capital labor ratio vis a vis the large-scale manufacturing firms. In 1979, the value of fixed capital (at replacement value) per unit of labor was J$2,041 in the SSI subsector. The corresponding value for all the manufacturing sector was $8,605 (see Ayub, 1981, p. 58).[1] Thus, the corresponding value for just the large-scale firms must be much higher than the overall average indicated here. In fact, for a sample of selected groups of firms with gross annual sales in excess of half a million dollars, Ayub gives this ratio close to $11,000 as of 1973 (p. 24). It may be concluded, therefore, that the capital-labor ratio in 1979 for the

[1]Ayub's capital value is not replacement value. Most probably it is book value.

large-scale manufacturing firms may be at least five to seven times as much as in the SSI subsector.[1]

In conclusion, when the necessary calculations are made for the total employment and dependency,[2] the number of people who are directly supported fully or substantially by the small-scale nonfarm enterprises (SSE) in Jamaica could be anywhere from one-quarter of one million to 300,000 people. This is more than one-eighth of the national population. When the other contributions, such as indirect employment creations, the training of apprentices, the generation of foreign exchange (e.g., the craft industry) and the social and political benefits are considered, the role of the small-scale nonfarm enterprises subsector in the national economy holds an important place. For general descriptions of such contributions to an economy, see Chuta and Liedholm (1979, pp. 2-7).

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[1]Because of data paucity or incomparability, no such comparative analysis could be made in terms of value added. For the SSI subsector alone, however, the rate of value added in gross value of production was about 80 percent. The fact that some clients (e.g., in tailoring) bring some of their own raw materials will probably tend to alter this rate. The distortion will be small, however, as the main input in the SSI subsector is (own) labor. In fact, for this reason out of every dollar of sales, about 60 ¢ accrues to proprietor and family labor (and normal profit).

[2]Dependency refers to the number of people or family members who get more than one-half of their support needs for more than half of the year from the person who is working in a SSI enterprise. The working person could be the proprietor, a permanently hired worker or an apprentice. The mean number of dependents for each of these three labor categories was 5, 2.5, and 0.3, respectively. This information was collected along with the management study data; these averages were assumed to be the same for the SSE enterprises also. Only about 6.4 percent of the total income to support these "dependents" comes from sources other than the small-scale nonfarm enterprises (see Section 4.1.3.4).

Regarding skill development through apprenticeship training, the SSI are far more important than the nonmanufacturing enterprises: The percentage of apprentices out of the total labor force among the nonmanufacturing group of enterprises in the SSE is only 0.8 (10 percent in the SSI enterprises). Although their number is half as many, the SSI enterprises support nearly 90 percent (125,000 people) of what the nonmanufacturing group of the SSE as a whole do.[1] They also contribute about 3.5 percent to GDP.

3.2 Recent Economic Trends

Earlier in the problem-setting section of Chapter 1, the plight of the Jamaican economy was reviewed. During roughly the last half of the 1970s, manufacturing output declined by about 26 percent and the national GDP fell by 13 percent. It was noted that the small-scale manufacturing subsector (SSI) seemed to be growing, number-wise at least, relative to the larger scale subsector.

In this section, a closer focus will be applied to the SSI to see what changes have taken place over the years and particularly during the second half of the 1970s. Special attention will be given to changes in the global or industry-wide product demand and the extent to which such demand changes are due to changes in number of firms in the industry and demand (own output) changes among existing firms. Furthermore, changes in the price structure of key inputs and outputs will be closely examined with the view that (a) they

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[1]Unless indicated otherwise, discussion henceforth will deal with the small-scale manufacturing or industrial (SSI) enterprises. When both manufacturing and nonmanufacturing are included, they will still be referred to as SSE.

might have influenced the level of production at the industry level or at the individual firm levels and (b) they may shed some light on the terms of trade for the subsector.

The direction of changes both in industry demand, number of industry firms, and own output were supplied by proprietors who were asked to state the general business trend in their own industry and their own enterprises over the last year and the last five years. the proportion of proprietors who responded with an increase are then compared with those who responded with a decrease. The difference between these two proportions is taken as a guide to explain trend changes in the respective area for a particular period of time. Such differences show only the net percentage of respondents who claim the demand or firm size to have improved or deteriorated over the period and not the actual rates of business growth or decline (see Haggblade et al., 1979, p. 37). This will be made clearer as the economic trend indicators of industry demand, number of firms, and own output are anlayzed in the following pages.

Changes in the size of an enterprise are also examined using changes in initial labor force size and number of all machines and specifically of powered machines over the years. As respondents were required to remember the numbers for these variables when the business was established and at the time of the interview (1980) only, rates of changes for them are relatively more reliable--i.e., there is less dependence on personal judgment compared with some of the other indicators.

3.2.1 Changes in Product Demand Levels

In attempting to describe the general economic picture of the small-scale manufacturing subsector over the last few years, the attention in this section will be on the demand situation. The basis for such analysis will be proprietors' perception of both demand levels and other external influences. Their responses are shown in Table 5. Before discussing that table, however, it would be useful to review the basis or criteria on which such responses were made. In other words, when respondents describe the demand level as being weak or strong, what are the criteria used to measure such weaknesses or strength? Attempts were made to find answers for this question. The results are shown in Table 4.

TABLE 4.--Indicators used by proprietors to estimate trend changes in demand (percent of proprietors)

Indicators	Percent
1. Total Sales (or Work)	91.1
2. Total Cash Received	5.4
3. "Profit"	2.5
4. Periodic Withdrawals	0.6
5. Other	0.4
	100.0

Source: Management Study Survey, 1980.

It is important to keep in mind that the indicators shown in Table 4 refer to description of the general business condition or state. It does not necessarily imply that the same variables are used by proprietors to analyze the periodic financial performance of their respective businesses. It will be shown in Chapter 4 that variables or criteria used for the latter purpose are different (except for total sales and profit) than those shown in Table 4.

Table 4 shows then that the demand responses given in Table 5 are based mostly on total sales or total amount of work done. When close to three-fourths of the total business (production) in the SSI enterprises is done on customer order basis, as opposed to production for stock or inventory (see Chapter 4), sales and work assume almost the same meaning. The respondents who gave "total cash received" as criteria are those 85 percent of whom have reported in Chapter 4 quitting extending credit (presumably because they may have been losing money from bad debts or credit sales).

Looking at Table 5, respondents' perception of what happened to demand over the previous year is not clear. Equal percentages thought business has improved (35.9 percent) and declined (34.7 percent), with the rest sensing no change. However, the analysis of such an aggregate response is misleading since there is a cancelling effect of answers across different industries. When the responses are examined within each industry, the existence of some trend is more obvious. Table 6 shows this industry-by-industry difference which will be discussed next.

TABLE 5.--Recent economic indicators of the SSI[a] subsector (percent of enterprises)

Indicators	Percent of Proprietors			
	1 Decreased	2 Same	3 Increased	4 (3-1)[b]
Period				
1. Over the last year[c]				
a. Industry Demand	32	31	33	1
b. Number of Firms	33	34	33	0
c. Own Output	39	29	32	-7
d. 1978 Output Value Compared with 1977[d]	53	30	16	-37
e. 1979 Output Value Compared with 1978	64	7	26	-38
2. Over the Last 5 Years[c]				
a. Industry Demand	20	28	43	23
b. Number of Firms	24	22	45	21
c. Own Output	31	14	51	20

Source: Management Study Survey (1980).

[a]SSI stands for the small scale industrial (manufacturing) enterprises subsector.

[b]Percentage increase minus percentage decrease.

[c]The balance from 100 percent is accounted for by people who didn't know the direction of the trend.

[d]This information was collected during the Phase II survey.

3.2.1.1 Over the one-year period.--An examination of the one-year period reveals the following from Table 6. Metal works, shoemaking, and wearing apparel (tailoring) seem to have their industry demand increased over the year. The remaining industries mentioned in Table 6 had a decline with the largest percentage of enterprises reporting such a decline found in woodwork.

The increased industry demand level in wearing apparel is reflected in increased number of new firms and expanding output of existing firms. Table 6 reveals there is great variation at the industry level. Thus, wearing apparel (except dressmakers which are not shown in Table 6), metal works and shoemaking had increased output demand while this is not true for woodworks, craft, and repairs.

Both for craft and repairs, the industry demand is described as declining over the year. In craft, this is accompanied by declines both in the number of enterprises and in own output. In the case of repairs, the declining industry demand is not only accompanied by an increased number of new firms joining the industry, but the existing ones were losing slightly, although the perception of proprietors seem to be less definitive for this particular group.

In the case of woodworks, there was both a general industry demand decline and an increase in the number of firms. Both of these resulted in a decline of the output in existing enterprises. The main problem with the woodwork industry was the lack of lumber (Fisseha and Davies, 1981).

TABLE 6.--Industrial differences in change of demand indicators (percent of enterprise)

Demand Indicators	Industry Groupings											
	Garment		Woodwork		Metalwork		Craft		Repairs		Shoes	
	1	5[a]	1	5[a]	1	5	1	5	1	5	1	5
1. Industry Demand												
a. Decrease	5	5	78	46	0	46	32	24	49	24	21	36
b. Same	39	26	2	6	35	0	48	24	31	10	0	0
c. Increase	45	53	20	48	65	54	20	53	21	66	79	64
d. (c-a)	40	46	-58	2	65	8	-12	29	-28	46	58	28
2. Number of Firms												
a. Decrease	19	20	24	24	0	29	64	38	16	14	74	67
b. Same	52	42	34	11	77	35	16	0	38	21	0	12
c. Increase	29	37	42	30	23	37	20	62	46	65	26	21
d. (c-a)	10	17	18	6	23	8	-44	24	30	51	-48	-46
3. Own Output												
a. Decrease	26	20	50	18	25	29	57	74	27	45	18	32
b. Same	14	43	32	8	29	35	38	0	54	6	21	0
c. Increase	60	37	17	48	46	37	5	26	19	48	61	68
d. (c-a)	34	17	-33	40	21	8	-52	-48	- 8	3	43	36

Source: Management Study Survey (1980).

[a]The 1 and 5 stand respectively for the one-year and five-year periods.

Industrial demand in metal works was good over the year and not only did this increase the output (demand) of existing ones, but it also attracted some new ones. There was also an improvement in shoemaking, which also resulted in an increase in own output of existing ones; however, for some reason proprietors' perception is that enterprises were also leaving the industry, i.e., closing down. Could it be that the increased own output that may have resulted from some enterprises closing down was wrongly interpreted as an increase in the industry-wide demand?

To sum up for the one-year period, although the aggregate picture presented in Table 5 implied no change in industry demand and size, dressmakers (the very small ones) actually either declined or remained constant as will be shown later.

It should be remembered, however, that a one-year period may be too short to establish trend; furthermore, the number of enterprises for some of the industrial groupings is small. Thus, the one-year industry demand change must be interpreted with great caution. For this, the two-year and five-year periods are more suitable as will be seen in the following discussion.

3.2.1.2 Over the two-year period.--Table 5 also shows 1978 and 1979 each compared with the year just preceeding it.[1] In both years, the difference in percentage points between those who experienced a demand decline and those who had an increase is about the

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[1]Both during the Phase II survey of January-February 1979 and the Management Study survey in April-May 1980, respondents were asked to compare the last year with the previous year for volume of output or sales.

same (see fourth column, Table 5). However, the percentage of proprietors who thought business was stable declined from 30 percent for 1978 to 7 percent for 1979; and the percentage of respondents who said business was better than the previous year increased from 16 percent for 1978 to 26 percent for 1979. The cumulative picture for the two years indicates that on the aggregate demand was declining for the SSI subsector. This is also indicated in Table 7, where although 1979 sales were higher by 4 percent on the average from those in 1978, about 50 percent of the enterprises registered a decline of 29 percent. Machinery was used only at half capacity and the number of new workers needed to bring production to capacity is also about equal to those who are already working. This also indicated production could be doubled before reaching capacity levels.

The other entries in Table 7 further describe the demand problem in 1979. Close to two-thirds in each case mentioned demand shortage as a cause of decreased levels of both production and employment. More will be said in Section 3.3 on the demand problem. Table 1 on page 15 also shows 1979 was a very bad year for the Jamaican economy; except for 1976, none of the other periods listed there showed a negative growth for all the sectors as 1979 does. Furthermore, unemployment reached its peak of 31 percent during this year. At the industry level, woodwork, craft, and shoes reported output decline in 1979, compared with 1978, with a percentage of 83, 79, and 70, respectively, of the respondents. For the remaining industries, the number of respondents who reported such decline was 50 percent each for garment and repairs and 33 percent for metal works.

TABLE 7.--Business condition indicators for 1979

Indicators	Mean	Median
1. 1979 Production comared with 1978 (% change)	4.2	-29.1
2. Percent of proprietors indicating excess capacity	90.7	--
3. Machinery capital level utilized (%)	52.5	49.6
4. Duration of current capacity under-utilization level (months)	26.2	12.3
5. Number of new workers needed to bring up to capacity	2.6	1.5
6. Additional hours per worker per day required to reach capacity	3.2	3.3
7. Percentage of proprietors citing demand shortage:		
a. as cause of excess capacity	65.0	--
b. as cause of limited employment	67.7	--
c. among the 1979/80 top three problems	58.1	--

Source: Management Study Survey (1980).

3.2.1.3 Over the five-year period.--Over the longer period of five years, the aggregate picture presented in Table 5 is more distinct. A full 23 percentage points more proprietors reported the industry demand has increased over the last five years than those who thought the opposite. The corresponding percentage points of increments for number of firms and own output are 21 and 20 percent, respectively.

Pursuing further the change in the number of enterprises, it is clear that in the perception of the proprietors, the number of enterprises has grown in aggregate (industrial differences will be noted later). The Phase II survey showed that 10 percent of the enterprises were one year old or less; 37 percent of the total were five years old or less (Fisseha and Davies, 1981, Table 4). Thus, there are a lot of new entrants into the subsector; this would give one reason to think that the number of SSI enterprises may be growing. However, without knowing the number of businesses that have closed down for the corresponding period, it is not reliable to speak of growth or decline. Chuta and others (1981) checked the growth rates of the number of enterprises and the labor force in the small-scale manufacturing subsector of Sierra Leone between 1974 and 1980 by checking these variables at both these times. Using the same survey instrument and methodology on the same firms or areas for the two period, they were able to estimate the average annual growth rates for firms and the labor force.

The method applied in the Jamaican case was less refined compared to that used by Chuta, Liedholm, and others; however, it will serve to give a rough indication of what is happending to the number of enterprises in the SSI subsector. As was indicated in Chapter 2, the Phase III sample was picked out of those respondents who participated in the Phase II survey. A year later, at the end of the Phase III survey, enumerators were asked to go back and visit each respondent in the original Phase II sample[1] (i.e., excluding those who are already giving us flow information) and confirm whether they are still doing business or not. The rate of confirmed or reported business closures among these respondents ranged from as low as 3 percent in some parishes (disregarding population size strata) to as high as 15 percent in others; this gave a nationwide average of 7 percent. During this confirmation visit, some respondents who could not be contacted were reported by neighbors and acquaintances to have moved away from their original addresses or localities. To the extent that some of those who changed addressed may have had subsequently closed down business, the rate of 7 percent attrition may go up to 8 or 9 percent.

During the Phase II survey, it was reported that about 10 percent of the enterprises were less than one year old (see Fisseha and Davies, 1981, Table 4). If this rate is assumed to hold for the following year as well, then combining this with the 7-9 percent rate of business closure given above, the number of enterprises in

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[1]Two things should be noted about this sample: (a) it was much larger than what would eventually be needed for the flow or Phase III study and (b) being, itself, a random sample of the population, the rate of business closure in it would also approximate that of the population; see page 65.

the SSI subsector may be growing at an annual rate of anywhere from 1 to 3 percent.[1] There is, of course, great locational and industrial differences where, in some cases, the growth rate will be higher and in others even negative.[2]

The industrial differences for the five-year period are presented in Table 6. Except in woodworks and possibly in metalworks, the industry demand has been growing in the remaining industries. The largest percentage of respondents who thought industry demand has increased are found in repairs and wearing apparel (tailoring). Just as in the one-year period, the increase in industry demand for garment is reflected in increased levels both in the number of enterprieses and in the individual enterprise output. This is also true for metalworks and possibly for woodworks. In the case of repairs, the increased demand is taken up by new firms.

In the remaining industries which showed an increase in demand, there was a trade-off between changes in number of firms and own output or demand. The case with shoemaking is the same here as

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[1]The rates of business attrition and entry refer here to those enterprises which are older than one year; those that come and disappear within a year are left out. Thus, although the rates of attrition and entry are underestimated, there is no effect on the net change.

[2]In the initial stage of this dissertation proposal, the prime motive, to study management variables _vis a vis_ business success was, among other things, to compare differences in managerial characteristics and practices among proprietors who recently dropped out from business and those still in business. The inability to trace down those who were said to have closed down business in the towns forced the cancellation of this objective at the outset.

the one-year period. An increase in industry demand is associated both in increase in own output and a decrease in number of enterprises. As noted earlier, the increase in own output may have resulted from some enterprises closing down and such phenomena may have been wrongly identified with an increase in industry demand.

To sum up this subsection, over the five-year period, the industries that have been growing in demand are repairs, garments, craft, shoes, and possibly metalworks. Woodworks barely maintained its initial demand level. Except in craft and shoemaking, the growth in demand was accompanied with growth both in the number of firms and the output of existing enterprises. In craft growth in the number of enterprises resulted in decreased demand or output for those already in the industry; in the case of shoemaking the decrease in the number of enterprises may have resulted in increased output or demand for those still in the industry (see earlier caveate though).

Over the five-year period, the locational differences show that the industry demand grew both in the urban and rural areas. This growth was accompanied by growth in our output in all the localities and growth in number of firms mainly in the Major Towns and the EDs.[1]

To finally conclude from the economic indicators presented in Tables 5, 6, and 7, the number of enterprises has been growing at least over the last intermediate term of five years. In fact, it may be growing at an annual rate of 1 to 3 percent. Similarly, other variables such as the labor force, powered machinery, and all machines combined have been growing at an annual equivalent rates

[1]EDs stands for Enumeration Districts (see Section 2.4.1).

of 2.8 percent, 3.4 percent, and 2.8 percent, respectively, over a mean period of 13 years (see next section). With respect to the aggregate product demand situation, it also has been growing over the years; however, the possible rise in the number of SSI enterprises and the declining real income level of the average Jamaican consumer may have contributed to some hard times in 1978 and particularly in 1979. Still, it can be concluded that during the last half of the 1970s (a period of great economic hardship brought about by internal and external factors), the small-scale manufacturing enterprises may have fared relatively much better than their larger counterparts in the manufacturing sector. The impression one gets from Tables 5 and 6 and the employment picture over the years seem to support this view (see GOJ, 1979a, p. 3 and 1981b, p. viii; and Fisseha and Davies, 1981, p. 2). For even during the difficult period of 1979, the average number of nonproprietor workers was about 5 percent higher than at the beginning.[1] There seems to have occurred, however, a shift from job workers (-6.2 percent) to family workers (11.0 percent) and apprentices (1.8 percent). It is possible that proprietors may have been trying to cut expenses by shifting to family members and apprentices. By contrast, total employment

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[1]In order to see the effect of the largely I.M.F. advocated (1979) economy-wide restriction on demand or expenditures, SSI respondents were asked to describe the number of nonproprietor workers and their distribution among the different labor categories (e.g., family workers, apprentices, and permanently hired) at the beginning, in the middle, and at the end of the survey year. The average number of nonproprietor workers for the three points of the year respectively are 1.45, 1.375, and 1.521; the corresponding medians are 0.407, 0.338, and 0.399. Roughly during the same period, employment in the large-scale manufacturing declined by about 12.6% (GOJ, 1981c, p. 2).

in the large manufacturing establishments declined at least by 8 percent in 1979 as it has done in 1976/77 (-7 percent), 1977/78 (-8 percent), and 1978/79, October to October (-9.8 percent); (see GOJ, 1981b, p. 14.6; Fisseha and Davies, 1981, p. 2; GOJ, 1979b, p. 5; 1981d, p. 49; 1979a, p. 1).

3.2.2 Changes in Sizes of Enterprises

For the following discussion, enterprise size change will be measured using changes in the size of the labor force (including the proprietor), the number of the total powered and nonpowered machines and the size of investment in equipment. Percentage changes in these variables between the initial year when the business was started and the time of the interview for the Management Study is used as one measurement of an enterprise size change between two points in time. To make the analysis reasonably comparable with the data shown in Table 1, some of the above size indicators have also been calculated for those enterprises that are five years old or less. Furthermore, these size indicators are shown for the different population size strata and the various enterprise groups or industries (see Table 8). It must be remembered, however, that this Table does not take into consideration enterprises that have closed down over the years and thus there is a bias to that extent in favor of the surviving ones.

Table 8 shows that on the average, all firms showed an increase in the size of their labor force, and the number of their

TABLE 8.--Changes in number of workers and machines between year of business start and 1980 (in percent)

Changes at	Mean Changes of Growth		
	Labor Force Size	Number of All Machines	Number of Powered Machines
<u>1. National Level</u>			
a. All enterprises (13)[a]	42.3	63.1	71.3
b. Enterprieses 5 years old or less (3)	74.7	61.4	63.3
c. Enterprises older than 5 years (19)	23.2	64.6	76.0
<u>2. Stratum level</u>			
a. Kingston (8)[a]	97.6	246.9	343.8
b. Major Towns (7)	85.1	146.2	115.4
c. Rural Towns (9)	58.9	136.1	130.3
d. EDs (15)	26.5	9.8	8.8
<u>3. Enterprise Group Level</u>[b]			
a. Woodwork (8)[a]	191.5	185.1	237.0
b. Shoemaking (11)[c]	79.9	276.5	272.4
c. Metal Works (10)	30.0	31.4	73.1
d. Craft (16)	28.4	13.8	13.8
e. Wearing Apparel (11)	4.1	48.0	45.0
f. Repairs (6)	-0.5	0.0	-3.0

Source: Management Study Survey (1980).

[a]Number in brackets in the first column show average age of enterprises.

[b]Care is required in interpreting these figures as the number of enterprises in some of the enterprise groups (industries) is small.

[c]In the Phases I and II reports (Davies et al., 1979; Fisseha and Davies, 1981), shoemaking was included in the wearing apparel group (now wearing apparel refers to tailors and dressmakers only).

machines, and the level of capital investment in equipment. For the SSI as a whole, they increased the size of their labor force by about 40 percent over a mean enterprise age of 13 years. However, nearly 50 percent of them made no gains at all (the median is 0.4 percent). Among the different localities, the highest rates of increase occurs generally in the more urban areas. There seems to exist a direct correlation between rate of urbanization and labor force growth. For the two most contrasting strata, for example, Kingston almost doubled its labor force over eight years (which is the average enterprise age there) while the EDs increased theirs by one-fifth only, and that, over a longer mean enterprise age of 15 years. In fact, the urban areas (i.e., Kingston and the major towns) as a group increased their labor force by 94 percent over a mean age of eight years while the rural localities (i.e., rural towns and the EDs) increased theirs by 30 percent over mean age of 12 years.

Without explanatory data on the intervening periods, it is not obvious why there should be a three-to-one difference in rates of labor growth between the urban and the rural areas. It might help though to look at the initial levels of some key variables, such as the initial levels of labor force, machinery, and investment, for the two most contrasting strata or localities: Kingston and the EDs. Their initial labor force sizes were 2.9 and 1.5, respectively. (The overall or national mean and median values for all SSI enterprises are 2.0 and 1.3.) The initial average numbers for powered and total machines are respectively 0.6 and 1.8 for Kingston and 0.5 and 0.9 for the EDs.

With respect to the average initial total investment, however, the lack of industrial goods price deflator makes it difficult to make any rigorous comparison based on this variable. Despite some reservations, a rough equipment price index was constructed here using the list of purchase prices for inventory of capital goods (excluding land and building) collected during the flow data phase. Since the fixed capital items were purchased at different years, choosing a homogeneous kind of capital item and tracing the variations in its prices over the years could give a rough indication of inflationary price variation over the years. Obviously, the further one goes back in years, the less accurate the deflator becomes due to, among other things, changes in embodied technology.

The improvised price deflator was supplemented with information from the Department of Statistics national consumer price index of the seventies and the information contained in Table 9.

Although the improvised deflator is based only on one industry (the tailoring group) and only on one item of investment, namely sewing machinery, it is not thought to be so serious as to make the approach useless: (1) the tailoring group is the most dominant in numbers (more than 5 to 1 ratio to the nearest most numerous machine using enterprise type, woodwork); (2) every tailoring proprietor has a sewing machine (see Table 3 of the Phase I report, Davies et al., 1979, p. 22); (3) investment in machinery/tools constituted more than three-fifths of the total initial business investment (Fisseha and Davies, 1981, Table 16, p. 50); and (4) sewing machines are relatively more homogeneous in quality. Thus, if any one among the industries or enterprise groups is chosen for this purpose, the tailoring group is the best one; a similar assertion could be made for the choice of their key machines compared with the other investment items such as buildings, office furniture, and other capital. The machines are not only more homogeneous, but are also more dominant in number and importance within each enterprise than any other machinery. The constructed indices are shown in Table 33 (Appendix).

Using this constructed capital goods price deflator, the average investment in equipment for Kingston in 1980 prices is $2,483; the corresponding value for the EDs is $443.[1] In capital/labor ratio, this works out to $856 for Kingston and $296 for the EDs, again in 1980 prices and for initial labor force sizes of respectively 8 and 15 years ago. The 8 and 15 years refer to the mean ages of enterprises in the two localities. (The corresponding national figures for a mean age of 13 years are $1,329 for the total and $665 for the ratio).

Thus, the size of the initial investment varies greatly between the two localities. Whether this was the main contributor to the difference in rates of labor growth cannot be said for sure. However, because of the lumpy nature of some capital investments, there is usually a tendency for enterprises to be initially overcapitalized which gives opportunity for expansion of the employment

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[1]The undeflated average equipment investment values for all the localities can be calculated using Tables 14 and 16 of the Phase II report (Fisseha and Davies, 1981).

size over the years. The urban enterprises may have been in this position to show such a high rate of growth.

Another possible reason for such differential labor growth rates may be due to differences in the effective product demand available. It was indicated in the Phase II report (Fisseha and Davies, 1981) that declining product demand was relatively more serious in the rural areas (p. 35). Whether this problem was typical also of the earlier years is unknown.

Table 8 reveals one interesting aspect of the older enterprises. More than 50 percent of them showed a decline in the sizes of their labor force (as well as in the numbers of all machines and powered machines).[1] The decline in the size of their labor force was almost by one-fifth. With enterprises older than 15 years, even the mean for the labor force growth rate becomes negative. In fact, the age for all enterprises is negatively correlated with all the growth rates. The simple correlation coefficient for labor growth is -0.37 which is significant at the 7 percent confidence level; and for those which are older than 5 years, it is even significant at the 5 percent level. On the other hand, enterprise ages less than 5 and 10 years are positively correlated, although not significant at the usual levels. When firms between the ages of 10 and 15 are added, the correlation again becomes negative, but insignificant. These figures seem to indicate that most of the SSI enterprises achieve their highest labor force growth rates when they are probably between the ages of 5 to 10 years and most of them start to

[1]Their respective median values are -18.7, -2.3, and -1.2.

decline beyond the ages of 15 to 20 years. Thus, the mean age of enterprises in the EDs being about 15 years, it is possible that relatively a higher percentage of them may be declining instead of growing. For example, the percentage of firms over 10 years is about 25 percent for Kingston, compared to 52 percent for the EDs (Fisseha and Davies, 1981, Table 4). By implication, this also means that relatively more new enterprises are being started in the urban than in the rural areas.

Looking at those enterprises which are five years old or less, the figures in Table 8 show that their labor force grew by almost twice (74.7 percent) that of the national average, 42.3 percent. (This also means that the labor force growth rate for those enterprises older than 5 years is only 23.2 percent.)

Another useful aspect of the labor force growth issue is to examine it at the enterprise group or industrial level. Here, the enterprise group that registered the highest rate of growth of 192 percent is woodworks. It is distantly followed by shoemaking enterprises with a rate of 80 percent. In third place is metalworks (30 percent). Craft enterprises achieved almost as much as the metalworks. Wearing apparel showed slight increase. The remaining group, repairs, remained about stable. The wearing apparel group increased their labor force by only 4.1 percent; however, tailors alone increased theirs by close to 30 percent, while dressmakers had theirs decline by more than 12 percent. When one looks at the labor force growth rates and the demand situation for dressmakers, the general impression is that dressmakers may be on the declining trend. They were also the only group encountered in the study who charged a fee to train apprentices. From an economic rationality point of view, there is no reason why one should pay to learn a declining trade. So, such payment may be more due to customary practices than due to demand-supply forces. The annual labor force growth rates[1] for the four strata (Kingston, Major Towns, Rural Towns, and the EDs) are, respectively, 8.9 percent, 9.2 percent, 5.3 percent, and 1.6 percent. For the urban rural dichotomy, these figures translate into 9.1 percent and 2.0 percent, respectively.

Finally, the labor force growth rates for all enterprises is 2.8 percent. However, the enterprises which are five years old or less had a rate of 20.4 percent, while for those older than five years, the growth rate is only 1.1 percent. Thus, new enterprises probably rapidly increase their labor force in the initial years and tend to stabilize in the later years.

Table 8 also shows the rates of change for all machines, as well as for powered machines alone. Their rates of change at the national level were about 60 percent and 70 percent, respectively. However, for both categories of machines, about 50 percent of the enterprises made no change. For the averages to be as high as they are then, some localities or some enterprise groups must have achieved a fantastic growth rate. Indeed, this can be confirmed from the table as shown by the large change rates for Kingston and shoemaking. This is mainly due to some Kingston shoemakers who

[1] I.e., annual rate equivalents.

increased their number of powered machines by 7 to 10 fold. If shoemaking is excluded from the calculation, the national rates fall to 44 percent and 54 percent respectively for all machines and for powered machines; in terms of average annual growth rates, these figures translate to 2.8 percent and 3.4 percent, respectively.

Looking at the enterprise groups, shoemaking, as indicated earlier, made the largest gains in machinery growth. It is followed by woodworks which is interesting in that it is also accompanied by high labor force growth rates.

At the national level, there is not much difference between the younger enterprises of five years old or those older than that; however, at least 50 percent of the older enterprises actually declined in number of both all machines and powered machines alone. Unlike what was shown earlier for the labor force growth, however, enterprise age is not negatively correlated with the growth rates of machinery.

The growth rates for labor force and machinery are positively correlated with each other and with the initial price deflated investment size; however, none of them is significant even at a confidence level of 10 percent.

For a more complete picture, the initial and current investment values in equipment also should be compared. However, it may be requiring too much of the crude price deflator constructed here to use it both in depreciation and deflation of each equipment. Thus, using here instead, the equipment replacement values for the current values, the means respectively for Kingston and the EDs are $3,200 and

$1,750. Therefore, equipment investment in Kingston has roughly grown by about 30 percent or at an annual rate of nearly 4 percent.[1] The corresponding values for the EDs are 300 percent and 20 percent, respectively. The high growth rates in the EDs are grossly exaggerated, however, in view of the fact that some enterprises almost always acquire their equipment used and sometimes very old. For those enterprises, the relevant replacement values should be much lower. The possibility of equipment hoarding is another factor which should also be considered since enterprise age is positively correlated with the number of machines--unlike that with the labor force.

To conclude this section, in aggregate, the SSI subsector has been growing both in the number of machines and the size of employment. Thus, over an average enterprise age of 13 years, the size of the labor force has increased by 40 percent and the number of powered machines increased by 70 percent, while nonpowered grew by 50 percent. However, 50 percent of all the enterprises either declined or made no growth at all in all the three indicators. Such wide differences are accounted for mainly by age differences among the enterprises. For example, for those enterprises which are five years old or less, the growth rate for labor and powered and nonpowered machineries are about 75 percent, 65 percent, and 60 percent,

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[1]These growth rates are between the initial price adjusted investment values and the replacement values, all in 1980 prices. Thus, such comparison is very rough at best.

respectively. Among the old enterprises, the corresponding percentage growth rates are about 25 percent, 75 percent, and 40 percent.

The industries that showed good growth in all the rates are woodwork, shoes, and metalworks. Craft showed modest growth in labor force size while garments grew in number of machines, but not in labor force. However, tailors alone increased their labor force by 30 percent.

The simple correlation coefficient between the age of the enterprise and the growth rates of labor force and machinery are negative and positive, respectively. For the younger enterprises, however, even that for labor is positive. This probably indicates that proprietors tend to hoard or accumulate machinery, even if the business is on the decline cycle.

Finally, the urban localities showed much greater rates of growth for all variables than the rural ones. For example, the urban growth rates for labor and powered machinery are respectively 90 percent and 270 percent; the corresponding rates for the rural areas are 30 percent and 20 percent.

3.2.3 Changes in the Price Structure of Key Inputs and Outputs

This section examines the SSI for price changes in key inputs and outputs of the SSI subsector. The period analyzed is the last half of the 1970s. The data are presented in Table 9.[1]

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[1]The data for this section were provided by respondents who were asked to give the prevailing costs or prices of key inputs and outputs for each year during the period. These costs and prices are,

TABLE 9.--April 1980 prices of key items compared with earlier periods (percentage changes)

Item	January of							
	1980		1979		1977		1975	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Key Raw Material	17.5	4.2	38.3	25.1	112.7	99.8	380.0	300.0
Key Product	11.5	0.1	47.1	20.0	113.6	86.7	195.5	166.5
Unskilled Labor	2.5	0.0	23.2	16.7	61.9	66.8	182.0	149.4
Skilled Labor	1.9	0.1	27.9	20.0	59.0	50.0	138.7	100.4
Used Machines	1.0	0.6	42.3	48.8	78.0	76.5	164.4	160.0
New Machines	2.2	0.2	31.2	26.7	81.0	71.6	173.2	106.6
Rent	0.5	0.4	3.0	0.4	23.7	1.0	97.3	12.5

Source: Management Study Survey (1980).

There are, of course, other important inputs and outputs that have been excluded from the study. For example, expense rates such as for fuel, transportation, utilities, or, on the revenue side, charges for repairs (except for enterprises whose key activity is repairing, e.g., auto repairs) have been excluded. Both for raw materials and products, the key ones are included here.

Machines in the price analysis refer to the kind of machines used within each enterprise so that if the machine in use is no more available for sale, then its nearest replacement or substitute is used as a subject of analysis. Ideally, the cumulative percentage changes in prices should be weighted in addition by the respective values of the items considered. The weights applied here have been the locational or strata weights only. Still, the percentage changes as given are useful for relative comparison of prices since they represent the most important items in each enterprise.[1]

Over the second half of the 1970s, the prices of key raw materials more than quadrupled and for key products, prices about tripled. However, while the quadrupling of raw material prices occurred for at least half of the enterprises, in the case of product prices, 50 percent of the enterprises were able to increase their

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however, unadjusted by weighted price indices to make them comparable within or across enterprises, industries, or locations.

[1]The respective prices of the different items for the different periods were collected actually in dollars and cents so that at least price weights can be applied to the percentage changes. Also, the rate of pay for skilled and unskilled workers was not confirmed by asking workers themselves.

1975 product prices by a little more than one and one-half times only. This wide discrepancy between key product and key raw material prices seems to have occurred early in the period.[1] Product prices were rising just as fast it seems as raw materials after 1976.

The table also shows that unskilled (apprentice) workers were able to increase their nominal wages by one and three-fourths times compared with the skilled group who even failed to increase it by one and one-half. Furthermore, 50 percent of the skilled workers were able to only double their nominal wage rates, while the same percentage of unskilled or apprentice workers were able to increase theirs by one and one-half times of their 1974-75 pay. These percentage increases have to be related to national consumer price indices in order to find income changes in real terms. Between December 1974 and December 1979, the Consumer Index increased by 155 percentage points (see Table 1 in Chapter 1 and GOJ, 1980a, p. 5). It seems thus during the second half of the 1970s, unskilled workers increased their 1974/75 income by about one-tenth (10.5 percent in real terms, while the skilled workers decreased theirs by about one-fifteenth (-6.6 percent). At an annual rate this is equivalent to 2.0 percent (median -2.0 percent) and -1.3 percent (median -9.7 percent), respectively. Furthermore, the real wages of 62 percent of the unskilled workers actually declined, while the corresponding percentage for the skilled workers is substantially higher (80 percent).

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[1]For a given raw material purchase, the resulting product value would be much higher so that product price needs to increase by a smaller percentage in order to cover the raw material price increase only.

For 38 percent of the unskilled workers, the real wages increased by more than 5 percent, the corresponding figure for the skilled group is only 15.0 percent.[1] Thus, while many of the unskilled workers more than maintained their ground against inflation, most of the skilled workers were losing to inflation. The unskilled workers were fairing well probably due to a number of minimum wage laws such as the one passed in 1979. In terms of nominal rates, even the skilled workers were doing no worse than their counterparts employed in the larger manufacturing sector (see GOJ, 1979a, p. 1).

New and old (used) machines increased their prices by about the same magnitude with new machines increasing theirs by slightly higher rate. However, for 50 percent of the proprietors who would buy new machines, they would find that the prices have at least doubled; for the same proportion of proprietors who would buy old machines, however, they will find that the prices are now at least two and one-half times their former prices. Thus, old machines actually increased at a faster rate in their prices than the new ones.

Finally, looking at rent, it is the only item of expense which did not double its rate. For proprietors who had to pay rent, 50 percent of them faced an increase less than 13 percent. The reason rent did not increase faster is due to legislation and rent control boards which froze most rent charges at the then existing rates.

In order to relate the supply conditions of labor, machinery and rented workshops, respondents were asked to estimate the length of time it would take them to secure these inputs. For labor they

[1]On annual basis, the corresponding figures are 20% and 5% respectively.

gave an average length of only 11 days with a median of 7 days; for new machines, the corresponding periods were 18 and 2 days. For old machines, they gave one month for the mean and two weeks for the median; the corresponding periods for workshiop availability were about one month and a half and one month, respectively. The increases are thus consistent with the supply condition, except for rent (and unskilled labor, too) both of which were probably more affected by regulatory laws than by demand and supply market forces.

There are also variations between localities (strata) and enterprise groups with respect to the rate of increase in prices. For example, over the five-year period rural areas showed higher rates of price increases in all items except in both kinds of machinery and unskilled labor. In the case of unskilled labor, the increase in both locations were almost the same (183.5 percent vs. 181.2 percent, the latter for rural). In both raw materials and product prices, the respective increases in the rural areas were 47 percent and 15 percent higher than those found in the urban areas. The largest difference in rate of increase is found in rent, however; while the rural areas faced an increase in rent of about 132 percent, the corresponding increase in the urban areas was only 34 percent. Rent control boards were not operating in the rural areas.

At the individual industry level, mean annual price increases for raw materials ranged from 23 percent for metalworks to as high as 44 percent for tailoring; the rate for woodworks was 36 percent. The corresponding product price increase for the three industries were respectively 33 percent, 19 percent, and 27 percent. The highest mean annual increase in wages occurred in craft (30 percent) for skilled workers (followed by repairs, 23 percent, and tailoring, 19 percent) and in woodworks (26 percent) for unskilled workers (followed by tailoring 24 percent and repairs, 22 percent).

Although the figures may seem to convey a different impression in tailoring, the increase in raw material price may be less burdensome when related to the increase in the product price. For in many instances, the key input for tailoring is a low valued item, such as a spool of thread which may cost about J$2-$4. The corresponding price or charge for making a pair of pants (where the customer brings his own fabric) would be about $10-$20. (And a spool of thread would be used to make several pants, too.) The case with woodwork is different though. Although most proprietors in woodwork can pass most of the raw material price increase to the consumer, it is not easy when they have to buy and store the raw material themselves.[1]

To conclude, over the second half of the seventies, raw material prices increased at an annual rate of 37 percent which is the highest among the items chosen here. Prices of the most important product in each enterprise increased at an annual rate of 24 percent (median is 22 percent). The corresponding price increase rates for new and old machinery are 22 percent (median 16 percent) and 21 percent (median 21 percent). Among the nonlabor costs, the annual rent

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[1]Due to the unavailability of raw materials to be stored, it is unlikely proprietors would benefit from inventory price gains.

increase is the lowest: mean of 15 percent and median 2 percent. The low rate of increase for rent is mainly due to the rent board restrictions.

Unskilled workers increased their wages at an annual of 2.0 percent in real terms; the rate for skilled workers was -1.3 percent. The respective medians are -2.0 percent and -9.7 percent. The higher rate for unskilled workers is due again to minimum wages laws passed in recent years.

Overall, proprietors in auto repairs, tailoring, woodworks, and shoe making seem to be (it looks in that order) more adversely affected by the price increases. However, proprietors in metalworks seem to have gained substantially from the price increases. At the urban-rural dichotomy, the rural areas were much more adversely affected by the price rises.

3.3 Persistent Problems in the SSI Subsector

The most important problems facing the small-scale manufacturing subsector as of 1978 have been described fully in the Phase II report (Fisseha and Davies, 1981, p. 28). During that year, the three most important problems were lack of product demand, lack of working capital, and raw material shortages in that order. Raw material problem was, however, a distant third with only 8 percent of the proprietors naming it as the most crucial problem, while those identifying product demand and capital in first place were more than one-third in each case (38 percent for demand and 36 percent for capital).

By the end of 1979, however, a shifting of positions or ranks has taken place among these three persistent problems. Problems related to working capital have risen to first position (45 percent) and had a marked lead over the other two problems (see Table 10). Raw material problems have climbed to a strong second place (29 percent) form a distant third in 1978 and demand problems are lowered to third position (21 percent). As in 1978, except for the above three problems, the other problems (of 1978) were still unimportant in 1979.

It was pointed out in the Phase II report (p. 99) that the raw material problem had not become a serious handicap by the beginning of 1979 and that it may get worse during the coming months. This is seen to be the case in Table 10 where 29 percent of the proprietors put it as the first problem and almost two-thirds of them put it among the top three, compared with 8 percent and 22 percent, respectively, in 1978. Inasmuch as working capital (finance) shortage is a manifestation of the high cost of limited raw materials, it is even possible that the latter has climbed to first place by 1980.

There are locational differences with respect to the ranking of the different problems. Demand problems are still more critical in the rural areas than in the urban localities. The reverse picture is true with respect to raw materials. Working capital problem is more serious in the rural areas which may be related to their demand problems.

There are also variations in problem seriousness among enterprises. The group that is most affected by raw material and working capital problems is woodworks. Nearly 50 percent and 40 percent of the proprietors there said that their chief problems were respectively raw material and working capital shortages. Among tailors and dressmakers, more than one-third of them said, they had no problem in 1979, while one-fifth put raw material as the number one problem and another 30 percent put finance second as the number one problem. The most important problems for metalworks is shortage of working capital, while for auto repair it is shortage of demand, resulting from crowded market.

The problems have been referred so far in general terms. They are broken down to specific problem components as follows: nearly 80 percent of the raw material problem responses have to do with shortages,[1] another 15 percent has to do with high prices and the remaining with poor quality. With respect to finance 90 percent of the problem responses are due to lack of working capital while the remaining 10 percent have to do with unavailability of loans. With respect to demand, 60 percent of the problem is due to poor product prices. The chief problems related to machinery and housing are respectively unavailability (90 percent) and insecurity (40 percent).

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[1]It should be kept in mind that although some inputs are very expensive, they are still available in the market (e.g., spools of thread); other inputs may not show substantial price increases (say, due to price control schemes) but are unavailable (e.g., lumber).

Also, there is not only shifting of problems among the different ranks or positions, but shifting of enterprises across the different problems as well (see Table 11). For example, out of those who had demand problems as number one in 1978, nearly half of them (47.3 percent) said they had no problem in 1979; about one-fifth said working capital (finance) was the major problem; another 17 percent said shortage of raw material was the critical constraint in 1979 and only 14 percent maintained demand was still the most important problem. In fact, only the group who had finance as the number one problem in 1978 still maintained it in first place in 1979.

There are three possibilities for the type of distribution in Table 11. Proprietors may (1) have successfully solved certain 1978 problems, (2) be faced with relatively more serious problems in 1979 without yet solving those of 1978, or (3) be unclear in their minds as to the exact cause when faced simultaneously with problems related to shortages of raw materials, working capital, and product demand. With respect to the third possibility for example, out of those respondents who mentioned lack of working capital as the key problem, it was doubtful whether one-third of them could get the raw material even if they had the cash; for another 20 percent, the problem was not so much with working capital as with lack of adequate demand; and in another case, out of the people who cited shortage or unavailability of raw material as the key problem, in 48.5 percent of the cases, the (expensive) raw material was availalbe, but they did not have the cash to buy it with.

TABLE 10.--Major problems in 1979/80 (percent of proprietors)

	Urban Areas[a]		Rural Areas[a]		Jamaica	
	First	Top Three	First	Top Three	First	Top Three
Finance	32.1	51.1	48.2	79.2	45.2	75.0
Raw Material	40.4	62.9	26.4	66.1	29.0	65.5
Product Demand	10.0	44.3	23.2	61.3	20.7	58.1
Parts/Machinery	7.4	25.7	1.4	25.6	2.5	24.5
Housing	7.4	49.9	0.5	1.1	1.8	17.5
Others	2.6	13.1	0.3	5.0	0.8	9.4
TOTAL	100.0	**	100.0	**	100.0	**

Source: Management Study Survey (1980).

[a]Urban includes the three major towns and Kingston while rural includes the small or rural towns and theEDs.

**Since a respondent can name more than one problem the total does not add up to 100.

TABLE 11.--1978 problems crosstabulated with 1979 problems (percent of proprietors)

Main Problem in 1979	Main Problem in 1978[a]				
	Demand	Finance	Raw Material	Parts/ Machinery	Others
1. No Problem	47.3	18.8	10.4	0.0	3.3
2. Demand	14.1	19.9	0.0	33.3	0.0
3. Finance	21.6	26.0	19.1	0.0	43.4
4. Raw Material	17.0	23.0	4.8	33.3	48.4
5. Parts/ Machinery	0.0	7.3	65.7	33.4	0.0
6. Others	0.0	5.0	0.0	0.0	4.9
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: 1978 problems, Phase II survey; 1979 problems, Management Study Survey (1980).

[a]Figures include only those who had a specific problem in 1978.

In conclusion, the three main problems (related to product demand, raw materials, and working capital) of 1978 still persisted in 1979/80. During the 1979/80 period, shortage or high costs of raw materials had become very critical contributing further to the working capital constraint. Product demand was still a problem more in the rural than in the urban areas. Shortage of raw material was also more critical in woodworks than, say, in wearing apparel, The effect of a problem or the response it provokes will vary too from one proprietor to another. For this reason, any investigation dealing with such issues and having in mind some kind of firm level assistance to be provided, a complete investigation of each problem at individual enterprise level is more useful. Chapter 4 will describe some management characteristics and practices which hopefully will indicate the capacity or capability among SSI proprietors to deal with such problems.

CHAPTER 4

MANAGEMENT CHARACTERISTICS AND BUSINESS PRACTICES

4.0 Introduction

In the small-scale household businesses, the operators provide the capital as entrepreneurs or owners and run the enterprises as managers. These dual roles as owners and operators will continue to be described as proprietorship and the owner/operators as proprietors. This distinction is barely alluded here not because of its importance in the small-scale industries (SSI), but because of its relevance in the context of comparing larger scale ownership and operation with those found in the SSI.

Chapter 3 briefly described some of the contributions of the SSI enterprises, their successes over the years, and some of the current problems they are facing. From a public policy point of view, relevant questions to ask are: What are the most constraining present problems faced by proprietors? How do successful proprietors solve or neutralize these problems? What characteristics do proprietors have in common and how do they differ in their business practices? What is the effect of differences in attributes and business practives among proprietors on the efficiency of resources?

This chapter will briefly describe some important characteristics of proprietors and their business practices. Some of the topics discussed have been discussed or alluded to for other countries by various researchers (see, for example, Chuta and Liedholm, 1976; Harris, 1971). Topics discussed here include the educational level of proprietors and the kind and level of practical training (experiences); the influence of the family or the community on the proprietor and vice versa; how proprietors initially acquired their business and what their goals and objectives were in doing so; what the degree of job and geographical mobility is among proprietors and their employees; finally, the differences in business practices such as production, marketing, financial control, and business performance evaluations.

Responses to some of the topics analyzed are subjective and must be interpreted with caution. They are not intentionally misleading, but it is difficult to be precise with such answers. Thus, it is more appropriate to look at ranges and trends, rather than individual entries of single figures.

Each topic discussed will be preceeded by a hypothetical base for its inclusion in the discussion here or in the model of Chapter 5. Discussion on the empirical evidence on each hypothesis (where applicable) is reserved for Chapter 5.

4.1 Characteristics of the Proprietor

In this section, a brief description of the age and sex distribution of the proprietors, their formal and informal training backgrounds, and some possible indicators of entrepreneurial talents or inclinations will be presented. When information collected for this study has been already presented elsewhere (e.g., in Fisseha and Davies, 1981), only a passing mention is made here.[1]

4.1.1 Age and Sex Distributions

It can be hypothesized that business experience increases with age of proprietor. Therefore, all things being equal, businesses run by older people should be more successful at overcoming obstacles than those by younger ones. On the other hand, it is possible that older proprietors will be more cautious in taking new ventures or practices (see, Watanabe, 1970, p. 542) and hence their incomes may be relatively less than those of the young.

The age-related experience posited above is more useful, however, when related to a given industry. Thus, the number of years the proprietor has been working on the same industry is more relevant than the age. In the context of the Jamaican SSI, the number of years for proprietor work experience are almost the same as the age of the enterprise; about 86 percent of the enterprises were started from scratch (see Table 16). Thus, the hypotehsis that is posited here implies that the age of the enterprise is positively correlated with business success. Success here is defined as an enterprise's score of technical efficiency as described in Chapter 5. For similar hypotheses, see Harris (1971), Page (1979), and Chuta and Liedholm (1976).

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[1]Needless to say, the study here is greatly slanted toward economic and quantifiable variables; however, additional psychological and social studies of the proprietor would be very important, especially for inter-country comparisons (see Watanabe, 1971, p. 532).

The average age among the proprietors is 40 years and the median is about 38. In fact, more than half of them are found between the ages of 30 and 50 years. From a policy point of view, the age information in itself is not very useful, however, when it is related to training backgrounds, technical assistance needs and other variables that are age sensitive, it could be fruitfully used to choose among competing programs and to detect fundamental trends characterizing the subsector. (See Table 14 for age information.)

At the industry level, tailors (excluding dressmakers) are younger (with an average of 30 years) while proprietors in metalwork are relatively the oldest group (with average of 45 years). Both dressmakers and proprietors in food preparation also tend to be older. The remaining have average ages very close to the national one (40 years). For enterprise age differences among industries, see Fisseha and Davies (1981, p. 21).

The age of the proprietor and that of the enterprise are positively correlated, but significant only at the 30 percent level. This is rather unexpected. So when proprietor age was correlated separately with those enterprises older than five years and those five years or less old, in the first one the result was positive (as expected) and significant at 3 percent; the result for the younger enterprises had a negative sign, although the level of significance is so low that one can attribute it to statistical chance occurrence. The Phase II report (Fisseha and Davies, 1981) did mention, however, that increasingly more and more people laid off by the larger enterprises were starting their own small business.

It is possible that these people may be older than the average new proprietor under more normal economic conditions. For these younger enterprises, 43 percent of them were started by proprietors between the ages of 26 and 45 and more than a third of them were started by proprietors older than 45 years. In fact, 15 percent of them were started by proprietors older than 55.

The sex distribution of proprietors allows one to examine participation by females and sex specific role specialization. Of those enterprises which are five years old or less, for example, 17 percent were started by women mainly from the rural areas. This relatively low percentage for females (compared with the national female share among the total proprietors) is consistent with urban-rural proportional share for new firms. (More than 90 percent of the female proprietors are found in the EDs as dressmakers and producers of craftwork and condiments. Most of them are also part-time farmers who find the off-farm employment as a source of immediate cash.

While that is not the case for craft work, dressmaking in the rural areas is on the decline probably due to competition from ready made dresses sent from abroad or locally available. With respect to the production of condiments and other food items, such as bammies[1] and even coconut oil, the future is not so discouraging if better means of processing, storage, and marketing can be devised for these local products.

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[1]These are bread or cakes made from cassava flour.

4.1.2 Formal and Informal Training

In many studies dealing with management or proprietor characteristics and practices, the experience and educational background of the subjects are given particular significance. Some people treat both formal educational level and on-the-job experience as one variable while others see them as two distinct sources of variation. Coffey and Herrmann (1976) say, for example, "Neither formal schooling nor experience is better or worse than the other: Their educational functions are different" (p. 2). They will be treated differently also in this study.

The hypothesis on education is that proprietors with at least some level of education should be more technically efficient. They should be more aware of their opportunities in their surroundings and their education should help them to analyze the different kinds of information they receive.

Formal education implies the pursuit of a structured coursework usually attended in a school or institute as opposed to on-the-job training. Table 12 shows the average proprietor has been in school for six years (the median is also 6).[1] More than 95 percent of the proprietors have had some elementary education, while 18 percent have secondary level education (see Fisseha and Davies, 1981, Table 24).

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[1]The standard error of the mean is 0.66 and the standard deviation is 2.75. Thus, about three-fourths of the proprietors most likely spent at least four years in school.

TABLE 12.--Training background of proprietors

Variable	Over All Enterprises		
	Mean	Median	Standard Error
1. Number of years in school	6.0	5.9	0.66
2. Outside on-the-job training			
a. Length of apprenticeship in months	20.8	10.4	6.33
b. Number of other trades or skills learned	0.6	0.5	0.18
c. Number of other jobs/ businesses of previous experiences	1.1	0.9	0.15
d. Number of related jobs/ businesses of previous experiences	0.5	0.3	0.19
e. Total years of experience in other jobs/businesses	11.1	6.6	3.15
f. Total years of experience in related jobs/businesses	1.8	0.14	1.29
g. Total number of years as supervisor or manager	4.4	0.16	2.34

Source: Management Study Survey (1980).

Proprietors in different industries or enterprise groups vary also with respect to the level of their education (Fisseha and Davies, 1981, p. 78). If the educational levels achieved by proprietors in different industries were to be ranked, starting with the highest level, the order would look as follows: metalworks, auto repair, woodwords, wearing apparel, craftwork, and shoemaking.

Compared with their counterparts in many other developing countries (where the average age in many of them is 40 or slightly above), Jamaican proprietors in the SSI subsector have a higher level of education. In Sierra Leone, for example, about 23 percent of the proprietors had formal education (Liedholm and Chuta, 1976, p. 52); and in Haiti about 56 percent had done what is equivalent to the primary level (Haggblade et al., 1979, p. 87). In Honduras, the literacy rate among proprietors is about 77 percent (Kelley and Coronado, 1979, p. 40). The literacy rate among Jamaican proprietors is close to 98 percent and those who have completed the primary level or beyond are about 73 percent of the total (see Fisseha and Davies, 1981, p. 77).

The educational level among the workers is very high too. In fact, there are no illiterates both among the "permanently" hired and among apprentices. Among the permanent workers, more than three-fourths of them have finished the primary level; among the apprentices, about 80 percent of them have finished the same level. Thus, the educational level achieved gets higher as the average age of the group is lower; (the average ages for proprietors, permanently hired workers and apprentices are about 40, 30, and 19 years, respectively).

As has been noted by Chuta and Liedholm (1976, p. 102) and other researchers, there may be a trade off between number of years in school and the length of on-the-job training. They hypothesize that the informal training or experience may provide a better form of training than the formal one (see also, Nafziger, 1977, for a similar view).

The Jamaica data show the existence of a positive correlation between education and on-the-job training, but significant only at the 35 percent level. The relationship between education and the number of years worked outside (see below) is negative, but again, significant only at the 40 percent level. (The number of years worked outside does not include apprenticeship training.) The implication of all these is not clear, since education is negatively correlated with the age of the proprietor too, and the latter is positively correlated with the duration of the apprenticeship. Statistical chance variations may be the culprits here.

Another hypothesis with respect to training is that proprietors who spend many years on-the-job training should run a business more efficiently than those who had no such experience or had very little of it. Such experiences would teach proprietors not only on the technique of production, but on marketing, public relations, and even financial management (see also Harris, 1971; Watanabe, 1970; Chuta and Liedholm, 1976; Lecrew, 1979).

Table 13 shows about 75 percent of the Jamaican proprietors acquire their skills or trade through some form of apprenticeship;

TABLE 13.--Skill acquisition by proprietors (percent of proprietors)

Mode of Acquisition	Kingston	Major Towns	Rural Towns	EDs	Jamaica
1. Apprenticed with Relative	37.5	23.1	21.1	17.6	20.7
2. Apprenticed with Outsider	25.0	46.2	54.5	41.3	41.7
3. Apprenticeship and School	12.5	23.0	6.1	17.6	15.4
4. Family Business	12.5	0.0	6.1	5.9	6.4
5. Job Experience	0.0	0.0	6.1	0.0	1.0
6. Self-taught	12.5	7.7	6.1	17.6	14.8
TOTAL	100.0	100.0	100.0	100.0	100.0

SOURCE: Management Study Survey (1980).

half of them are apprenticed with nonrelatives. The majority of the self-taught are found in the EDs and refer mainly to craft or straw work proprietors.

Except in dressmaking, apprentices are paid in most enterprise types. This is partly due to minimum wage laws and recent worker social security regulations. Although some proprietors mentioned these laws as inhibiting reasons for not using or employing apprentices, no study was made here of the effect of such laws on the rate or number of apprenticeship training (see Chuta and Liedholm, 1979, p. 59).

The mean length of apprenticeship training is about 21 months (the median is 10; see Table 12). The variation among locations and enterprise types is quite substantial. For example, except for the EDs, more than 80 percent of the proprietors in the other locations had been apprenticed for more than the national median period of 10 months. However, such locational differences are mainly due to differences among enterprise types since certain locations are known for the prevalence of certain enterprises.

A look at the different enterprise groups reveals that the mean varies from a little below two months for craft to 40 months for auto repair (see Table 14). Woodworks and metalworks also show 36 and 33 months respectively.

So, if the length of apprenticeship is any indication of the complexity of the job or business, the major enterprise groups would again rank as follows: auto repair, woodworks, metalworks, shoemaking, tailoring, dressmaking, and craft. Thus, the ranking is very close to the one given earlier by the level of formal education attained.[1] The joint ranking (using their sums) for the two variables is as follows: auto repair, metalworks, woodworks, tailoring, shoemaking, dressmaking, and craft.

Another possible area of practical training are jobs or businesses previously acquired. Such experiences also provide opportunities to acquire some savings for the initial investment

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[1]Kendall's tau for the two rankings is 0.97 and is significant at 1 percent level of significance.

TABLE 14.--Training and experience profile of proprietors by industries

Industry or Enterprise Group	Proprietors Mean Values For				
	Years of				Months of Appren-ticeship
	Own Age	Enterprise Age	Formal Education	All Jobs Experience	
Garment	37	12	7	4	15
Woodwork[a]	43	8	7	13	36
Metal	45	10	8	11	33
Craft	38	16	5	14	2
Repair	36	6	7	11	40
Shoes	43	15	5	5	27
All SSI[b]	40	13	6	11	21

Source: Management Study Survey (1980).

[a]Includes sawmilling

[b]SSI stands for the small-scle industrial or manufacturing subsector.

fund and possibly establish business connections useful for future business activities (see Watanabe, 1970, p. 539). Jamaican SSI proprietors had on the average worked for about 11 years in some other jobs or businesses before the current business was started (see Tables 12 and 14). Out of these, about two years were spent on jobs or businesses directly related to the current line of activity. Also out of these 11 years, about four years were spent being involved in some supervisory or managerial capacity. Except for the total number of years of outside (this business) experience which has a median of six-and one-half years, however, the medians for related jobs/businesses and for supervisory capacity are less than two months. Thus, few people were working in jobs or businesses directly related to their current enterprise or were involved in any supervisory or management roles. Still, the lessons of the trade learned from such an experience must be very useful in widening one's scope of awareness on how sales, purchases, and stock are handled and/or on how employees are treated.

Related to this outside experience is the skill acquired on a different trade (such acquisition could also be obtained in school as well). The number of proprietors who have such additional trade skills (i.e., beside the one they are currently using) is small and the mean and median are only 0.6 and 0.5. In fact, 51 percent of the proprietors had no additional skill or trade, 42 percent had one additional, 4 percent had two additional, and the rest had 3 additional skills or trades that they can use if necessary to earn a living. Among the enterprise groups, more proprietors in the repairs and woodwork groups have additional trades than say, in tailoring or craftwork. Consequently, Kingston has more of these proprietors with more than one skill or trade (farming was not included in the additional skill determination).

Further examination of the data reveals that the average number of jobs/businesses where proprietors get prior opportunities to work is very small (the mean is only 1.1 with a standard error of 0.149; see Table 12). In fact, what usually happens is that a prospective proprietor may join a private company or civil service and work there long years, mot so much for the experience as for the investable funds that can be saved from such a job. Thus, such opportunities are available mainly to proprietors outside the EDs.

It was pointed out above that farming was not included when the issue of other skills or trades learned was considered. However, attempts were made to find out what the average number of years worked (past or present) on a farm was. This turns out to be about four years with a standard error of 1.176. The people who have such farm experience are those mainly living in the EDs and to some extent in the Smaller Towns.

In summary then, more than 95 percent of the proprietors have some elementary or higher level of education; those who have finished the elementary or higher levels are about 73 percent of the total. The corresponding percentages for permanently hired and for apprentices is about 75 and 80, respectively. Again about 75 percent of the proprietors have gone through some form of apprenticeship and the average duration was close to two years. Furthermore, each proprietor spent about 11 years on the average working somewhere else before the current business; the median is about six years.

The next section will deal more with personal traits of business inclinations, goals, and expectations. In the final analysis, it may be that such traits or dispositions are just as important, if not more important, in influencing management decisions and business outcomes as the variables of education and training that were discussed in this section.

4.1.3 Possible Indicators of Entrepreneurial Disposition or Capacity

It is very difficult to show a relationship between the success of a proprietor and the attributes to be discussed here. However, an analysis of management variation being difficult as it is, even if they could help to shed some light, albeit remotely, on such variations, they will have served a useful purpose. There is another side to the issue: even if they are not used here to explain management variation among proprietors, such pieces of information are still important in contributing toward a fuller picture of the small-scale manufacturing subsector.

Some of the key topics that are discussed here are referred to as "D-factor--drive, dynamism, determination, energy, self-discipline" by some authors (e.g., see Atkinson, 1976, p. 29). They include geographical mobility of proprietors (job mobility has been already discussed in the last section), mode of business acquisition, business objectives, and the level of proprietor commitment toward the business. The last topic refers to a proprietor's view concerning the correctness of choosing the current enterprise and whether or not the business would be closed if the income falls below an acceptable level.

4.1.3.1 Geographical mobility of proprietors, permanently hired workers and apprentices.--The mobility of proprietors (i.e., where they were born, raised, and where they are working) varies greatly among the locations. The mobility information (see Table 15) shows that only 50 percent of the proprietors in Kingston were born there, whereas the corresponding figure for the EDs is about 80. The table also shows that Kingston attracts proprietors further out than the surrounding parish--Kingston being surrounded by the Parish of St. Andrew only, close to 20 percent of the proprietors in Kingston come from that Parish. However, close to a third of the proprietors in Kingston come from parishes that are further out.

The Major Towns show that the main source of entrepreneurs are the surrounding parishes. This is not the case, however, for the Smaller Towns and the EDs because they have limited opportunities to offer and those that are available are taken up mainly by the people who live in the same parish. On the other hand, the case of the major towns *vis a vis* Kingston shows the benefits of decentralizing and improving economic and administrative services among different regions that are markedly different in distance or type of economic occupation (see Fisseha and Davies, 1981, p. 47).

TABLE 15.--Geographical mobility of the labor force (percent of respondents)

Labor Force	Locations		
	Same Parish	Bordering Parish	Other Places
1. Proprietors			
a. Place raised	81.7	8.1	10.2
b. Place of Birth	75.2	9.9	14.9
1. Kingston[a]	50.0	18.7	31.3
2. Major Towns	38.5	53.8	7.7
3. Rural Towns	72.7	9.1	18.2
4. EDs	82.4	5.9	11.8
2. Permanently Hired Workers			
a. Place raised	93.5	--	6.4
b. Place of birth	87.1	9.7	3.2
3. Apprentice workers			
a. Place raised	87.5	8.3	4.2
b. Place of birth	91.7	4.2	4.2

Source: Management Study Survey (1980).

[a]Because of its population and economic importance, Kingston is often considered as one of the parishes.

At the national level, about three-fourths of the proprietors were born in the same parish and another 10 percent were born in the surrounding parishes; the rest come from parishes further out. In analyzing mobility, however, it is more appropriate to relate place of work to place where a person grew up, rather than to place of birth. In the case of the proprietors, about 80 percent of them are conducting their business in the parish or area where they grew up.[1] The remaining 20 percent were brought up in surrounding and further out parishes.

In the case of permanent workers, 87 percent and 94 percent were born and raised respectively in the same parish; the corresponding figures for apprentices is 92 percent and 88 percent. Whether many of these permanently hired and apprentice workers will continue to live and work for the future in the places whre they are working now cannot be projected; the present study did not relate place of prior job or business with current place of work.

At the enterprise group level, wearing apparel and craft proprietors tend to have been born in the place of current work. For woodworks and metalworks, however, proprietors tend to come from outside the parish or locality. For example, in the case of woodworks, close to 44 percent of the proprietors were born in the bordering parishes, while another 36 percent came from places further out. Shoemakers are also widely distributed in their place of birth while auto repairs tend to be mainly from Kingston.

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[1]In case a person grew up in more than one place, then only the years for the 14 to 20 age period were considered.

The relevant issue here is whether geographical mobility helps to explain managerial quality differences. The hypothesis here is that those proprietors who face the unknown by moving from a familiar surrounding indicate people who are businesswise, aggressive, self-confident, and willing to take risk. They are proprietors who are looking for new opportunities and incentives and who seize them when they are available. The implication of all these for the success of the business will be pursued further in the next three subsections.

An item somewhat related to the present topic of discussion is proprietors' view on the present locations of their businesses. Three main factors determined the present locations: (1) proximity to the home (26 percent), (2) ownership of the place (25 percent), and (3) unavailability of alternative sites (24 percent). In other words, 26 percent of the proprietors, for example, chose the present site because it was close to their home. At the strata level, the first two factors are the most important determinants in the rural areas.

When respondents were asked whether they were satisfied with the present location, about 83 percent said they were satisfied. The main reasons for the dissatisfaction of the remaining are location inaccessible to consumers (58 percent) and small workshop (31 percent). Furthermore, these dissatisfied group did not move to more suitable places because either the rent was too expensive (66 percent) or can't find a suitable one (28 percent); potential considerations of both security and loss of present customers were two other reasons (each with 3 percent) against moving to a new place.

At the locational level, the unavailability of a place and the size of the rent rate are more important for the present location of urban firms (49 percent) than proximity to home. The dissatisfied urban proprietors (57 percent) did not move to new places mainly because they could not find suitable ones.

4.1.3.2 Mode of business acquisition.--In conjunction with other explanatory variables, the way the business was acquired may show qualitative differences among proprietors. Not only does it take a lot of effort and work to start a new business from scratch, but it requires specialized inputs such as sizing the demand level, identifying sources of raw materials, planning the market strategy, and choosing a particular approach to introduce products to future patrons. Combined with other similar pieces of information such investigation could help explain success variations among proprietors of the same industry. Care must be taken, however, to look closely into the specifics of each situation.

Table 16 shows that the large majority of proprietors start their own businesses from scratch. About 12 percent of the enterprises were inherited. Except for the rented entry, there is not that much difference between rural and urban locations in the mode of business acquisition. The difference in the rented mode of acquisition is due to relatively large number of auto repair shops (31.3 percent) that are rented out to proprietors. To point out

TABLE 16.--Mode of business acquisition (percent of enterprise)

Mode of Acquisition	Urban[a]	Rural[a]	Jamaica
1. Started from scratch	84.1	86.5	86.0
2. Inherited	11.4	12.0	11.9
3. Started in partnership	0.0	0.6	0.5
4. Rented	4.3	0.4	1.3
5. Bought	0.2	0.3	0.3
TOTAL	100.0	100.0	100.0

SOURCE: Management Study Survey (1980).

[a]Disaggregation at the location or strata level are shown in Table 2, p. 17 of the Phase II report (Fisseha and Davies, 1981).

further the industrial or enterprise group differences, shoemaking, and craft work are almost 100 percent started from scratch. They are followed by woodworks (93.7 percent), wearing apparel (72 percent), metalworks (46.1 percent), and auto repair (42.4 percent). More than half of the enterprises in metalworks and close to a quarter of those in wearing apparel and auto repair also show inheritance as a means of business acquisition. Partnership is found mainly in wearing apparel, woodwork, and auto repair. Because of industrial differences such as those noted above, the mode of acquisition when related to management quality differences must be done within the same industry or enterprise group.

Other means of starting a business are very insignificant; thus, the great majority of proprietors are forced to start their own businesses from scratch. For this reason, the "mode of business acquistion" variable may not be a good discriminating variable among proprietors.

4.1.3.3 Entrepreneurial expectations and goal fulfillment.-- Observations and business analysis of an enterprise performance are not always adequate for making prescriptive statements. It is just as important also to find out about the goals, expectations, and commitments of proprietors. Admittedly, this is a very complex issue. Nevertheless, the objective here is to get a broader and deeper insight by examining factors that substantially affect decision choices or alternatives available to the proprietors. Specific topics to be discussed here include proprietors' initial objectives in going into business, their current goals, their level of satisfaction with current incomes and their perception of employment alternatives or opportunities outside the business. From a practical point of view, answers to such issues will also help inspect the validity of the assumption of profit maximization among proprietors.

The first column in Table 17 lists the different reasons proprietors gave for choosing and starting their enterprises. For each reason of choice given, the distribution of proprietors for different variables are shown in the other columns. For example, of those proprietors who each choose the business out of one's own interest, about 72.4 percent of them started their businesses from scratch.

TABLE 17.--Entrepreneurial expectations and their fulfillment (percent of proprietors)

Choice of Enterprise[a]		Business Started From Scratch[b]	If Choice Given[c]		Current Goals[d]		Satisfied with Income[e]	Business Would Close[f]
Reason	Percent		Same Business	Other Business	Income	Employment		
1. Own interest	50.9	72.4	60.0	20.6	54.6	28.4	68.6	43.2
2. Only opportunity	26.6	97.2	19.8	53.9	52.7	43.5	23.3	53.9
3. Good income	10.9	100.0	54.5	6.9	17.2	82.8	65.1	10.0
4. First opportunity	6.1	100.0	14.0	12.1	67.9	0.0	82.4	64.8
5. Family business	5.1	53.9	75.3	0.0	59.4	0.0	51.3	34.2
6. Other	0.4	100.0	100.0	0.0	100.0	0.0	100.0	100.0
TOTALS	100.0	83.4	46.8	26.4	51.1	36.6	53.9	42.7

Source: Management Study Survey (1980).

[a]Proprietors were asked why they originally chose their particular business or enterprise.

[b]Percentage of proprietors who started their business from scratch for each possible answer given in column 1 (i.e., reason for enterprise choice).

[c]If proprietors had a chance in 1980 to choose the type of enterprise they wanted, what kind of enterprise would they choose?

[d]Percent of proprietors for whom income or employment from the business are the priority goals now.

[e]Are proprietors satisfied with the current (1980) level of income they are getting from the business?

[f]If the current income were to fall down below a level which proprietors identify as very low, would proprietors close down business?

About half of the proprietors gave personal interest as a reason for choosing a business. It seems clear, however, that personal interest in this case incorporates a certain level of income as pre-condition. For out of those who made their choice out of sheer "liking" or "interest" for the business, about 40 percent would not choose it now (presumably because it has failed to satisfy also their employment and income needs) and close to 60 percent said they would not close it now for they have no other alternatives. More than 80 percent of this group, in fact, say in Table 17 that their current priority goals are income or employment; close to 70 percent of them also said that they were satisfied with the level of income they were getting from the business. Such an answer was almost invariably qualified, however, with responses such as "given the present situation, yes, I am satisfied. . . ." This seems to imply that, at least up to a point, the expected income follows a sliding scale which is conditioned by the outside economic environments and opportunities. Going back to what was said earlier, a liking for the type of the business and getting good income from it are not incompatible. So, the information in Table 17 seems to indicate that even for those who chose an enterprise for personal liking, income or employment were also paramount in their minds. If this was not the case, then 80 percent of them would not have income or employment as their leading current goals nor would as many as 43 percent of them be willing to close the business if the expected income fell below a certain level (this income level is discussed in the next section).

About a quarter of the proprietors said that they were limited in their choices to go into the current business for lack of other alternatives. And only about a fifth of them end up liking it, while three-fourths of them would rather have unrelated job or business. Furthermore, less than a fourth are satisfied with the current income and more than half are willing to close the business if it is doing badly. One can't help but ask, Why don't they close business? Possible answers to such questions will be presented in the next section too.

Another 11 percent of the proprietors chose their businesses for the potential income there. For these people, the current number one goal was also income or employment. Two-thirds of these people said they were satisfied with their current level of income, hence the remaining one-third would be expected to agree in closing down poor business instead of the 10 percent shown. The next section will show that whether a proprietor closes business down or not for poor performance will depend on the opportunities available outside. However, it must be pointed out here that the rather low 10 percent who would close down business is very low and thus seems to be contradictory to their stated objectives; for they face the same outside opportunities as the other proprietors who showed a higher percentage of willingness to close down poor business.

Finally, two groups about the same size got involved with their busiensses either because these businesses happened to be the first opportunities for the proprietors or else they happened to be family businesses.

At the urban-rural dichotomy, starting a business for one's own personal interest was the number one reason given for both groups. A little more than a fourth (28.8 percent) of the rural proprietors chose a business because that was the only opportunity available and a fourth (24.8 percent) in the urban areas "chose" the business because it initially belonged to the family. Also, for the combined two groups, the current business would still be their first choice (49 percent) or their second one (41.0 percent) for about 90 percent of them. This, of course, shows either there is great dissatisfaction with the current business (for the remaining 59 percent) or else new areas of opportunities are now available that were not present at the time the current business was started. In any case, proprietors indicated that if they had a chance, unrelated jobs or businesses would be their first and second choices now by percentage points of 39 percent and 34 percent, respectively.

Among all proprietors, the generation of adequate income is the number one current goal for 48 percent of them, while employment was the first goal for another 40 percent. Thus, for 88 percent of all proprietors, income or employment are the first goals they want to get from their respective businesses. Of the remaining, 11 percent said their current goals are either being one's own boss or else just running a business that they like. Being one's own boss got the highest response for the second place position though with a percentage point of 38.4 percent.

At the industrial or enterprise group level, the same enterprise would be preferred as first choice with the following percentages: shoes (91.7 percent), woodwork (84.7 percent), metalworks (65.4 percent), wearing apparel (40.7 percent), craft (39.6 percent), and repairs (24.2 percent). The remaining proprietors in craftwork would rather choose unrelated businesses; their counterparts in the repairs group are widely distributed in their preferred choice among unrelated businesses or jobs, farming, and related jobs. In the wearing apparel group, about a fourth (24 percent) said they would rather have a related job, while 28 percent said they prefer unrelated businesses. What is important from these choices is that in all of the industries, the choice that has the highest percentage point is always the one preferring the same business. The alternative choices discussed above were hypothetical in the sense that respondents were asked to express their preferred decisions under certain alternatives. In the next section the question of choices *vis a vis* the current business will be made more personal and concrete by forcing respondents to think in terms of the present situation and the decisions they are taking.

This section has revealed the following points. For the great majority of proprietors, considerations of incomes and employment are of vital importance in their businesses. Although there is great dissatisfaction with the current business condition, a higher percentage of proprietors would still choose the present businesses than any other one. This is particularly true with respect to the woodwork industry where 51 percent of the proprietors are dissatisfied with the income they are getting and yet 85 percent of them would still choose the business if they had a second chance to choose again; and although a very high percentage (82 percent) of this group started the business out of personal interest, and thus their continued commitment is a reflection of that, it is also true that for 85 percent of them, the current goal is income (78.9 percent) or employment (6.1 percent). Thus, their seemingly contradictory behavior must be based on their faith in the woodwork industry for the future. Indeed, the problems in the industry are not lack of effective demand so much as the shortage and escalating costs of raw materials. The following section will discuss proprietors' view toward closing a declining business.

4.1.3.4 Factors affecting proprietor exit from an industry.-- The theory of the firm in neoclassical economics stipulates that if a firm can't cover all of its variable costs in the short run, then it should shut down the plant. The shut down point under a competitive market is the point where the price or marginal revenue line cuts the marginal cost curve below the average variable cost curve. This is based on the fact that besides the fixed cost items such as basic maintenance, depreciation, interest, taxes, insurance, and rent, the firm will also fail to cover some of its variable costs; this will cause it to lose more money than if it closed down. The important point here is the distinction between fixed and variable costs and the assumption that there will be other business (job) alternatives to move into. Furthermore, cost associated with labor is usually assumed to be variable.

Figure 2a depicts a family of cost curves (solid lines) for a firm that behaves according to the neoclassical assumption of profit maximization (cost minimization). According to that model, the firm will shut down for any output less than Q where price P' equals marginal cost; (an amount Q will be produced at d and the firm is indifferent whether it closes or not at that point). If the cost structure is as depicted in Figure 2b, then for a price of P_1' the firm can produce or close anywhere between Q_1 and Q_2. If the price falls below P_1', then the firm will close no matter at what level of production it is producing between Q_1 and Q_2.[1]

For many SSI enterprises, Figure 2b probably shows the most relevant cost relationships: the average costs (both total and variable costs) stay stable until the level of production has risen quite substantially.

In the small-scale enterprise where the main or only source of labor is the proprietor (and family members) and where alternative outside opportunities may be severely limited, such labor becomes a fixed item of investment. In some cases, even hired labor may constitute a fixed cost under given social and cultural setting. Under such circumstances, a small-scale enterprise will have a larger fixed cost segment and the shut down point will be below the average variable cost curve shown in solid line.

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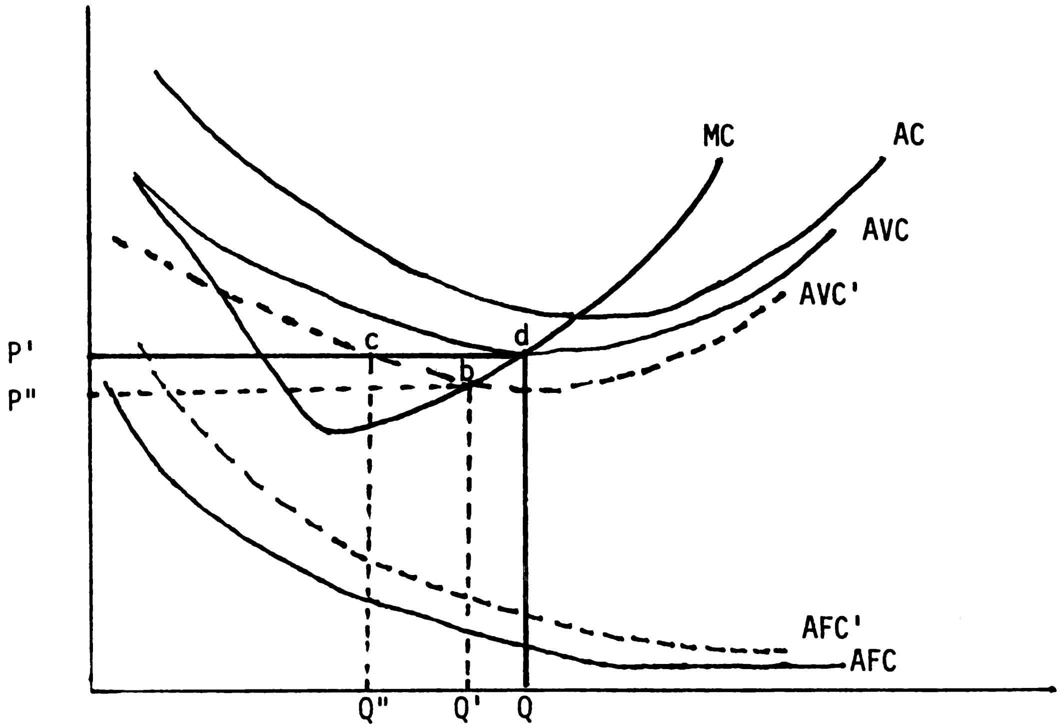
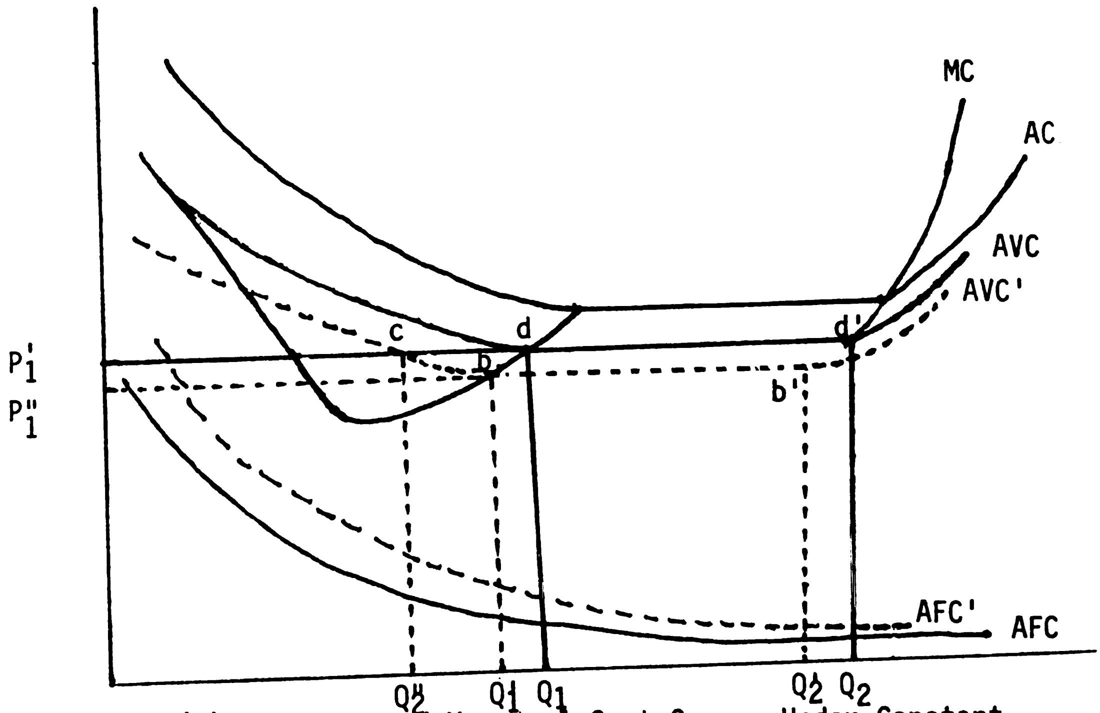
[1]The shut down point will also be affected by among other things, the difference between the acquisition price and the salvage price (see Johnson and Quance, 1972).



(a) Conventional Average and Marginal Cost Curves



(b) Average and Marginal Cost Curves Under Constant Average Cost Production

Figure 2. Average and Marginal Production Cost Curves.

When the labor input of the proprietor or the family is considered fixed, this has the effect of lowering the average variable cost (AVC) and raising the average fixed cost (AFC); it should have no effect on the total cost (AC) unless "payment" to the proprietor and the family is variable (which it usually is) depending on available funds.

When proprietor (and the family) time is fixed, the new AVC curve (dashed in Figures 2a and b) is lower than the old AVC (solid) in Figure 2a. The distance between the old (solid) AVC and the new (dashed) AVC (shown as AVC') is bigger at lower than at higher levels of production; the same is true for the corresponding fixed cost curves. This is due to a "fixed" level of family payment divided by increasing quantities at different levels of output.

In the AVC' curve, point b or c (In Figure 2a) becomes the shut down point depending on the source of business decline. If the decline is via falling prices, (along the supply curve segment db) then b will be the shut down point (i.e., price falls to P''); if decline is via shrinking demand and the product price still remains fixed at P' (at least in the short tun), then the new demand-supply equilibrium segment becomes dc (instead of db as before) and point c becomes the shut down point at a production level of Q''. If the cost structure is as shown in Figure 2b, the analytical results are the same as in Figure 2a, except now the proprietor may have more choices of production levels before getting to the shut down points of b or c in Figure 2b.

The conclusion from the above analysis is that SSI proprietors who depend on own household for labor supply will tend to operate a declining business below the conventional shut-down point. Such economic behavior (which could mistakenly be labeled "irrational") mainly depends on the proprietor considering own labor fixed and outside earnings or job opportunities limited.

There are two things to note here. One, the above analysis is obviously short-run so that in the long run either the proprietor closes down business earlier, or the equipment is run down to a halt. The second thing to note is that, unlike an idle machine which can stay put, the fixed item labor must be fully maintained and taken care of even if it is not producing. (Thus, it is behaving in this case as a truly fixed cost, although the latter deals more with consumption than production decisions.) In order to maintain this fixed factor labor, production will continue (depending on outside opportunities) so long as there is excess revenue over variable costs even if it means to eat up the existing nonlabor capital (e.g., fail to provide for depreciation). On the face of it, this may seem like a bad choice. Given the available alternatives and proprietors' assessment of the future, however, this probably is the best move for them.

Table 18 shows how proprietors may respond to a declining business. At the national level, production capacity at the SSI subsector in 1980 was about 50 percent and slightly more than half of the proprietors were dissatisfied with the business environment. And

TABLE 18.--Proprietors' response to business decline (percent of proprietors)

Industry Groupings	Level of Capacity[a]	Dis-satis-fied[b]	Willing to Close[c]	Reasons for not closing[d]		
				No Choice	Part time Job	Future Hope
1. Garments	55	22.6	40.1	62.8	27.7	9.4
2. Woodworks	45	51.0	15.1	51.9	6.2	34.1
3. Metal-works	--	61.5	0.0	76.9	23.1	0.0
4. Craft	55	95.8	66.7	0.0	88.5	3.6
5. Repairs	65	33.3	18.2	51.4	12.5	18.1
6. Shoes	45	43.1	48.6	24.3	24.3	51.4
ALL SSI	53	55.7	40.6	49.4	29.9	15.9

Source: Management Study Survey (1980).

[a]This refers to the rate of capacity currently used (1979).

[b]Respondents were asked if they were satisfied with the present level of income.

[c]Those that are prepared to close if business was much worse.

[d]Besides the three choices of "no choice or alternative," "will do part-time job" and "I have hope in the business" given here, others said it is too late for them to close and start a new life. Thus, the percentages for the three reasons do not add up to 100.

the proportion of proprietors who would close even if business got much worse still is only about 40 percent. In fact, the remaining 60 percent said they would not close down business even if they are losing continually. The three main reasons given by them for not closing are shown in that table. Nearly half of these respondents said that they don't see any other alternative to continuing on this business; another 30 percent said they would rather do some part-time job and subsidize the business for the time being; and about 16 percent said that they really believe things will turn around and hence they will stick with the current business. What is significant too here is that in evaluating the performance of the business proprietors have a multi-period time element in the analysis.

At the enterprise group level, Table 18 shows that the proportion of respondents who are prepared to close down bad business is not directly related to the level of dissatisfaction nor inversely related to the level of capacity level utilized. The wearing apparel group showed the highest level of satisfaction and the proportion willing to close down is about the national average. Woodworks shows a high level of dissatisfaction, but a low level of business closure inclination. The high rate for part-time job option for crafts is due to their part-time farming activities in the EDs.

Thus, another important consideration that needs to be mentioned here is the level of outside income coming from other sources. These sources include farming, other business, part-time jobs, retirement pay, and remittances from family members living abroad. Because some of these incomes may not be flowing in regularly, respondents' usual first answer is that they don't have any other source of income. In fact, 75 percent of the proprietors do have some outside income coming in during the year. This outside income amounts on the average to 21 percent of the business income (the median is only 2 percent). The largest source of this income is farming.[1]

It should be noted, however, that this outside income expressed as a percentage of the business income is unweighted by the size of the recipient's business income. Hence, it greatly exaggerates the contribution from outside income. Many of the proprietors who have farming as a supplementary source of income have small businesses while many of the large businesses in Kingston and the major towns have no secondary souce of income. Thus, when it is weighted by the size of the proprietor's total income, the mean percentage of income that comes from outside sources is only 6.4 percent (median 0).

Those respondents who said they will close down business if things got worse were asked how low the weekly income has to be to cause them to close. The average was about $80 with a median of $40. Since proprietors vary in their perception of costs, however (see Section 4.3.3), these figures must be taken with great caution. At the industry level, these figures ranged from $30 for urban craft

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[1]The distribution of proprietors among the different sources are as follows: farming, 52 percent; other business, 39 percent; part-time jobs, 32 percent; and other resources (e.g., remittances), 29 percent--a proprietor could have more than one source.

and food processing to more than $400 for woodwork and automobile repairs.

The discussion presented here is relevant to the contents of Chapter 5. If proprietors expect limited opportunities outside, then most probably they will work harder to make the current business more viable. This includes making the most out of available resources. The hypothesis here is that proprietors who view themselves with limited outside opportunities will achieve higher technical efficiencies for their resources.

4.2 Outside Influences

In this section, three main topics will be discussed: (a) the influence of the family in setting up the business and its participation in ownership and operation; (b) the influence of nonfamily members on the proprietor; and (c) the participation of the proprietor in community or civic organizations. The main rationale for discussing these topics is that they may be just as important as the business or economic factors in influencing the contents and direction of management decisions. Because of the limited objectives here and the complex nature of any social and psychological relational analysis, the effort is limited to presenting certain quantifiable variables. The variables chosen are considered to be important in indicating outside influences on management which, in turn, will affect the performance of the business.

4.2.1 Family Influence and Participation

The number of proprietors who had the same kind of business as their parents or relatives is small. It was indicated in the first section of this Chapter that the number of proprietors who either inherited a family business or took training in one is about 15 percent. In fact, the number of proprietors whose mothers did a related work is a mere 13 percent; and both for spouses and father it is even smaller, 6 percent each.

The proprietors whose parents had similar jobs or businesses are found mainly in wearing apparel (23.6 percent), craft (29.8 percent) and metalwork (42.3 percent). However, many proprietors came from families who had their own businesses (i.e., related or unrelated nonfarm businesses, see Table 19). For example, the proportion of proprietors whose relatives or family members (spouse, mother, and father) had their own businesses are roughly as follows: wearing apparel about 20 percent;[1] woodwork and repairs each 50 percent; metalwork 40 percent; and craft and shoemaking each 60 percent. The mothers dominate among the relatives in having nonfarm businesses. Also, nearly two-thirds of the fathers (see Table 19) were farmers while about 40 percent of the mothers were homemakers or housewives. Thus, it seems that the family influence lies more with instilling the idea of having their own business, rather than continuing the family business.

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[1]Note, the 23.6 percent mentioned earlier includes similar jobs as well.

TABLE 19.--Job distribution of relatives (percent of proprietors)

Industry Groupings	Relatives with Own Business[a]			Doing Farm Jobs		
	Spouse	Mother	Father	Spouse	Mother	Father
Garments	2.0	17.2	1.4	16.3	23.5	78.6
Woodwork	12.7	31.4	7.5	0.0	2.0	37.2
Metalworks	0.0	0.0	42.3	32.5	0.0	11.5
Craft	0.0	32.0	27.6	96.1	63.9	70.0
Repair	15.5	22.2	13.1	0.0	0.0	46.5
Shoes	22.1	36.1	0.0	15.2	18.1	63.9
OVERALL SSI	6.2[b]	22.7	12.4	22.8	26.6	64.0

Source: Management Study Survey (1980).

[a]Does not include farming.

[b]The balance out of 100 percent is accounted for by other jobs in the case of spouses and fathers and by homemaking for the mothers.

The participation of family members in business ownership is small, only about 7 percent of the enterprises had such explicit arrangements of ownership. The family members' participation in the operation of the business is also modest. The Phase I report showed that, a little over 10 percent of the SSI labor force belonged to family members (Davies et al., 1979, Table 4, p. 29; the corresponding proportion for the nonmanufacturing small-scale enterprises is 25 percent). So, family members' participation in the SSI labor force is relatively unimportant.[1] However, for about 13 percent of those proprietors who keep records, their books are kept by a relative, usually the spouse (62 percent keep their own records). It seems though that family members are well aware of what is going on in the business. When respondents were asked how long they can have a family member run the business, the average period was four months with a median of 50 days.

Nearly two-thirds of the proprietors said that in their absence they would allow their family members to do all the activities of production, product marketing and input purchasing. But only a third said that they would allow their employees to do all these activities and that only for about 40 days (median is a month). However, employees would be allowed to do production activities only by two-thirds of the proprietors. So, it seems that proprietors are willing to delegate responsibilities to family members and

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[1]Family members contributed only 3 percent (strata weighted) of the total annual enterprise hours (see also Table 27).

employees.[1] This should free them to do more managerial work such as general guidance, planning, investigation, and clientele contact.

Finally, it would be useful to look at the kinds of people that influence proprietors. About 40 percent said that they are not influenced by family members, employees, church groups, or friends in their decision making. A little more than 40 percent said that they are greatly influenced by family members in the day-to-day running of the business. The next highest percentage point for such influence is 10 percent for friends. This is followed by 5 percent for other proprietors.

While proprietors have significant influence from family members and other groups, that from employees is minimal: only 3 percent of the proprietors would bother to consult with their employees or seek their advice as a matter of priority; about half would seek such help, but only after they have consulted family members, friends, and/or church members.

Thus, the strength of influences seems to rank as follows: family members, friends, church members, and employees. Here an influence could constitute anywhere from advising the proprietor on how to rearrange the workshop to helping one decide on when and how to make a major investment outlay. Such interactive relationships have great implications both on the efficiency of existing proprietors and on the supply of new ones (see Chuta and Liedholm, 1979, p. 51).

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[1] A little more than 10 percent said that they would entrust such responsibilities with their friends or church members, but not with employees or even family members.

The influence from business related organizations is small in aggregate. Only 3.3 percent of the SSI proprietors were members of the Small Business Association (S.B.A.) and no other organization of membership was mentioned except cooperatives and credit unions.[1] Since nearly 40 percent of the proprietors were active church members, it is understandable why church members loom large in their influence on the proprietor. Furthermore, only about a third were simple members, whereas the remaining were either committee members or had executive positions in the different organizations. Thus, the influence is two way. Proprietors through their participation in social activities and leadership influence the community, while in return, the community provides psychological and business support. What the implication of all these on resource productivity and growth is not clear, but it can safely be assumed that it must generally be beneficial else proprietors would not have participated to this extent.

4.3 General Business Practices

The discussion in Chapter 4 has so far dealt with characteristics and attributes of the proprietors and the supportive interaction between proprietors and the community they reside in. In this section, the practices and policies followed to run a business will be examined. The topics discussed here include aspects of production and marketing, extent of record keeping, business financial

[1]A third claimed no membership to any organization while a fourth were members of Youth and Sport Clubs. Membership for cooperatives and credit unions were 0.5 percent and 1.6 percent, respectively.

handling and ways of evaluating the performance of the business periodically. It seems that these topics will have the greatest effect on resource productivity as will be discussed in Chapter 5.

It should be kept in mind that SSI proprietors in Jamaica are for the most part like their counterparts in other developing countries. However, some topics discussed particularly in this section must be understood in the context of not only a given country at a given stage of economic development, but also in the context of a given state of the economy.

4.3.1 Production and Marketing

In small-scale manufacturing enterprises, there usually is no specialization and also no mass production.[1] For a typical Jamaican SSI proprietor, more than 70 percent of the total production is done with orders from customers (see Table 20).[2] In fact, the median is 98.7 percent. The industry means range from 94.8 percent for wearing apparel to 44 percent for shoes.[3] There is no difference at the urban-rural strata level, each has a mean of 72 percent.

What is the implication of such production arrangements? The effect will vary from industry to industry. Generally, however, one can say that it minimizes the need to hire workers on a permanent

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[1]Up to a point, it seems the level of specialization varies directly with the size of the business.

[2]When the percentage is weighted by the size of the annual value of production, the mean goes down to 50 percent.

[3]The means for the other industries are woodwork, 78 percent; metalwork, 45 percent; and craft 45 percent.

TABLE 20.--Indicators of production and marketing

	Variable	Mean	Median
1.	Production amount on order (%)	73	99
2.	Percent of weekly hours spent on		
	a. product marketing	8	0
	b. input purchasing	9	8
3.	Product value in sotck (J$)	683	139
4.	Raw material value in stock ($)	274	94
5.	Amount of receivables ($)	514[a]	60
6.	Credit written off as bad debt (%)	8.3	4.5
7.	Amount of all debts ($)	1,789[a]	80
8.	Customers known by face (%)	80	96
9.	Customers known by name (%)	75	76
10.	Proprietors using signs or ads (%)	42	--

Source: Management Study Survey (1980).

[a]These means were obtained after discarding values that lie beyond four standard deviations; otherwise, the means would have been $745 and $3580, respectively, for receivables and debts. The reason for the high debt level is due to some proprietors who have large debts of $50,000 to $100,000 owed usually to developmental banks or agencies. Moreover, some parts of a business receivables are so old that it is doubtful they can be recovered.

basis. Workers would be required to work only when there is demand. In practice, however, any demand slack period is covered by attending to the remaining 30 percent or so of total business production and spending some time on agricultural or other activities. Although hired workers are technically job workers, they behave as if they were permanently hired. They are always available for work. The proprietor usually will see to it the worker gets some subsistence means (at least on a loan basis) even if there was no work. By so doing, the proprietor may be securing the faithful attendance of the worker for the future when demand picks up. Because of the farm activities in the rural areas, such an arrangement usually works to the mutual benefit of both the proprietor and the job workers.

Production on order (job shop) also means very little time spent on selling one's product. Proprietors spent on the average about 8 percent of their weekly hours on product marketing; the median is less than 1 percent (see Table 20). This is, however, a tricky ground; everytime a proprietor sees that the customer is well attended either in the process of negotiation of prices, styles, and production due dates or even in the discussion of nonbusiness issues, some form of marketing activity is going on. The success of maintaining one's clientele depends, as expected, both on the quality of work (material) and the social interaction or treatment extended.[1]

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[1]When proprietors were asked to give first and second reasons why customers come to them, answers given for first reason were no competition (23 percent), quality of raw material (27 percent), quality of work (29 percent) and don't know (11 percent); close to 50 percent gave proper treatment given to a customer as a second reason.

For this reason knowledge of one's patrons is very important. Thus, on the average proprietors know about 75 percent of the customers (the median is 76 percent) by name and about 80 percent of them by face, the median is 96 percent (Table 20). Also more than 50 percent of the proprietors don't use any signs or business names nor advertise on any of the media. Many of them refrain from doing so however, least they attract both the tax man and the burglar.

Production on order also means limited products in stock, thus reducing working capital needs. During the Phase III data collection, stocks of products and raw materials were taken several times during the year. The overall mean value of product inventory for the year is about $683 and the median is only $139. The corresponding mean for raw materials is about $274. There is great variation, though, among the industries with respect to the raw material stock. While in wearing apparel the customer (mainly in the rural areas) may bring the fabric to be used, this is not the case with woodwork. In fact, in order to satisfy each person's specification of material and design, the woodwork proprietor may be forced to maintain a larger inventory of raw materials than would be necessary for stock production. Thus while the average value of raw materials in stock is about $200 for wearing apparel, for woodworks, it is about $2,850. The effect of such differential requirements would mean different industries will have different working capital needs. For this reason, woodwork proprietors cite working capital needs as the number one problem by a higher percentage than any other enterprise group or industry.

The advantages and disadvantages of production under order and for stock are varied (see Table 21). At the national level,

TABLE 21.--Proprietors' preference and reason for mode of production (percent of proprietors)

Reason for Given Mode of Production	Preferred Mode of Production	
	Stock	Order
1. Product sells easily	10.6	52.1
2. Good price possible	8.9	8.3
3. No need to give discount prices	31.0	7.7
4. No additional expenses incurred	1.7	26.9
5. More profitable	6.0	5.0
Total	100.0	100.0

SOURCE: Management Study Survey, 1980.

about 40 percent of the proprietors think that production on order is more preferable than production for stock. And about 35 percent think stock production is better. Another 20 percent who are entirely found in the garment and craft industries said they don't know. These last group presumably may not have tried to produce for stock. Generally, woodworks, shoemaking, craft, and repairs[1] think production for stock is more profitable than production on order. Wearing apparel and metalwork proprietors think order production is more profitable; however, they produce for stock because there is not

[1]Stock production for repairs is to buy old items, repair them, and sell them.

enough order (i.e., not enough market). The proprietors who prefer stock production gave a number of answers why they were not producing 100 percent under that mode. Lack of market is still the leading reason given by 49 percent of the respondents; other reasons given include price negotiation hassle, cash flow problems, and lack of raw materials.

The proprietors who prefer production on order gave as reasons that it sells easily, one does not incur additional expenses (such as storage costs, and discounting prices) and charging higher prices is possible whenever a customer requests even a slight change in design than the usual one (Table 21).

It is not obvious how the productivity of resources would be affected under the two modes of production. It would seem, however, that production on order would greatly limit the opportunities for aggressive business enterprising behavior. It is also possible that under both modes of production, labor efficiency could be either favorably or unfavorably affected. Under a piece work arrangement, job workers would finish a job much faster so that they could use the time saved for something else. On the other hand, since there is no explicit contractual agreement on the amount of time taken to finish a product, it is occasionally possible to spend more time on an item than necessary.

Almost all enterprises (92 percent) show seasonality patterns in production. Sales are high during public holidays such as Christmas, Easter, and Independence celebrations in August (see Table 22). Thus, the periods November-December, July-August, and March-April are

TABLE 22.--Seasonality in production (and sales)[a]

Month	Percent of Proprietors Who Think the Month is Usually			Proprietor Estimated Monthly Sales	
	Low	Medium	High	Mean	Median
January	45	28	27	$ 651	$ 299
February	63	24	13	639	150
March	33	52	15	1,073	298
April	23	60	17	1,290	301
May	50	48	2	911	248
June	42	52	6	999	248
July	29	35	36	1,624	250
August	8	33	59	1,363	302
September	36	51	13	905	302
October	41	42	17	1,056	302
November	20	28	52	1,382	673
December	2	12	86	1,972	602

Source: Management Study Survey (1980)

[a]Due to the prevalence of production on order (or job shop), production value and sales value are almost identical.

the best months of the year. During these months, production for stock increases relatively much faster than production on order.

According to the monthly sales estimates made by respondents, the mean monthly sales from a firm range roughly from $650 in January or February to $2,000 in December (see Table 22). The mean sales value for the best month is about $2,060; the corresponding sales value for the medium and low months are $900 and $450, respectively. These figures are high due to a few urban enterprises with large monthly sales (e.g., $6,000 for the worst month and $40,000 for the best month). Otherwise, the mean monthly sales values in the rural areas for the best, medium, and lowest months are respectively $780, $450, and $200. Also, in all the areas the median sales values for the three kinds of months are $680, $300, and $150, respectively, while the minimum values are $70, $25, and $20. At the industry level, wearing apparel (tailoring) gross about $490, $190, and $160, respectively for the best, medium, and worst sales months; the corresponding values for woodwork are $3,835, $1,765, and $780.

The figures given in the preceeding paragraph are simple estimates by respondents.[1] The accuracy of their absolute sizes is therefore questionable. For the purpose of the present aim, their relative sizes are what are important. Thus, on the average, sales per firm for the best month was four and one-half times greater than

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[1]Compared with the sales value from the flow data (longitudinal study), the sum of these monthly sales over the year tend to overestimate the annual value of production. This is opposite to their tendency to underestimate it when they give it in one lump sum figure (see footnote 2, p. 67).

the worst month for the SSI as a whole. In the case of tailoring and woodwork, the best month was respectively 3 and 5 times greater than the worst month.

4.3.2 Record Keeping

As the activities of a business become more complex, some sort of record keeping becomes absolutely essential both to keep track of business transactions and to periodically evaluate the enterprise. It is hypotheiszed there that enterprises that keep records would register a higher level of resource use efficiency than those who don't keep any records.

Two factors that usually determine the kind and level of bookkeeping are the educational level of the proprietor and the size of the enterprise (Fisseha and Davies, 1981, p. 90; see also Haggblade et al., 1979, p. 87). Furthermore, the Phase II report found that younger proprietors, proprietors who borrowed money from the commercial banks and those who had business ownership other than sole proprietorship tended to keep records more than the others (Fisseha and Davies, 1981, p. 92).

In Jamaica, about 10 percent of the SSI enterprises and 20 percent of the small-scale service enterprises (nonmanufacturing) keep essential records (Davies et al., 1979, pp. 22, 38). This is lower than what Chuta and Liedholm (1979, p. 50) found in Sierra Leone.[1] The studies in Haiti and Honduras do not identify those who keep

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[1]Their definition of small-scale manufacturing is, however, those that have a labor force of 50 instead of 25 as in the Jamaican study.

complete records and thus it is not possible to make comparison with them (Haggblade et al., 1979, p. 87; and Kelley and Coronado, 1979, p. 49). Chuta and Liedholm quote 6 percent who keep records for enterprises in Bangladesh (see footnote, Chuta and Liedholm, 1979, p. 50).

Another 9 percent keep partial records containing items such as sales value, raw material expenses, credit sales, etc. The remaining 80 percent or so do not keep any kind of records at all (see Table 23). There is great variation, however, by location and enterprise type (see Davies et al., 1979, p. 38). For example, more than a third of the enterprises in the urban areas keep records, the corresponding figure for the rural areas (consisting of the Rural Towns and EDs) is only 5 percent. At the industry level, there is none that keep complete records among the craft group, with a 2.0 percent wearing apparel is almost on par with craft. For woodwork and shoes, the percentage is nearly 20. The industries that show high record keeping rates are metalworks, repairs, and other types of manufacturing.

The reasons given by proprietors for not keeping records are varied. They vary from no interest to no knowledge of record keeping procedures (Table 23). About a third of the proprietors said that they don't keep records because they don't know how. Another third said that there is no need to keep records since the business is small and they can remember things without much difficulty. (Fewer than 1 percent said they don't want to do it because of the

TABLE 23.--Record keeping among enterprises (percent of proprietors)

Management Variables	Types of Records Kept			Jamaica[a]
	Complete	Partial	None	
1. Proprietors keeping records	9.5	9.0	81.5	--
2. Reason for not keeping complete records				
a. small business	--	70.0	28.7	31.0
b. no knowledge	--	0.0	34.8	33.0
c. takes time	--	10.0	0.0	0.4
d. other reasons	--	20.0	36.5	35.6
3. Profit used as a measure of analysis	52.0	0.0	1.9	7.8
4. Secondary or higher level education	47.4	22.0	21.4	23.0
5. Presence of bank accounts	48.8	26.1	18.8	22.4
6. Those keeping business and nonbusiness money separate	74.4	80.2	40.6	49.1
7. Business analyzed once or twice a year	37.9	0.0	1.2	4.2

Source: Management Study Survey (1980).

[a]The entries under this heading give percent of all enterprises that satisfy the given management variable whether they keep records or not.

time it takes to record things). The remaining gave various reasons ranging from having no interest at all to fear of the tax man or the leassor of workshop equipment who gets paid a percentage of the total sales. For half of the third group, however, it has never crossed their minds that they may need some sort of record keeping.

Depending on the size or complexity of the business, record keeping is an indispensable tool for tracking the success or failure of the business. Considering the time it takes to compile, analyze, and interpret it, however, record keeping may be a liability for the very small enterprises whose activities can easily be remembered by the proprietor. And if the proprietor (or a family member) can't do the recording, then the expenses involved may greatly deter the adoption of any record keeping. Thus, instead of making a blanket recommendation for all enterprises to keep records, one should look carefully at the enterprise size, the system of production and marketing, the potential benefits to be accrued from record keeping, and the mechanics of keeping such a record.

With respect to the costs associated with record keeping, 62 percent of the proprietors keep thier own books, 20 percent hire either an employee (12.9) or a contract accountant (7.1 percent) and another 13.4 percent have their relatives, such as the spouse (9.1 percent), do the bookkeeping.

Beginning with the third entry, Table 23 shows the relation between record keeping and other variables. Record keeping it seems, is directly related to the level of education. Comparison between those who keep records and those who don't keep records at all show the following: more of the proprietors who keep records use profit as a measure of business performance; own bank accounts; keep business and nonbusiness money separate; and tend to analyze the business performance over a longer period of business operation. They also tend to be more geographically mobile (compared with those who don't keep records), use more of product promotion techniques, attend more seminars, seek more external credit funds and also pay more attention to the costs and returns associated with individual items in production. When proprietors were asked to list all their costs (see next section), those who keep partial records omitted 31 percent of the costs compared with 42 percent for those who don't keep records. The record keepers considered higher percentage (11 percent) of credit sales as bad debts compared with those who don't keep records at all (8 percent); (whether this difference shows management inefficiency or a superior use of record keeping, one cannot tell).[1]

Finally, it is interesting to know that those who don't know how to keep records are willing not only to learn it, but to contribute some money to do so. Nearly half (47 percent) said they will be willing to pay and the average level of contribution they were willing to pay was $110 with a median of $100. Out of approximately a 40-hour week, they were also willing to give 5.6 hours (median is 5) of their time per week for eight weeks to learn how to keep records.

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[1]In fact, it is not obvious whether the differences indicated in this disucssion are mainly due to record keeping or other factors such as the educational level.

4.3.3 Financial Management Differences Among Proprietors

Sometimes all the attention is given to production and marketing in SSI enterprises and very little to the control of funds generated by such activities. Financial control in small-scale production is very crucial because external funds are either unavailable or expensive (see Chuta and Liedholm, 1979, p. 68; Fisseha and Davies, 1981, p. 67). The availability of external funds assumes even greater importance in times of demand and raw material shortages as existed in Jamaica in 1979-80.

4.3.3.1 Identification of costs.--This section will briefly analyze proprietors awareness of the different types of costs and the financial handling of enterprise funds. Two approaches were used to check proprietors' accounting of all costs. In the first approach, they were asked to name all their costs or expenses that they incur in running their business. This approach is called the expense approach. In the second approach they were asked to specify what costs or expenses should be subtracted from total sales in order to arrive at what they call profit. This inquiry is called the profit approach.[1] The results for both approaches are shown in Table 24. As a countercheck to the responses given by them in the profit approach, respondents were also asked to specify what the profit will be used for. In the expense approach, they were asked (after they

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[1]It should be pointed out that since the expense approach preceded the profit approach in the administration on the questionnaire, it seems the former had a conditioning effect on the response to the profit approach (Table 24).

TABLE 24.--The identification of enterprise costs by proprietors (percent of proprietors)

VARIABLES	Percent of Proprietors Failing to Identify the Relevant Costs					
	Urban		Rural		Jamaica	
	Expense Approach	Profit Approach	Expense Approach	Profit Approach	Expense Approach	Profit Approach
A. Cost Items						
1. Fuel-Transportation	57.3	12.8	66.8	21.4	65.3	19.8
2. Depreciation and Repair	53.5	29.2	50.8	23.6	51.3	24.6
3. Own Labor	22.0	15.9	24.3	5.6	23.9	7.5
4. Utility	24.8	12.8	20.7	10.1	21.3	10.6
5. Rent	28.7	0.0	18.3	26.9	20.2	21.7
6. Hired Labor	4.5	1.0	1.2	1.0	1.8	1.0
7. Raw Material	2.1	0.5	0.0	2.5	0.4	2.1
8. Tax or Interest	100.0	81.9	100.0	87.8	100.0	86.4
MEAN FOR ALL COST ITEMS	34.1	19.8	40.6	19.9	39.6	19.9
B. Number of Relevant Cost Items Left Out						
0	5.4	46.9	7.6	50.4	7.3	49.9
1	23.7	16.9	18.8	13.8	19.5	14.3
2	36.5	24.2	28.5	18.2	29.7	19.2
3	26.3	4.6	39.6	14.4	35.5	12.9
4	2.8	0.0	2.7	3.1	4.8	2.6
5-8	5.4	7.3	2.8	0.0	3.1	1.1

named what they identified as their costs) if they would produce an item for sale if they were paid the costs they mentioned. About 40 percent of them said they could not, indicating they had left out some costs. After they added whatever costs they considered, they were again asked if they were willing to sell now after the price covers the latest costs as well. If the response to the second question is positive, then the number of all relevant costs and those left out by the respondent were checked and tallied. The results of these two approaches will be discussed now.

The average number of cost items (excluding taxes and interest) in the SSI enterprises is about 5.6 (median is 5.7) out of which about 2.2 (median is 2.3) were left out in the expense approach. Thus, about 40 percent of the cost items were left out. (When individual proprietor's percentage of costs left out are added and averaged, the resulting percentage is also 40 percent.) When the profit approach was used, the percentage of costs left out is 20 percent. The 20 percent is a very conservative level, since proprietors were already made aware of some of the costs from the expense approach question which was asked first.

Ranking the costs according to the percentage of proprietors that failed to mention them in the expense approach, fuel and transportation expenses are in first place followed by repair-maintenance-depreciation. Almost a fourth of the proprietors also failed to include their own labor as cost. By contrast, the number of people who failed to include raw materials and hired labor is very small. With the profit approach there is improvement with every cost item.

This, as already explained, is due to the fact that the expense approach was administered first and as a result of the probing that occurred, proprietors had their minds refreshed and thus were able to count or include more costs in the profit approach.

The percentage shown for taxes are not actually percentage of proprietors who failed to count them as costs when they should. They show percentage of proprietors who never mentioned them in the discussion. Thus, nobody raised them during the expense approach while about 14 percent mentioned them during the profit approach. Hence, it could be inferred that at least 14 percent of the proprietors probably pay taxes. Because of the sensitivity of the topic, respondents were never directly asked whether they pay taxes or not.

Table 24 also shows the percentage of proprietors who failed in the two approaches to include a number of valid costs. For example, at the national level and using the expense approach, 43.4 percent of the proprietors failed to include at least three cost items.

At the industry level, wearing apparel showed the highest rate (51.33 percent) of failure to include all costs under the expense approach. It is distantly followed by shoes (39.8 percent), repairs (33.6 percent), and woodwork (31.0 percent). When the profit approach is used, there is not much difference although woodwork and repairs take the lead now over shoes. The percentage of cost items "forgotten" to be included probably depends on the number of purchased inputs, on the frequency and size of purchases and on the differences of meanings for costs.

It has not been proven here that failure to identify certain costs as expenses means proprietors also ultimately fail to make provisions for all of them. Some proprietors lump some costs with others (e.g., transportation with returns to own labor). Failure to identify a relevant cost may result from (1) not considering it as cost, (2) lumping it with other costs, or (3) considering it unimportant. Whatever the reason may be, failure to explicitly identify and account for all costs could result in ineffective cost control measures and thus in inefficient business performance.

The relation of the present discussion to that in Chapter 5 is very important. For, if respondents did not know what their costs consist of, then it would be difficult to see how they can achieve price or allocative efficiency. The performance analysis of the business and the decisions that come out of such analysis may be misdirected at least. Calculated technical efficiency could be affected also via the value added approach if respondents don't state all their cost items. The implication of the discussion strongly points also the importance of paying greater attention to how field data should be collected. It is not enough to simply ask for certain values without making sure there is a common understanding of concepts between the interviewer and the respondent.

4.3.3.2 Handling of funds.--Here topics such as the separation of business and nonbusiness funds, the mode and frequency of payments for the proprietor's services and factors affecting cash withdrawals and budget allocations will be briefly discussed.

Fifty percent of the proprietors don't separate household and business funds (particularly long-term funds). The other half tries to separate them through bank accounts, bookkeeping, and physically separating them in storage. The two most popular ways to separating the two funds (home and business funds) are bank accounts and physical separate storage of each. As will be seen below, sometimes priority is given either to the home or the business.

About half of those who try to separate the two funds maintain bank accounts; this would be about 33 percent of the total number of proprietors. At the industry level, except for repairs and woodworks about 30 to 40 percent of the enterprises keep bank accounts. Repairs proprietors have the highest percentage (61 percent) for bank accounts while woodworks have the lowest (7 percent).

Proprietors who don't try to keep the two funds separate were asked how they allocate funds between business and other needs. About 50 percent said that the one which has the greatest need takes priority in withdrawing from the funds. This depends strictly on need. About 40 percent said they usually have no specified way of fund allocation. Cash needs for the business, the home, personal use, etc. would all be drawn from the same pocket, so to speak, depending on current necessities. About 9 percent said that they give first priority to business; only 3 percent would give first priority to the home. Another 2 percent would treat them equally, i.e., split the available funds between the two. About 4 percent of the wearing apparel proprietors would give priority to nonbusiness need in sharing the current sales funds; the corresponding percentage for woodworks is 0. About 8 percent of the wearing apparel group would given priority to business need to 7 percent for the woodwork group.

Only 16 percent of the proprietors have a fixed salary which they withdraw regularly. The remaining depend on regular withdrawals from sales. For 99 percent of the respondents, payment is done every week. For a third of those who depend on this method, regular withdrawals depend on the size of the total sales.

At the industry level, 43 percent of the wearing apparel group base withdrawals on the size of total sales; the bigger the sales, the bigger the withdrawal. The corresponding percentage for woodworks is only 14 percent.

Proprietors were also asked how they allocate what they call profit. (It was pointed in the last section that this profit may contain at least 20 percent of the cost items undeducted.) The attempt here is to see what other nonbusiness related activities have a claim also on the funds generated from the business. Since the analysis both for those who keep the business and nonbusiness funds separate and for those who don't was done together the picture is not clear. However, what is strongly shown is that about 58 percent of the proprietors would use money generated from this business to support other businesses, such as farming, or build a home. In light of what was said in the previous subsection concerning proprietors awareness of future needs of investment funds, this could create critical financial problems when the time comes to replace some of the equipment or machinery. Another 18 percent would reinvest it in the business in the form of working capital while another 12 percent just put away in the bank for future long-term investment.

To conclude this subsection then, about 50 percent of the proprietors don't separate business and nonbusiness funds. About a third of the proprietors keep bank accounts which they use to separate the funds. About 84 percent of the proprietors are paid on withdrawal basis every week. It seems a large portion of the business funds are siphoned to other businesses or activities.

Finally, looking at the effect of such financial management on the technical efficiency of resources, it seems that the availability of funds to replace old machinery or to buy new ones for expansion, has an important implication for the average productivity of labor and thus for the enterprise's overall technical efficiency. This has also an implication for the potential scale of production and the concomitant input productivities.

4.3.4 Financial Business Evaluation

The subject matter in this section is fundamentally related to the objectives of the proprietor. It has been pointed out in Section 4.1.3 that the overwhelming majority of proprietors want income and employment from their businesses. Therefore, the criteria used in business evaluation should reflect these objectives.

For two reasons, the discussion here will be brief. A substantial portion of it has been discussed in the Phase II report

(Fisseha and Davies, 1981, p. 90) and some of it has already been touched upon in the previous section and in Chapter 3.

It was indicated in Chapter 3 that proprietors look at total sales to see overall trends and business environments. When it comes to examining the financial or income performance of each business, however, the indicators used vary with some industries using more of some indicators than others. Table 25 shows that less than a third of the proprietors check the returns made on given raw material purchase per period, usually a week or two. For example, a shoemaker may buy a piece of leather for $50, then at the end of a week, he would sit down and compare the total sales or repairs with the value of leather he has already used up. If sales has covered the purchase value of the used leather and some is left for his own labor and other expenses, then he may be doing good.

The percentage of craft proprietors who check return to raw material is very high (94 percent). This is partly due to the fact that they don't commonly have any input other than raw material, usually straw, to buy and that only occasionally.

About 28 percent of the proprietors check sales and expenses for key items. A dressmaker may, for instance, check the number of dresses she has sewn and the expenses that go with them (rubber bands, thread, belts, etc.) and not pay attention to the amount of repair work she has done. About a fifth to a fourth of the proprietors cost out each item made making sure there would be enough in the charge to pay for other expenses besides the raw materials involved. In fact, due to the lack of standardization of products,

TABLE 25.--Indicators of business performance (percent of proprietors)

Indicators	Industries						Jamaica
	Garment	Woodworks	Metals	Craft	Repairs	Shoes	
1. Return to raw material	31.5	29.2	38.5	93.5	10.0	20.6	31.4
2. Some sales and key expenses	44.5	20.3	15.4	0.0	24.5	20.6	28.5
3. Return to individual item	17.5	40.6	46.1	6.5	38.8	23.8	22.8
4. Profit	3.3	6.6	0.0	0.0	20.0	20.6	7.8
5. Others	3.2	3.3	0.0	0.0	6.7	14.2	9.5
TOTALS	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Management Study Survey (1980).

this method is probably much more prevalent than indicated on the table. What is shown on the table is only those who use it as a measure of overall business performance; otherwise, it is also widely used by those who also use the periodic profit analysis. About 8 percent use the true profit analysis. Then there are others who check just total sales, or look to the weekly withdrawals made from the business or who just rely on their overall feelings or perception of financial constraints; these are the 9.5 percent mentioned in entry No. 5.

4.3.4.1 Frequency of business analysis.--How often do proprietors check the overall performance of their businesses using or not using the indicators shown in Table 25? For it is possible that for longer periods of time, proprietors may compare, say this year's cash and value of inventories with that of last year or at the beginning of the current year. About a fourth (27 percent) of the proprietors make no checks at all to see how the business is doing (see Table 26). This percentage rises to 46 if the proprietors who totally depend on returns to individual items are included. Another 24 percent do some checks now and then during the year when unusual circumstances come up or a bank loan application demands it (see Fisseha and Davies, 1981, p. 93). Among those that do a regular or periodic check, the once a week is the most popular one. The majority of proprietors who don't make any checks at all are found in the craft industry. Contrary to the impressions one gets by looking at their educational and training backgrounds, shoemakers seem to make

TABLE 26.--Frequency of business performance analysis (percent of proprietors)

Frequency of Analysis	Industry Groupings						Jamaica
	Garment	Woodworks	Metals	Craft	Repair	Shoes	
1. No analysis	2.8	6.4	0.0	82.6	9.1	0.0	27.1
2. Weekly	29.5	4.6	15.4	2.5	9.1	44.4	19.8
3. Occasionally	26.6	52.2	0.0	13.8	9.1	20.7	23.6
4. Monthly	2.0	0.0	0.0	0.0	28.3	0.0	2.3
5. Yearly	1.4	3.2	0.0	0.0	0.0	20.6	3.0
6. Depend on returns to individual items	26.5	29.3	84.6	1.1	35.3	14.3	18.9
7. Others	11.2	4.3	0.0	0.0	9.1	0.0	5.3
TOTALS	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Management Study Survey (1980).

a more frequent analysis of the business than other proprietors. They are followed by woodworks, wearing apparel, repairs, and metal works in that order.

Finally, it should be pointed out that Table 25 plays a dual role in that for some proprietors it refers to longer-term performance of the business while for others, it also implies a short-term picture of profitability or losses.

To summarize the chapter very briefly, the average proprietor's age is about 40 years with a median of 42. Compared with proprietors from other developing countries, Jamaican proprietors have a higher level of education, an average six years of school, and more than 95 percent of them have had some elementary education.

About three-fourths of the proprietors have gone through the apprenticeship scheme. This is slightly lower than what one may find in Africa, say. Chuta and Liedholm (1979, p. 50) found the percentage for Sierra Leone proprietors was 90.

The average Jamaican proprietor had worked for about 11 years before the present business. Out of these, four years were spent in farming. Also, proprietors are more likely to have their business in the place where they grew up. About 86 percent of the enterprises were started from scratch, i.e., no transference or consolidation of ownership occurred. About half of the enterprises were started out of the proprietor's personal interest or liking for the job.

The influence of the family on the proprietors and the latter's participation in community life is extensive. The majority of them belong to a church or some social or sport clubs.

About three-fourths of the total production is produced on order (the median is 99 percent). The main reason for production on order seems to be lack of demand and lack of working capital. Close to 91 percent of the enterprises have seasonality of production. The best periods are November-December, March-April, and July-August where the public holidays fall.

Only 10 percent of the proprietors keep complete records and another 9 percent keep some partial records covering certain costs and expenses. Inasmuch as many proprietors tend to either forget or disregard certain expense items, record keeping could be useful for many proprietors. For example, among the major items of production, own labor (i.e., proprietor's labor) was not counted as one of the costs by a fourth of the proprietors. In analyzing the financial soundness of their activities, most proprietors check the returns either to a complete item of production or an input. The great majority of proprietors also don't do any periodic global analysis of their businesses. Attempts will be made in Chapter 5 to relate some of the variables discussed in this chapter to technical efficiency performance.

CHAPTER 5

RELATIVE TECHNICAL EFFICIENCIES IN THE SMALL-SCALE MANUFACTURING SUBSECTOR

5.0 Introduction

Topics covered in Chapters 3 and 4 included a descriptive profile of Jamaican small-scale industries (SSI), their contributions in employment, production and training, and the management characteristics and practices found in the subsector. The following topics were briefly summarized: an overall view of the subsector with special emphasis on static characteristics of enterprise size, composition and contribution; recent dynamic changes in basic economic variables such as prices and outputs; persistent, mostly exogeneous, subsectoral problems, such as demand and raw material shortages; and variation in proprietor characteristics and management practices. These topics should help one to evaluate or better appreciate the degree of variation and potentiality among typical enterprises in the context of the forthcoming discussion on production efficiency.

This chapter deals with technical or production efficiency as described in Section 1 of Chapter 1 and Section 2 of Chapter 2. Briefly, technical efficiency implies the degree to which producers are successful in achieving the greatest possible output from given available resources under prevailing economic and technical conditions (Farrell, 1957). In contrast, allocative or price efficiency refers to the degree producers succeed in using resources in their correct proportions given their market or shadow prices (Farrell, 1957; Page, 1980). Technical efficiency requires no input prices, except to the extent required to derive the total value of the relevant inputs when those inputs are expressed in monetary terms (e.g., intermediate inputs). The examination of technical efficiency implies the determination of the technical relationship between inputs and outputs, a relationship commonly known as the production function. Thus, one of the first needs here is to identify or estimate the production function for each of the industries discussed in this chapter.

Specifically, this chapter will deal with (1) the estimation of the input-output relationships or production functions as a prerequisite for examining the inter-enterprise technical efficiency differences; (2) construction of relative technical efficiency indices[1] among the enterprises; and (3) an examination of the inter-enterprise causes of variation in the efficiency[2] indices.

5.1 Input-Output Relationships

The determination of the input-output relationship or the production function is the first step toward establishing the efficiency performance indices among enterprises in each industry group.

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[1]The degree to which an enterprise succeeds in attaining the efficient standard of output is expressed as an index number between 0 and 1 inclusive.

[2]Unless stated otherwise, the use of the word "efficiency" (inefficiency) alone refers to technical efficiency (inefficiency).

Toward this end, this section briefly describes the selection of model variables, identification of the models to be used, and the analytical results from such input-output models. Although the section on efficiency uses both regression and linear programming techniques, this section on the production function deals only with regression. The regression results (along with the LP results presented later) will then be used in Section 5.3 to construct inter-enterprise efficiency differences.

To estimate the production function coefficients, regression analyses were run on three types or groups of industries: (a) the tailoring group consisting of tailors and dressmakers, (b) woodworks (excluding logging and lumber production), and (c) all small-scale industries combined together (including tailoring and woodworks).

Because of the possible diversity of inputs, outputs, and scale operations, theoretical aggregation issues get progressively troublesome as production functions are estimated at the intra-firm, inter-firm, or economy-wide levels. The seriousness of the aggregation problem depends on the degree of aggregation, the diversity of inputs and outputs and the heterogeneity of the producing units.[1]

The ideal conditions under which aggregate production functions can be estimated are discussed in detail in Fisher's (1969) article. Such convenient conditions will hardly exist in the real world. Thus, Fisher (1969) says the question (problem) of

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[1]Of special historical significance is the controversial discussion about the capital component in the production (or growth) function (see Harcourt, 1972).

aggregation will arise even, "at the firm level with production actually carried on in individual establishments or, more fundamentally, by individual workers using individual kinds of capital" (p. 554). So the question is whether perfect aggregation is necessary for all purposes. He adds, "What we really care about is whether aggregate production functions provide an adequate approximate to reality over the values of the variables that occur in practice" (p. 569). Based on such a position, many have estimated production functions at the industry, sector, or even economy-wide level of aggregation (for brief theoretical review and critical examination, see Fisher, 1969; Sato, 1975; Walters, 1963). Fisher, Solow and Kearl (1977) also add, "For many problems, aggregate production functions are simply too useful to pass up, especially since they can work, as our [simulation] experiments show" (p. 319). Ultimately, the usefulness of such aggregate production functions lies in the fact that they give statistically good results to the estimated input and output results (production functions) and particularly "the calculated marginal products appear to be related to observed factor payments" (p. 305).

It is precisely for these two reasons why an aggregate production function at the small-scale subsector (S.S.I.)[1] level has been included in the present analysis. Relatively speaking, there is likely to be more aggregation issues with estimating a production function for the S.S.I. or small-scale manufacturing subsector than for a single firm (from time series) or a single industry such as

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[1]S.S.I. or SSI always refers to the small-scale manufacturing firms.

tailoring. As will be shown later in this section, however, the average production function[1] regression results from the S.S.I. model are statistically superior than the industry level estimations.

There are several reasons why one should get a good regression fit for the small-scale industry as a whole. First, the level of capital distribution among S.S.I. enterprises, both in amount and complexity, is not that wide as may be the case, say, for a whole economy, a region or even the manufacturing sector; second, the skill difference among the labor force is not that wide either. For example, total wage share[2] of the total income or value of production is 65 percent, 69 percent, and 70 percent, respectively, for tailoring, woodworks, and the S.S.I. (The corresponding percentages for the value of raw materials are 13 percent, 11 percent, and 13 percent, respectively.) In other words, there does not seem to be wide relative differences or departures from reasonable expectations in the factor shares either; and when such is the case, the aggregate production function is reasonably a valid manifestation of the empirical world (Fisher, p. 572).

In spite of good functional results, however, one must be careful how results from highly aggregated functions are used, particularly if one wants to use them to predict parameter values and prices over time. In the present objective of estimating efficiency

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[1]A production function curve from a usual regression model is called average here to distinguish it from the frontier production curve which is constructed in such a way that no production point lies above it, but at least one may lie on it.

[2]This is both explicit wages and returns to proprietor and family labor.

indices from frontier (or maximum ever attainable) production functions, the S.S.I. model would tend to show a wider divergence or spread as one industry using specific technique of production could dominate output at the frontier level (this will be clearer when the analytical results are discussed in Section 5.3).[1] Thus, the aggregate S.S.I. production function and the corresponding efficiency results are not pressed too much here, except to serve as a basis of comparison for woodwork and tailoring. It is better to heed the warning by Fisher and colleagues, "Our parting advice is to handle them [aggregate production functions] the way the old garbage man tells the young garbage man to handle garbage wrapped in plastic bags of unknown provenance: 'Gingerly, Hector, gingerly'" (p. 319).

5.1.1 Data Description

The sampling design and the field work on data collection have been already explained in Section 2.4. To sum up what was said there, continuous flow of inputs and outputs were collected every three or four days over a period of twelve months. Stock information on inventories of buildings, equipment, and working capital (i.e., raw materials and finished products) was collected both at the beginning and at the end of the flow data survey period. In the case of the working capital, it was collected as many as

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[1]This would be particularly true in the LP model where the frontier curve is determined only by those efficient enterprises whose points of output fall on the curve. In the OLS model, the effect is mainly via the adjustment of the constant or the intercept.

five times during the year; its annual mean is used in the production function analysis.

The emphasis in this section is on the selection and aggregation of inputs that go into the production function. It was hypothesized that five key variables would explain the input-output relationships or production functions for the three industrial groupings (i.e., tailoring, woodwork, and the S.S.I.). These variables are total production (as dependent variable), labor, capital, intermediate inputs (mainly raw materials) and mean index of fixed capital age. Total production (i.e., including repair work), capital, and intermediate inputs are all measured in Jamaican dollars. Thus, total production refers to the value of all items produced (and repaired) during the year. Labor is measured in actual hours of work done. Capital refers to the user cost value of all fixed assets, plus working capital used in production. Intermediate inputs include raw materials and other consumable items such as fuel and electricity. The capital age index is a linear summation over all equipment of the pure ratio between the expired and expected economic life of each equipment weighted by its fractional contribution toward the total purchase value of all the equipment used by an enterprise. The result of such a summation is a single enterprise index number lying between 0 and 1.[1]

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[1]The index number for an enterprise is calculated as follows:

$$i = \Sigma F_j(P_j/TP), \qquad j = 1,2,\ldots,n$$

where:

5.1.1.1 Vintage indicator.--The fixed capital age index is used as a rough vintage indicator to capture improvements in technologies embodied in more recent generation of capital equipment.[1] Sato (1975, p. XXVII) says, "The ages of capital goods tell us the vintages of techniques embodied in them. Thus, we have the 'vintage' capital theory." He adds, "In our vintage model, the newest machine has the highest productivity" (p. 231).[2] Aigner and Chu (1968, p. 828) also note, "And new equipment generally reflects technical improvement . . . [firms with] new equipment are generally more efficient." (See also Page, 1980; Lecrew, 1979; Artus, 1977; and Klein, 1962, on the importance of encorporating the equipment vintage differences in formulating the production function.)

When Ordinary Least Squares (OLS) regressions of a Cobb-Douglas model were run, the coefficient for the vintage indicator was negative (as expected), but nonsignificant at 10 percent both for the woodworks and the S.S.I. group. It was unexpectedly positive, but insignificant in the tailoring regression. Different regression

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i = the equipment age index number for an enterprise

F = the portion of equipment expected life that has expired

P = inflated purchase value of the equipment

TP = total inflated value of all enterprise equipment (linear summation)

n = number of equipment used by the enterprise

[1]Vintage refers more to date of manufacturing for similar type equipment rather than actual depreciation or physical deterioration *per se*.

[2]The chronological reference point used here is the date of new equipment purchase, rather than the year of manufacture; this introduces hardly any bias as the time span between the two is short.

models[1] were tried, but it was consistently positive in tailoring. This is contrary to the usual expectation of old equipment being less productive. Therefore, a positive coefficient for the vintage indicator (as in tailoring) could result if the use or purchase of new equipment reduced labor productivity such as due to unfamiliarity, constant breakdowns or excessive idleness associated with new equipment. This does not seem to be the case in tailoring, however.

Not only is the vintage indicator coefficient in the woodworks and S.S.I. regressions insignificant, but its inclusion has a minor effect on the capital and labor coefficients. For example, the capital coefficients increase only by 1.37 percent and 0.87 percent, respectively, in S.S.I. and the woodwork regressions. The corresponding adjusted R^2 in each declines by 0.1 percent and 1.8 percent, respectively.

When value added (see footnote, Table 27) is used instead of value of total production (and repair), the vintage coefficient is as expected negative and this time significant too at 4 percent both for woodwork and the S.S.I. group. In tailoring, the coefficient is

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[1]An economic note that applies here and for the rest of the analysis is that none of the models (or the variables in them) were subjected to computer analysis without a valid theoretical or economic reasoning behind them. Otherwise, the search for different computer generated combinations of inputs may come up with some variables being spuriously and significantly related with the dependent variable. Such an approach will invalidate the use of the T-test as a result of pre-test bias (see Maddala, 1977; Gujarati, 1978; and Kennedy, 1979). Other writers while cautioning against any blind research for combinations of significant variables contend that one can still use all relevant and available information to investigate a problem in an objective manner, rather than totally depend on one's assumptions (see Wallace and Asher, 1972, and Wallace, 1977).

TABLE 27.--Annual mean levels of inputs and outputs in production (no stratum weights applied)

Item	Industry Groupings		
	Tailoring	Woodworking	SSI[a]
1. Labor (hours)	2,633	4,118	3,307
a. Proprietor	1,906	1,671	1,785
b. Family members	43	100	90
c. Skilled, hired workers	419	1,824	1,166
d. Apprentieces (unskilled)	554	1,098	577
2. Capital Service Flows ($)			
a. Total at purchase value	805	1,904	1,740
b. At replacement value	964	2,714	2,277
c. Capcity adjusted			
1. at purchase value	557	1,289	1,101
2. at replacement value	724	1,755	1,503
3. Intermediate inputs ($)			
a. Raw materials	910	2,840	2,107
b. Other inputs	166	341	429
4. Value of Production ($)			
a. Gross Total Value	7,201	25,529	16,820
b. Value Added[b]	5,861	19,596	13,537

Source: Jamaica Flow Data Survey 1979/80.

[a]Small-scale industries or manufacturing subsector

[b]Gross Total Value less expenses for intermediate inputs

still positive and significant at 55 percent, compared with 26 percent when value of total production is used as the dependent variable. See Appendix II for regression results where the vintage indicator is included both in total value of production and in the value added regressions.

The effect of raw material on the coefficient of the other variables is, however, much more profound, compared with that from the vintage indicator which was contributing little explanatory power in the presence of raw material. For this reason, the vintage indicator variable in woodworks and SSI regressions is considered superfluous and is dropped from both of them (see Rao and Miller, 1971, p. 36). Both for comparability and because it is suspected of having the wrong sign, it was also dropped from the tailoring regression.[1]

5.1.1.2 Labor input.--The usual ways of adjusting for labor skill differences is by using as weights variables such as the age cohorts, training backgrounds, or wage rates of workers. In the Jamaican situation, age differences are not important; also, the predominance of proprietor time over the other labor types and the practice of payment on piece or job rate basis to skilled workers presents a problem of using only wages as weights. Thus, by using

[1]The omission of a relevant (significant) variable will result in a trade-off between some bias and smaller variance (see, for example, Rao and Miller, 1971, p. 63). Furthermore, since the vintage indicator coefficient has the expected sign and is significant in the value added regression, Appendix II is included here for any future comparative further investigations.

wages and job-related training background as complementary aids, differences in skill levels were weighted as follows (see Section 4.1.2 for levels of formal education).

From the flow data collection, the two most dominant activities in an enterprise were direct production of new items and repair work of old ones; both are lumped here as production. They accounted for 90 percent of the total business hours of work. Thus (proprietor) activities such as marketing of outputs, purchasing of inputs, and supervision of overall activities accounted for a very small percentage. Also a hired skilled worker generally does just as much (if not more) of production and repair work as the proprietor, both in quantity and quality of work. Given these two conditions, both proprietor and hired skilled workers were weighted equally and given a weight factor of 1.

The contribution of an apprentice varies greatly from industry to industry. In almost all industries, apprentices provide a vital role in production (and repair); in others, their contributions toward these activities are supportive at most. The mean total number of hours apprentices participate in such activities is relatively low at the SSI level: only one-third of the number of hours spent by the proprietor or about half of that spent by the hired skilled worker (see Table 27). Since apprentices need the approval, guidance, and help of a skilled hand such as the proprietor, their labor was given a weight factor of 0.5. Such a weight is partly based on their reported weekly wage of about $30, compared with $60 for skilled hired workers.[1] It should be pointed out, however, that only about 20 percent of the skilled workers are paid regular weekly wages; the rest are paid on a piece rate or job work basis.

As already indicated in Chapter 3, family member workers do not seem to play a big role in the small-scale industries of Jamaica. In fact, the mean annual number of hours for family members in the S.S.I. is only 90 (i.e., compared with 1,785, 1,166, and 577, respectively, for proprietors, hired skilled workers, and apprentices; see Table 27). However, in those cases where they participated, they seem to be engaged more with bookkeeping routines and overseeing or just keeping the workshop open in the absence of the proprietor, rather than with direct production activities. In terms of skill in production, the majority are probably at the level of (or a little better than) apprentices. Thus, because of the higher nonproduction responsibilities they assume also, their labor was weighted by 0.75, a weight factor higher than that of the apprentices.

<u>5.1.1.3 Capital input</u>.--Three types of capital are involved here. These are equipment and tools, buildings or workshops, and working capital. The first two combined will be called technical capital or simply capital. Working capital here refers to the value

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[1]This wage information was reported by proprietors during the management survey study. Incidentally, the weekly wage figure of $60 is probably biased upward (less typical) since enterprises that pay weekly wages tend to be larger, have better business, and use relatively more skilled workers. As a general observation, it could definitely be said that there is wider wage relative differences than a corresponding skill relative differences between apprentices and skilled workers.

of material inputs and finished products held in stock.[1] Regarding capital, there are two basic issues: (a) the calcuation of the annual capital service flow or the user cost, and (b) if the level of capacity utilized in a plant should te taken into consideration or not.

The concept of capital service flow or user cost is equivalent to the price one would have to pay to rent the services of a sewing machine, for example, instead of owning the capital asset outright (see Yotopoulos and Nugent, 1976). Two figures were calculated for the user cost in the present situation. In the first case, the original purchase price of each fixed asset was adjusted for price changes over the years and expressed in 1979 dollars; the price index used is the one described in Section 3.2.2. In the second approach, the corresponding current market price of the replacement value (as of 1979) of each such fixed asset (reported during the time inventories of such items were collected) is used as one measure of the available capital. The formula[2] used to convert each of these two fixed capital figures (excluding working capital) into a user cost value is the following:[3]

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[1]Because of the problems of collecting information on cash held and on receivables, these two were not included in the capital figure. The values for receivables shown in Table 20 indicate receivables accumulated over a number of years and it is even doubtful whether they can be recovered.

[2]See Yotopoulos (1967) for a full discussion.

[3]If any building or equipment were rented, its rental value was used for the user cost. Since rent rates were officially regulated by rent control boards, such rental value probably underestimates the user cost component from buildings than would be the case without such control. The expected life of each building was estimated on the basis of construction materials used for floor, wall, and roof; it could be anywhere from three to forty years.

$$R = \frac{rV}{1-(1+r)^{-n}}$$

where,

R = the value of the estimated annual capital service flow of an asset

V = the current or original (undepreciated) market value of the asset depending on which approach is used

r = the discount rate

n = the expected life of the capital asset in years

For each fixed asset both the original or current market value (V) and the expected life (n) were obtained from the respondents. With respect to the discount rate, attempts to get information on the informal credit did not provide any significant insight into that subsector. The indicated volume of informal credit seemed insignificant and a substantial number of the reported interest rates were either zero (in the case of credit from relatives) or below the going commercial rate of 13 to 18 percent (see Fisseha and Davies, 1981, p. 61). It is possible that all informal credits are not covered in the response and for those covered, the respondents may have failed to properly estimate the actual interest rates. For this reason, information on the informal credit subsector could not be used here to help estimate the appropriate discount rate (r). There is reason to believe, however, that if relatives and friends are excluded, the informal credit operation in Jamaica is relatively far less important compared with the other sources (see Fisseha and Davies, 1981, Tables 17 and 18).

Thus, the discount rate (r) was estimated by combining information on the interest rates charged by public and private financial institutions, the consumer price index and trends in the cost of machinery. Interest rates in the commercial banks were generally about 13 to 15 percent in 1979-80. Public financial institutions were charging lower rates of 11 percent or less. The consumer price index for 1979 increased by about 20 percent (GOJ, 1980a, p. 3). Finally, during the survey period the mean increases in the prices of old and new machines were respectively 35 percent and 24 percent (see Table 9); these increases are based, however, on the key machine in each industry and rates of price increases for most other machines were probably lower. Furthermore, the rates of increase over the flow data study period (May 1979 to April 1980) are generally lower than in all of 1979. Thus, given these pieces of information, a discount rate of 25 percent was concluded reasonable for use in the user cost formula.

In addition to the user cost issue, the level of capacity utilization in an enterprise is also a very crucial point in the estimation of production function coefficients. Unless capacity level utilized is taken into consideration, the capital coefficient in regression will be smaller and those enterprises at higher levels of utilization will appear less capital intensive; the effect on the labor coefficient is to increase it. All these combined will also affect the size of the elasticity of substitution between capital and labor (see Bhalla, 1981, p. 331). More important for the present objective, enterprises at higher levels of capacity will appear more technically efficient. (More will be said later on higher levels of capacity utilization due to superior management input.)

It was obvious at the time of the survey that Jamaican S.S.I. proprietors were facing difficult problems mainly due to shortages of raw materials and unstable demand (see Section 3.3). As a result, idle hours of workers and machinery were common.[1] (See Winston, 1974, for a detailed discussion on capital underutilization.) As already indicated, the labor hours used in the production function are those based on actual work so that hours of idleness, sickness, and non-business related work have been excluded. Thus, to make the capital usage compatible with labor hours, the total capital service flow was discounted or reduced by a percentage equivalent to the level of machine idle hours due to lack of work, raw materials, spare parts, or electricity.

Information on the level of capacity utilization was acquired by asking proprietors how much they could increase their current production using the available capital resources to reach their past peak capacity levels or what they consider peak capacity levels under normal working conditions.[2] Such a measure of capacity corresponds to the minimum average cost curve definition when the average cost curve is a short-run one (see Christiano, 1981, footnote 3). For

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[1]From the management study survey (1980), each enterprise on the average had a machine idle for 6.25 months during the 12 months of production (see also Table 18).

[2]Their responses were then converted into levels of capacity utilization by finding the reciprocal of (1+P) where P is the percentage increment possible in total production.

more detail on the approach used here, see Fisseha and Davies (1981). Liedholm and Chuta (1976) and Page (1980) used similar respondent estimates for capacity determination. On the general weaknesses and strength of such an approach, see Phillips, 1963, and Artus, 1977. For the most part, the issues raised by them (e.g., mergers or consolidations, branch related expansions, bankruptcies and bias due to data based on large enterprises) are almost irrelevant for the small-scale industry. Even for the larger manufacturing firms, Artus (p. 7) concludes, "There is, however, no dobut that [such] surveys are, when cautiously interpreted, a useful source of information on the amount of spare capacity as viewed by the entrepreneurs." (Emphasis in the original.)

As for working capital, several times during the course of the flow data survey, inventories of finished products and raw materials were taken. The mean of the inventory values is used to estimate the working capital fund. The same discount rate of 25 percent was used to calculate the interest change on such funds tied up in working capital stocks. The interest charge was then combined with the capacity adjusted, fixed, or technical capital service flow to give the total capital variable.

5.1.1.4 Intermediate inputs.--Raw materials including other expenses such as for fuel, lubricants, and electricity are also used as a single explanatory variable in the regressions where value of total production is the dependent variable. (Some researchers would include expenses such as fuel and electricity as part of the capital service flow; (see Timmer, 1971, for the U.S.A. and Leddin, 1980, for Ireland). The inclusion of raw materials is based on the assumption that the ratio of value added to total output value may not be constant across firms or be distributed randomly around a constant mean (see Lee and Tyler, 1978). Klein (1962) also suggests that all intermediate inputs should be included in the production function. Tyler (1980, p. 484) warns that omitting raw materials present the problem of omitted variable. Finally, Ringstad (1978) says that the omission of raw materials simultaneously supports two opposing possibilities: (a) that there is an infinite elasticity of substitution between value added and raw maerials and (b) there is a zero elasticity of substitution between the two.[1]

There is usually one problem with the inclusion of raw materials as an explanatory variable: it tends to swamp the effects of the remaining independent variables (see Rao and Miller, 1971). This seems to be the case in the woodworks regression model. When such a problem exists, the dominant variable is usually dropped from the regression model.[2] This, however, means the coefficient sizes of capital and labor will be exaggerated (Bhalla, 1981), depending on

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[1]If (value added) = (value of production) - (raw materials) or $V = Y - M$, then it leads to the infinite elasticity case; if raw material is a constant proportion of output of $M = aY$ then $V = Y - aY = (1-a)Y$ would lead to the case of zero elasticity (Ringstad, 1978, p. 260; see also Bhalla, 1981, p. 45).

[2]In the present situation, not only is raw materials dropped but its value is also subtracted from total value of production to give the value added output (see Rao and Miller, 1971, p. 42 where it is not necessary to subtract raw materials).

the transformation relationship between raw materials and output. A similar assertion could, of course, be made for omitting specialized inputs such as management, although their effects on the coefficients may be relatively less striking.

5.1.2 Choice of Production Function Model and Results

As already indicated in Chapter 2, the basic model of production function analysis used here is the popular log-linear Cobb-Douglas (C-D) equation.[1] However, in order to check the appropriateness of the C-D formulation, other models such as the simple linear and the constant elasticity of substitution (CES) were also tried. (See Ramsey and Zarembka, 1971, for a detailed description of several tests on various models.) Based on the size of the adjusted R-squared ($\bar{R}^2$), the signs and standard errors of the coefficients, the C-D model was superior to the other linear regression equations.

Additionally, the C-D model was checked by subjecting the data to CES regression model. The constant elasticity of substitution (CES) production function always has a constant value for its elasticity of substition parameter (σ) between any pair of inputs. When

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[1]Some of the reasons for its popularity are (see Klein, 1962, and Zak et al., 1979):

a. It is economical in the degrees of freedom and still gives linear regression in the parameters
b. The input coefficients directly show elasticity of output with respect to each input
c. The sum of the coefficients show "returns to scale"
d. The sum of the coefficients show the degree of homogeneity
e. The marginal productivity of each input depends on the level of other inputs which is intuitively appealing
f. There is empirical evidence in support of it.

that value is equal to one, the CES reduces to the Cobb-Douglas specification (and to the fixed proportion model if equal to zero). Thus, the appropriateness of the C-D model was confirmed here by checking if the elasticity of substitution (σ) in the CES regression is significantly different from one or equivalently if the elasticity parameter (ρ) is significantly different from zero (see Yotopoulos and Nugent, 1976). The CES model used was of the following form:

$$y = a_0(\delta_1 k^{-\rho} + \delta_2 l^{-\rho} + \delta_3 m^{-\rho})^{-v/\rho}$$

where y, k, l and m are respectively total value of production, capacity-adjusted capital flow, labor hours and value of raw materials; a_0 is the constant of efficiency parameter; $\delta_i (i=1,2,3)$ is input coefficient, also known as the distributive parameter; and v is the scale parameter. The elasticity of substitution (σ) is defined as (where ρ is the elasticity parameter):

$$\sigma = \frac{1}{1 + \rho}$$

The CES function parameters cannot be estimated using (log) linear regression techniques unless perfect competition exists in the product and input markets, so that the marginal value product of labor can be equated to the wage rate. The resulting equation can then be log linearized. In the Jamaican SSI case, however, given minimum wage laws the shortages of capital and raw materials and the various quota limits on the importation of certain goods and materials during the survey period. It is unrealistic to assume perfect markets. Therefore, such an approach was not tried here. The Kmenta approximation using tailor series expansion (see Kmenta, 1967) also produced insignificant coefficients due to extreme multicollinearity among the independent variables. Thus, the method used here to estimate the CES regression equation is a nonlinear maximum likelihood estimating procedure.[1]

The results of the CES estimation are presented in Appendix III. Calculation of the elasticity parameter ρ (or rho) shows that it is not significantly different from zero at 10 percent for tailoring and the SSI regressions.[1] This means that the elasticity of substitution (σ) is not significantly different from 1; hence, the use of the Cobb-Douglas model is not inappropriate for the present set of data.

With respect to the woodwork regression, it was not possible to make such straight tests of model specification. When the nonlinear CES production function was repeatedly subjected (by changing initial values) to the maximum likelihood estimation technique, no convergence of estimation iterations were achieved to determine final

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[1]The algorithm used was developed by University of California, Los Angeles, and is called BMDP-70, Biomedical Computer Programs, P-Series (Dixon and Brown, 1979). The specific program that was used here is called BMDPAR and employs derivative free, nonlinear regression to derive the parameter values.

[2]In tailoring, the elasticity parameter was 0.4136 with a standard error of 0.4956; its T-value was only 0.8345 for 45 degrees of freedom. In the SSI, the corresponding values were -0.1025 and 0.4895 thus giving a T-value of -0.2093 for 130 degrees of freedom. (No tests were made on woodworks; more will be said on this.)

values of the parameters. Whether this is due to the characteristic of the estimating algorithm, or a CES regression model that does not fit the woodwork data or even to poor data quality cannot be determined for sure. Furthermore, a number of other regression models and a number of independent variables were tried, but none showed improvements over the Cobb-Douglas model.

The woodwork Ordinary Least Squares (OLS) regression of total production on labor, capital, and raw materials resulted in insignificant coefficients for labor and capital while the raw material coefficient was highly significant. It is possible that raw material was swamping the effect of labor and capital (see Rao and Miller, 1971). To avoid this problem, raw material was dropped and value added regressed on labor and capital (the results are discussed later). When the maximum likelihood estimation of CES was applied to the data with value added as dependent variable, the results were very large ρ (rho) and a capital coefficient almost zero. Both parameters were not statistically significant, however, because their symptotic standard errors were very large. Thus, the labor coefficient was very close to 1. Because of these unrealistic parameter values, the residuals were plotted against the capital and labor inputs for visual observation. The residual-capital plot seemed to indicate a problem of heteroskedasticity; the residuals were negatively correlated with the capital input levels and the plot of the squared deviations against the capital variable was U shaped. In the presence of heteroscedasticity, the coefficients are still unbiased and consistent in statistical sense, but would have large standard errors making the estimate inefficient. This problem was corrected along the procedure suggested by Park (1966). The details of this procedure are presented in Appendix IV.[1]

A second possible souce of problem in the woodwork model is multicollinearity among the independent variables. Shortage of raw materials having been a very crucial problem in woodwork, access to it was a very important determinant of the volume of business. Thus, if raw material (lumber) was available, labor could be doing some work, for example, the correlation coefficient between these two variables was 0.78 which is highly significant at 0.1 percent.[2] Thus, the data could be suspected to have multicollinearity problems too. If that is the case, then the labor coefficient would be expected to be insignificant in the presence of raw materials and, second, it will have relatively large coefficients in its absence. The first possibility can be seen to exist from Table 28; the second situation appears to be true in the value added regression of Table 29--a coefficient of 0.5485 seems high compared with its corresponding

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[1]Also since the plots of residuals against capital seemed to reveal an obvious large gap between what may be considered small and the large enterprises (e.g., all capital values were either below $1,500 or above $2,500), a check of structural stability of production function coefficients was carried out using the Chow Test (see Chow, 1960). The test showed that there was no difference between large and small enterprises in the current woodwork industry. Thus, both large and small enterprises in this industry could be represented by the same basic production function.

[2]Kennedy (1979, p. 131) says, "a high value (about 0.8 or 0.9 in absolute value) . . . indicates high correlation between the two independent variables. . . ." and thus, there is a problem of multicollinearity.

TABLE 28.--Regression results of the Cobb-Douglas production function model[a]

Parameters		Industry Groupings		
		Tailoring	Woodwork	SSI[b]
Capital (k)	\$1	0.0541 (0.6988)[c]	0.1087 (0.7320)	0.1337*** (2.6484)
Labor (l)	1 hour	0.6697*** (5.4089)	0.2738 (1.4209)	0.3940*** (4.5128)
Materials (m)	\$1	0.3774*** (4.9244)	0.5757*** (3.0783)	0.5440*** (10.7632)
Constant (a)		1.8159 (0.8243)	10.9801** (2.5113)	3.6231** (2.5131)
$\bar{R}^2$		0.750	0.697	0.823
df		46	25	128

Source: Jamaica Flow Data Survey, 1979/80.

*** = Significant at 1 percent.

** = Significant at 5 percent.

* = Significant at 10 percent.

[a]The estimating equation is of the form $\hat{y} = ak^{\alpha_1}l^{\alpha_2}m^{\alpha_3}$

[b]Small-scale industry or manufacturing subsector.

[c]Values in parentheses are T-values.

TABLE 29.--Value added[a] regression results of the Cobb-Douglas Production Function model[b]

Parameters	Units	Industry Groupings		
		Tailoring	Woodwork	SSI[c]
Capital (k)	$1	0.1389 (1.4828)[d]	0.3609** (2.3732)	0.3788*** (5.8954)
Labor (1)	1 hour	1.0794*** (8.0161)	0.5844*** (3.3712)	0.9340*** (9.2930)
Constant (a)		-0.8616 (-0.8302)	2.2876** (2.1113)	-0.9752 (-1.4524)
$\bar{R}^2$		0.612	0.601	0.647
df		47	26	129

Source: Jamaica Phase III (Flow) Data Survey 1979/80.

*** = Significant at 1 percent.

** = Significant at 5 percent.

* = Significant at 10 percent.

[a]Value added = Total value of production <u>less</u> noncapital and nonlabor costs.

[b]The estimating equation is of the form, $\hat{y} = ak^{\alpha_1} l^{\alpha_2}$

[c]Small-scale industry or manufacturing subsector.

[d]Values in parentheses are T-values.

value of 0.2738 in Table 28. (The effect is even more marked on capital; 0.3609 compared to 0.1087).

A third source of the problem could be that the capital data in woodwork are not as good as those in tailoring or the other industries. This could happen, for example, if woodwork enterprises had a large number of machinery and equipment (which they do relatively speaking) so that they could not accurately tell the replacement value of all their equipment. However, the fact that no convergence was also achieved with the original capital purchase values in the maximum likelihood estimation suggests that the problem may not be with data quality (unless respondents also had problem remembering the original purchase prices). It may well be that among other things, the difficulty arises due to all these possible sources of problems. In any case, although the woodwork CES nonlinear regression failed to converge, the OLS parameter values do not seem to be much different from those found in tailoring and the SSI. And these are the values that have been used in the technical efficiency analysis.

5.1.2.1 Ordinary least squares regression.--The results of the Cobb-Douglas regression model are given in Table 28. The basic formulation of the model starts out in the identical manner to the one used by Artus (1977) for his aggregate production function of the manufacturing sector. Of special relevance are the ways he treats the "mean age of the capital stock" (corresponding to the mean equipment age index here) and the manner in which he incorporates the "intensity of use of labor and capital" (or capacity level of utilization) to estimate the production function. The model used here has the following format:

$$y = a(ke^{\alpha_o i})^{\alpha_1} l^{\alpha_2} m^{\alpha_3} e^U$$

where y, k, i, l and m are respectively total value of production, (capacity-adjusted) capital service flow, mean equipment age index, labor hours and intermediate inputs (raw material), all as described in the preceeding section; a is the constant or shift parameter; α_i (i=0,1,2,3) is a coefficient; e is the base to the natural logarithm; and U is random distributed error term satisfying the ideal properties of the error term. Because of what was described in Section 5.1.1.1, the age index or vintage indicator was dropped from the equation, thus leaving only the value k inside the parentheses.

The log linear form of this final C-D model (whose regression results are given in Table 28) has the following format:

$$Y = A + \alpha_1 K + \alpha_2 L + \alpha_3 M + U$$

where

Y,K,L,M = natural log values respectively of total output, capital, labor, and raw materials (actually intermediate inputs)

A = the value of the natural log of the intercept "a"

U = the error term.

In all the three models of regression, Table 28 shows the raw material coefficient is highly significant. The labor coefficient is significant in tailoring and SSI, but not in woodwork; capital coefficient is significant only for the SSI. One of the clear differences observed in Table 28 is the relatively low coefficient values for capital and raw materials in the tailoring regression. In the case of the labor coefficient, the unusual situation is the reverse.

One reason why the raw material coefficient in tailoring may be comparatively low is due to the fact that not all raw materials are accounted for in the tailoring regression. This is due to the fact that some of the raw material (e.g., a piece of cloth for pants) is brought by the customer so that there is no need for the proprietor to supply the raw material.[1] For this reason, production functions using value added as dependent variable are presented in Table 29. Using Tables 28 and 29, one should get a better feel for the relative magnitudes of the capital and labor coefficients in each industry. As Table 28 clearly shows, however, there is a strong case that raw materials should be in the regression. If the coefficients for raw material were each close to 1, then this would

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[1]Thus the reported value of raw materials is less than the actual raw material that goes into the finished products (whose value is also accordingly reduced). By looking at the value added production function, the relative sizes of the capital and labor coefficients can be examined; the effect will depend on the correlation coefficients between these two variables and raw material (see Rao and Miller, 1971, p. 31). Depending on the percentage of total raw materials supplied by customers in each enterprise and the correlation between sewing charges and fabric quality, the ultimate effect on the relative efficiency measure is expected to be negligible.

imply that there was a one-to-one transformation rate from raw materials to total value of output and the use of value added would be a valid and adequate representation of the model. However, this is not the case in Table 28; the raw material coefficients are significantly different from 1 and the 1 percent level for tailoring and the SSI regressions and at 2.5 percent for woodwork.[1]

The assumption of constant returns to scale cannot be rejected for all three groups of industries shown in Table 28 (see Madalla, 1977, p. 195, for testing linear combination of coefficients). When value added is used as the dependent variable instead of the value of total production, there is increasing returns to scale in tailoring and the SSI group where the T-value significance levels are respectively 10 and 1 percent. The implication of this could be that although they may be relatively less efficient in the use of raw materials, larger enterprises are more efficient in generating higher value added from a given percentage increase in capital and labor.[2]

5.2 Inter-Enterprise Relative Efficiency Indices

This section will present the conceptual basis, computational models, and the statistical distributions of the relative technical efficiency indices. Depending on one's assumptions concerning the stability of the output elasticities (or input coefficients) between firms on the frontier and those on the average production curve, two

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[1]The significance levels shown in Table 28 are calculated for coefficient sizes relative to 0.

[2]Under perfect competition $\Sigma\alpha_i$ measures scale.

(complementary) approaches are used here to estimate the frontier production function. Under the assumption that frontier firms have different relative output elasticities from the rest, an LP technique is used to estimate the input coefficients and thus the relative indices. Under a different assumption that both frontier firms and those at the average curve have identical output-input elasticities and the only difference is in the value of the constant or the shift parameter A, an OLS technique is used to compute the relative technical efficiency indices. A detailed description of the methodologies and the associated technical weaknesses and strengths of the approach are presented in Chapter 2.

5.2.1 Conceptual Considerations

The construction of the relative technical efficiencies among firms is done by comparing what they actually achieved in production with what they are expected to achieve according to some (frontier) production function models. Comparison is based on the assumption that barring major errors of measurement, what enterprises achieve in production should be the same as (or closely approximate) the predicted production level estimated by the production (frontier) function.[1] The index of efficiency is constructed by dividing the former by the latter. An efficient enterprise would have its actual or realized output level the same as the one estimated from the

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[1]The production function estimated by OLS in the last section is actually "average" production function and needs to be converted to a frontier production function in such a way that production levels for all enterprises lie on or below it.

frontier production function (or the predicted value). Such a firm would have an index of technical efficiency equal to 1. On the other hand, an inefficient enterprise would produce less than what is predicted (given the size of its inputs) and thus would have an index lying between 0 and 1. Thus, the closer the actual level of production achieved to the predicted, the closer the index to 1. Since the frontier production function is constructed from data of actual firms, each enterprise's level of achievement is measured against a standard which is realizable under the prevailing empirical conditions.

5.2.2 The Linear Programming (LP) Approach

One method of estimating the frontier production function is through the use of an LP algorithm as described in Chapter 2.[1] The idea behind this approach is to draw the frontier (as opposed to the "average") production function curve in such a way that each observed output lies on or below this curve.

The use of the LP algorithm to determine frontier coefficients is justified on the following grounds. Every LP problem has four major requirements (see Levin and Kirkpatrick, 1978, p. 261): (1) there must be an objective function--something to maximize or minimize; (2) there must be alternative courses of action to achieve

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[1]It is very important that this LP algorithm should be viewed strictly in the context of solving (frontier) regression coefficients using the LP technique rather than solving a complete firm production system with an LP model--thus many variables will not be in it.

the objective; (3) resources must be limited in supply; and (4) the objective function and the resource limitations must be capable of being expressed in linear mathematical equations or inequalities. The calculation of the frontier production functions satisfies all these four requirements: (1) the objective is to minimize the non-negative differences between the (model-predicted) frontier value and the observed (achieved) value of production; (2) the alternative couses of action to achieve this objective are reflected in the various ways that capital, labor, and raw materials can be combined giving equally different output elasticities; (3) the limitation or constrainst in the problem is that the frontier value for each firm must not be less than the observed value--thus, there are as many functional constraints in the LP model as there are firms in the sample; and (4) the required linear mathermatical expressions are as described in Chapter 2.

In the LP model, the unknowns to be determined (the optimal solution variables) are the coefficients of capital, labor, and raw materials. These input coefficients are estimated subject to the constraint that the sum of the non-negative differences between the expected or predicted levels of output and the actual or realized levels (i.e., $\hat{Y} - Y = U_i \geq 0$) is minimized. In essence, the objective is to determine the proper input coefficient values that would determine the frontier production function subject to the stated requirements. The corresponding C_j's are the sample mean values for capital, labor, and raw materials. For a complete development of the LP model, see Chapter 2.

Unfortunately, the LP approach is determined by a small subset of the sample (in the present case by those enterprises which are the most efficient ones whose number is equal to the number of positive parameters to be estimated).[1] Thus it is extremely susceptible to outliers which may result from nonmanagement-related influences, such as measurement error in data recording or enterprises which are very efficient due to a right chance combination of circumstances. In order to minimize the effect of such undesirable estimation results, outliers are discarded a few at a time until the sizes of the input coefficients (i.e., the output elasticities) are stabliized. In the present case, 4 percent each from tailoring and the SSI and 10 percent from the woodworks enterprises were discarded.[2]

Unlike the OLS one, the LP approach (1) determines the parameters of the frontier production function directly without the need for further adjustment (see Section 5.2.1); and (2) it produces the coefficients of firms at the frontier (i.e., the most efficient ones) rather than of what may be called "average" firms. Thus, in determining a firm's relative efficiency index score, it is conceptually superior to make such comparison relative to the LP coefficients (of most efficient firms), rather than the OLS ones which are average

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[1]See Timmer (1971, p. 781) for a fuller discussion.

[2]The relatively large percentage reduction from the woodwork sample is due to the problems in the woodwork data mentioned earlier and also due to the small size of the sample; in the present case three enterprises out of 29 were dropped.

results from combining all firms. Therefore, the main model of efficiency analysis used here is the LP approach, specifically the outlier-free LP results of Table 30.

5.2.3 The Corrected Ordinary Least Squares (COLS) Approach

The second approach to estimate the frontier production curve is to start with the results of the OLS regression as given in Table 28. This approach assumes that both frontier firms and those at the average curve have identical output-input elasticities and the only difference is in the value of the constant or the shift parameter A. For example, Marshak and Andrews (1944) had earlier said that the "production functions of all firms are identical up to a neutral disembodied productivity differential; in other words, the parameters (α_1, α_2, and α_3) are assumed common to all firms in the sample, but the parameter A varies from firm to firm." One clear advantage of the OLS approach over the LP one is that the OLS parameters can be subjected to statistical tests of significance.

The OLS regression equations estimated in the preceeding section being "average" production functions, for each production curve some enterprises will have thier production levels above it and others below it. In order to convert this "average" production function into a frontier curve and thus make it consistent with the dictates of production theory, each of the production points must lie on or below the curve and some must lie on it (see Section 2.2.2).

The approach used here to estimate the OLS statistical frontier production function is the technique employed first by Gabrielson

TABLE 30.--LP and Cobb-Douglas frontier production functions

Industry Grouping	Parameter Values			
	Intercept	Capital	Labor	Material
1. Tailoring[a]				
1a. COLS[b]	4.0604	0.0541	0.6697	0.3774
1b. LP_{100}	26.9639	0.1475	0.3262	0.3839
1c. LP_{96}	1.0000	0.2475	0.8637	0.1458
1d. COLSK[b]	4.5633	0.0083	0.6719***	0.3942***
2. Woodworks				
2a. COLS	65.3684	0.1087	0.2738	0.5757
2b. LP_{100}	3,824.5649	0.1803	0.1967	(missing)[c]
2c. LP_{96}	16.2209	0.0705	0.5098	0.3732
2d. COLSK	71.3071	0.0187	0.2923	0.6264***
3. SSI[d]				
3a. COLS	27.4868	0.1337	0.3940	0.5440
3b. LP_{100}	3,050.6200	(missing)	(missing)	0.4231
3c. LP_{96}	4.8361	0.3673	0.3123	0.5114
3d. COLSK	29.6107	0.1032**	0.4018***	0.5558***

Source: Jamaica Flow Data Survey 1979/80.

[a]LP_{100} refers to the LP results using 100 percent of the enterprises and LP_{96} refers to using 96 percent of the enterprises, i.e., after discarding the outliers. Asterisks show significance levels of COLSK parameters as described in Table 28.

[b]COLS and COLSK stand respectively for shift-parameter corrected OLS respectively for capacity-adjusted capital and for the unadjusted one.

[c]"Missing" here means coefficient did not show up in the LP solution.

[d]Small-scale industries or manufacturing subsector.

(1975) and elaborated by Greene (1980a). They estimate the Cobbs-Douglas parameters using Ordinary Least Squares (OLS) as was done here and then correct the intercept A (hence the name corrected OLS or COLS) by shifting the resulting production curve up until no production point lies above it and at least one is on it (i.e., at least one realized production level lies on the curve or is equal to the predicted level). One way to do this would be to add the largest (positive) OLS residual to the intercept term a. For example, the constant term ln(1.8159) from Table 28 was raised by 0.8047 to give a new intercept a' or 4.0519 (i.e., ln(0.5966 + 0.8047)) where 0.8047 is the largest (positive) residual value for the tailoring OLS regression). This method leaves the new intercept term a' still consistent in the statistical sense.[1] A similar "correction" would be applied to the wood and SSI OLS regressions.

Since the use of capacity-adjusted capital could fail to capture differences in levels of capacity-utilization due to difference in management capability, a second COLS regression (COLSK) where capacity unadjusted capital is used was also estimated for comparison. The resulting parameter values of the two capital approaches and the LP model are presented in Table 30. The COLS

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[1]It is also possible here that the most efficient enterprise (i.e., the one with the largest OLS residual value) could be considered an an outlier being affected by exogeneous variables specific to it. However, dropping its residual and using the second highest residual value will have no effect on the relative efficiency ranking of the enterprises; if the enterprise with the highest residual is dropped altogether from the data, the effect on the resulting parameters, and hence on the relative efficiency ranking of the enterprises, is expected to be minimum.

input coefficients with the capacity-adjusted capital are actually the same as those found in Table 28. Incidentally, the use of capacity unadjusted capital reduces its coefficient by more than 80 percent in the tailoring and woodwork regressions and by 23 percent in the SSI group; there is no change in the value of their adjusted R-squares; the coefficient standard errors are consistently smaller for labor and larger both for capital and materials when capacity unadjusted capital is used. However, these changes in the case of labor and raw materials are so small (the largest is 1.2 percent) that for all practical purposes, the two capital measures produce identical standard errors for the labor and material coefficients. For the capital coefficient, the changes are slightly bigger; the use of the capacity adjusted capital results in larger standard error by 6.7 percent, 5.8 percent, and 13.5 percent, respectively in the SSI, tailoring, and the woodwork industries. Note, however, that these changes relative to those of the coefficients themselves are minor. Furthermore, it will be shown later that as far as the relative efficiency index is concerned, there is no difference in the ranking of the indices whether one uses capacity-adjusted capital or the unadjusted one (the Spearman rank correlation between the two techniques is 0.99). The distribution of the efficiency indices are, however, more positively skewed for the unadjusted capital. For the above reasons, the emphasis here so far as the regression approach goes will be on the capacity-adjusted capital approach. It will be used here for comparative purposes with the main model of efficiency analysis which is the outlier-free LP results of Table 30.

5.2.4 Computational Results

The results of the OLS (for average firms) and LP (for frontier firms) approaches are shown in Table 30 where there is usually wide difference beween their coefficients particularly in tailoring and woodwork where the difference is as much as one-third in absoute terms; this signifies that within an industry both groups of firms may indeed have different output elasticities. Whenever a relevant variable is missing from the LP_{100} solution, the value of the shift parameter is unusually high. The material coefficient for wood and the capital and labor coefficients for the SSI group are not in the LP_{100} solutions. This actually shows poor functional fit. In a minimizing LP problem, a variable may fail to appear in the solution for two reasons. If its C_j (return per unit) is extremely large, then it would be uneconomical to include that variable in the solution; (in a two-constraints LP graphic representation, the iso-profit line would be practically vertical if the expensive item is on the horizontal axis). Also, if its C_j is extremely small, then this cheap item will produce an iso-profit line almost horizontal and the optimum corner solution may fall on the vertical axis of the other constraint.

It was stated earlier that the variables (unknown coefficients) used in the LP model have their C_j's equal to the sample means of their respective inputs. For example, the C_j for the labor coefficient is equal to the mean of labor hours in the sample. Thus, a resource will not be in the solution if proprietors did not use any appreciable amount of it or if they used too much of it relative to the constraint level so that excess capacity gives rise to zero "shadow prices" or elasticities (see Mijindali, 1980, p. 149).[1] Thus raw material failed to be in the woodwork LP_{100} solution, probably showing that firms did not have enough of it relative to their capital and labor. Capital and labor do not show up in the solution of the SSI LP model (while raw material is in with coefficient comparable to that of the OLS and the outlier-free LP solution) may be because they were too much in supply relative to raw materials. Maybe demand was more crucial for the rest of the enterprises than for woodwork (this also was the general purport of Section 3.3). However, since all the coefficients are in for the outlier-free LP solutions, probably not much weight should be given to the LP results containing all cases (i.e., LP_{100}).

The general conclusion to be drawn from Table 30 is that frontier firms (represented by LP coefficients) were more efficient in the use of capital and labor compared with enterprises represented by the average (COLS) regression equations. The role is reversed with respect to the use of materials, however. This could mean, however, that frontier firms had more raw materials to work with than

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[1]Besides Mijindali (1980), Timmer (1971) also seems to have a relevant variable which failed to appear in the LP solution (see his land coefficient in Table 1). He does not discuss the matter, however.

firms at the average production level.[1] Thus, in order to partially compensate for material shortages, firms at the average production curve were using more of both capital and labor and by so doing depress their marginal productivities. Such substitution could be possible, for example, through more hours spent on repair work than production of new items and/or bringing scrap and low quality material up to usable forms (see Tyler, 1971, and Aigner et al., 1977, for similar model-related differences in the magnitudes of the coefficients). The main objective in this chapter is, however, not the individual input productivities, but overall enterprise productivity or technical efficiency whose statistical distributions are presented in the following subsection. The sources of differences in the technical efficiency indices are reserved for later discussions.

5.2.5 Distribution of Relative Technical Efficiency Indices

An enterprises's relative technical efficiency index is calculated by dividing its predicted output (estimated using the relevant frontier parameter shown in Table 30) into the actual output. For comparative purposes, each firm has four efficiency indices here corresponding to the four frontier functions in that Table. The distributions of each of these indices among the enterprises are shown in Table 31. All values in this table are entered as percentages. The variations within each industry is very large. This is

[1]The marginal productivity of an input in a Cobb-Douglas model is a decreasing function of own and other inputs. Thus, a comparatively smaller marginal productivity (holding other inputs constant) would show more use of that input.

true even after discarding the outliers in the LP solution. The use of capacity adjusted capital results in smaller variation (particularly for woodwork and the SSI) compared with that from capacity unadjusted capital. A similar relationship holds for the use of outlier-free LP compared with that including all the cases.

Three-fourths of the enterprises managed to achieve an index of about 53 percent, 32 percent,and 27 percent of what they are expected to achieve in the COLS model respectively for tailoring, woodworks, and the SSI group. Except for tailoring, the picture is worse when capacity-unadjusted capital is used. It is much better when the outlier-free LP results are used.

The use of outlier-free data improves the overall variation in the LP efficiency indices, except in tailoring. This is attested by the histograms presented in Figures 3 to 8.[1] As the outliers are dropped, the level of skewness is reduced. The ranking of the indices is not changed whether one uses the two corrected OLS measures or the outlier-free LP method. The Spearman Correlation between any two of these three techniques is greater or equal to 0.9 almost in every case. Thus, the COLS technique being easier and faster to analyze, it should probaly be preferred to the LP one. The two corrected OLS techniques rank the enterprises almost identical--their Spearman correlation is 0.99 in each of the three industries. The general observation from Table 31 is that there is an extreme variation in inter-firm efficiency performance with a few lying high in

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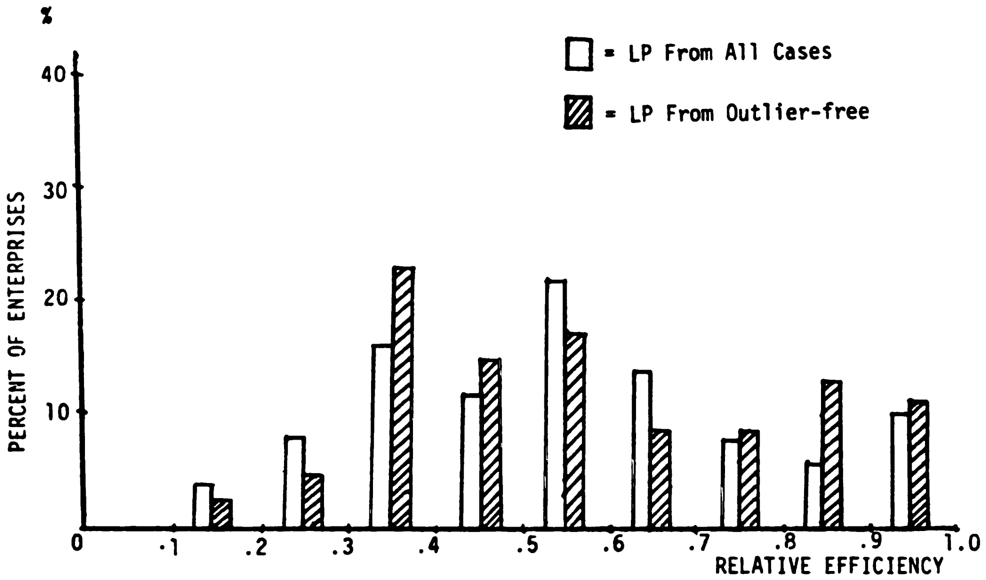
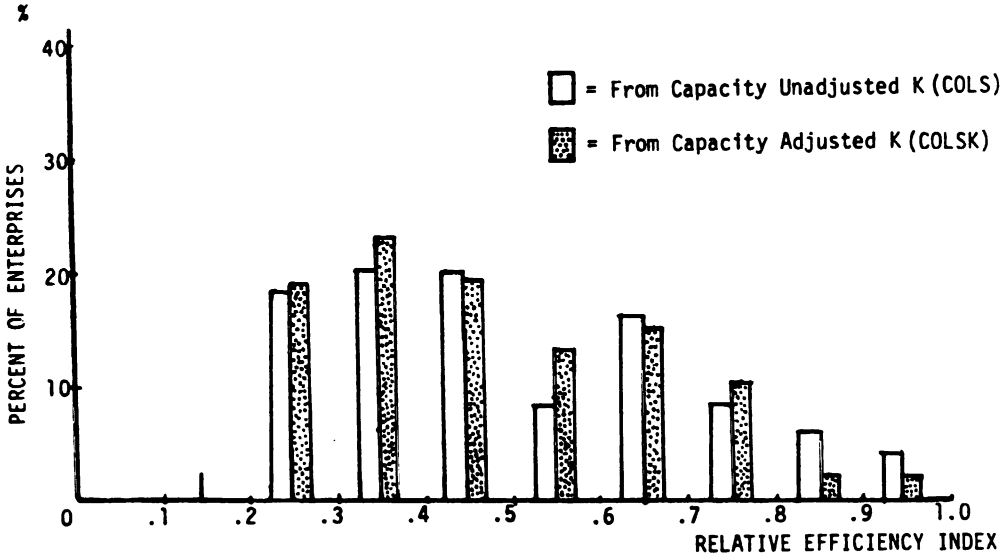
[1]The histograms were reproduced to scale from a computer printout.



(a) HISTOGRAM for LP Results



(b) HISTOGRAM for OLS Results

Figure 3.--TAILORING Relative Efficiency Indices Histograms.

(a) Using the Linear Programming Technique
(b) Using the "Corrected" OLS Regression

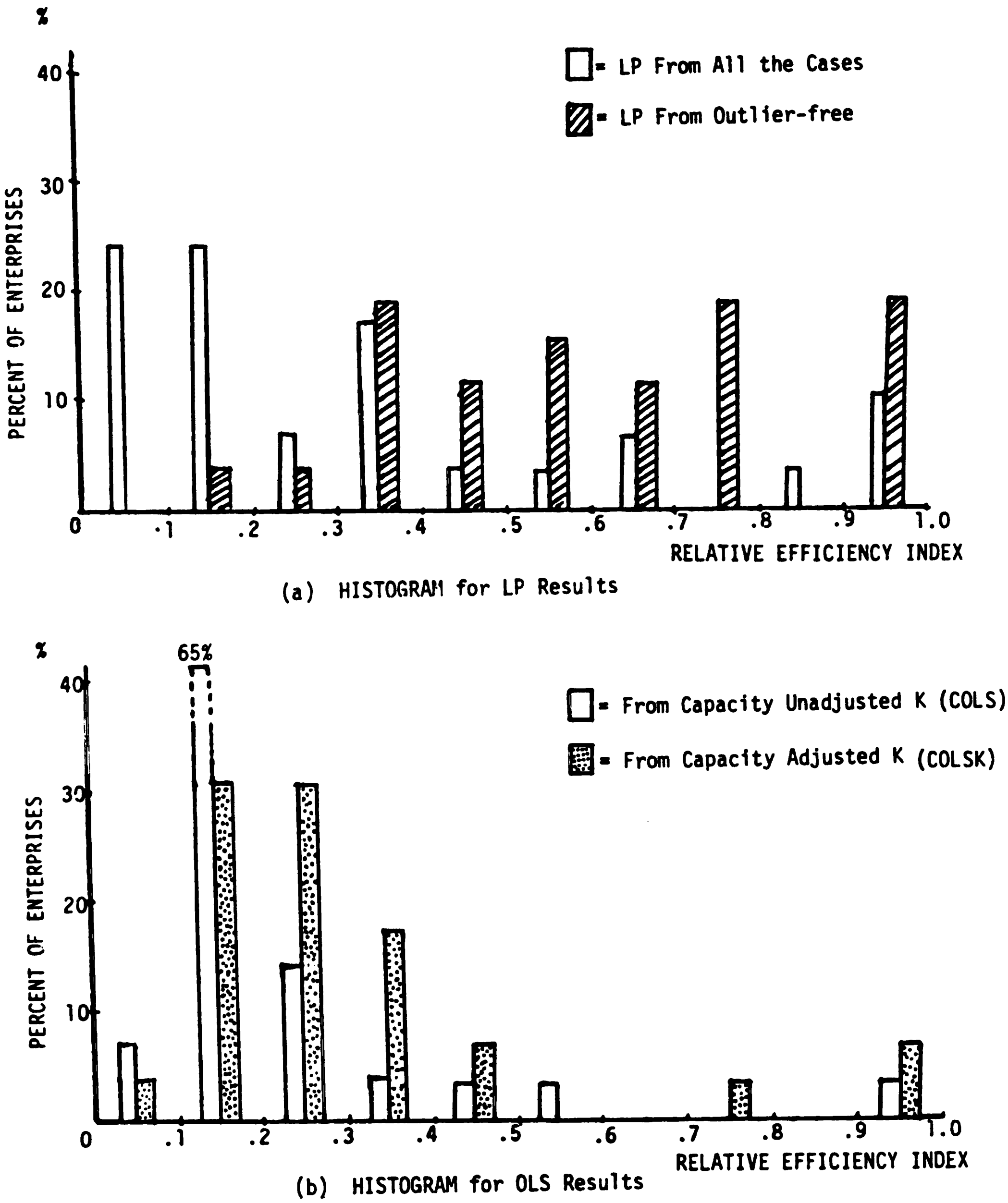
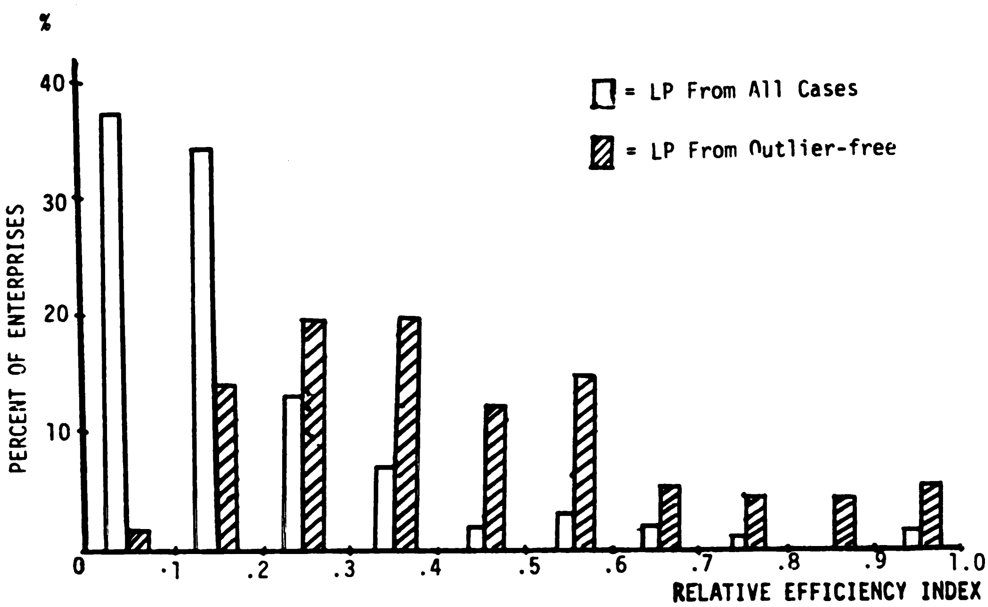
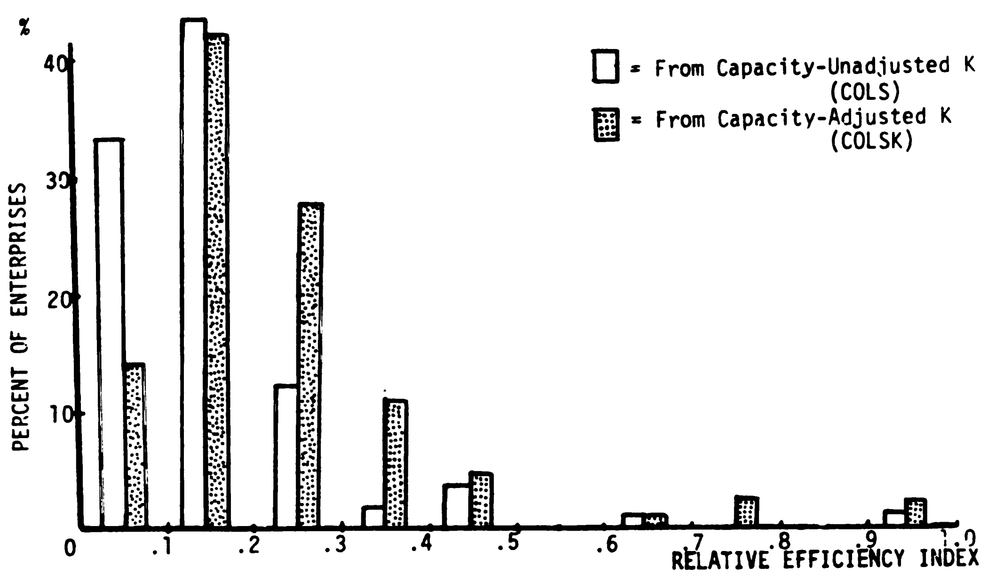


Figure 4.--WOODWORKS Relative Efficiency Indices Histograms.

(a) Using the Linear Programming Techinque
(b) Using the "Corrected" OLS Regression



(a) HISTOGRAM for LP Results



(a) Histogram for OLS Results

Figure 5.--SSI (All Industries) Relative Efficiency Indices Histograms

(a) Using the Linear Programming Technique
(b) Using the "Corrected" OLS Regression

TABLE 31.--Summary statistics of efficiency indices (expressed in percentages relative to the most efficient firms)[a]

Model Statistics[c]	Industry Groupings		
	Tailoring	Wood	SSI[b]
A. Corrected OLS Results			
1. COLS: adjusted capital			
a. Mean	43.9%	29.1%	21.6%
b. Median	40.3	22.4	19.0
c. Standard Error	4.9	8.9	2.4
d. Third Quartile	53.4	31.8	26.7
2. COLSK: unadjusted capital			
a. Mean	45.6	18.9	14.0
b. Median	42.4	14.9	12.1
c. Standard Error	5.1	5.5	1.6
d. Third Quartile	57.8	19.0	17.3
B. LP Results			
1. All Cases (LP_{100})			
a. Mean	51.3	21.7	13.4
b. Median	52.2	15.4	9.8
c. Standard Error	5.9	9.0	2.2
d. Third Quartile	61.5	28.6	15.6
2. Free of Outliers[d]			
a. Mean	51.6	68.6	47.4
b. Median	48.2	52.8	41.3
c. Standard Error	6.8	19.2	7.3
d. Third Quartile	53.4	70.1	57.1

Source: Jamaica Flow Data Survey 1979/80.

[a]Percentages show production level achieved compared to what firms are expected to achieve given the estimated frontier production function. Entries are weighted by stratum weights. Since the rural stratum is heavily weighted and since rural enterprises are less efficient, the use of unweighted indices raises the values of the 'a' entries or means by a factor of 10 to 15 percent.

[b]Small-scale industries or manufacturing subsector.

[c]The four efficiency indices for each industry correspond to the four frontier production functions of Table 30.

[d]After discarding 4 percent each from tailoring and the SSI and 10 percent from woodwork.

the scale and the great majority at the bottom (i.e., positively skewed distribution).

No other such studies seem to have been done on the small-scale industries in other countries. Therefore, strict comparison is not possible. Page's (1979) soap study in India and his (1980) research on the woodwork industry in Ghana are the closest; his mean efficiency indices for the two industries were about 60 percent and 70 percent, respectively. His study in India revealed that 60 percent of the enterprises achieved only 70 percent or less of the most efficient enterprise. In both cases, however, he includes large manufacturing enterprises. Timmer (1971) with close to 90 percent found relatively high efficiency levels in his state-farm study; he used, however, state average values which eliminate extreme values. Lecrew (1979) found that the average technical efficiency index was about 77 percent in Thailand's industrial sector and quotes Meller (1976) finding 75 percent of the Chilean manufacturing enterprises achieving less than 50 percent of the frontier ones. Lee and Tyler (1978) found that the average technical efficiency index in Brazilian large manufacturing was about 62.5 percent and they note that this is higher than was found among French manufacturing enterprises. Thus, the LP efficiency performance levels of all three groups of industries here, although comparatively lower, are not that bad. Besides, it should be remembered that (1) the weighting technique employed here tends to lower the mean levels of efficiency performance (against urban enterprises)[1] and (2) the discussions in Chapter 3 showed that for the most part, the small-scale industries (SSI) were operating under shortages of product demand, raw materials, and working capital. All of these would introduce elements that would adversely affect the efficiency level of an enterprise. For example, the number of idle hours counted as work hours could increase if respondents don't have a steady supply of work.

There is also a difference at the urban-rural category. Based on the LP outlier-free model, the urban enterprises are more efficient than their rural counterparts.[2] The differences in tailoring and the SSI groups were significant; even though the difference was insignificant, the urban woodwork enterprises also scored more than 30 percentage points higher efficiency indices than the rural ones.

At the intra-industry level, the medium-sized enterprises with employment between three and six or with annual sales of J$10,000 to $30,000 had a higher efficiency score both in tailoring and woodworks. Enterprise at the lower and upper levels of the sales size scale showed generally lower efficiency levels. Whether economies of scale, management constraints, or other issues were factors that contributed to such a phenomena is hard to tell.

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[1]If stratum unweighted values were used, most of the means shown in Table 31 would have risen by about 10 percent.

[2]The mean indices for urban enterprises were 64 percent, 97 percent, and 66 percent, respectively, for tailoring, woodworks, and the SSI group. The corresponding rural means were 50 percent, 63 percent, and 45 percent.

In the next section, possible causes of differences in efficiency performances will be examined. So far, the discussion has been a means to an end. The important question is what the sources of inter-firm differences in technical efficiences are.

5.3 Sources of Differences in Technical Efficiency Performance

From a polciy point of view, the most useful aspect of the efficiency analysis is to determine the causes of variation in efficiency performance. The success of such an attempt greatly depends on correct proprietor goal identification, the homogeneity of inputs, outputs, and the production techniques and the degree to which the role of exogeneous variables are minimized or isolated.

While the profitability of an indivdiual enterprise ultimately depends also on the factor prices relative to the product price, it can be said ceteris paribus, enterprises which are technically efficient will also be more profitable (see Tyler, 1979). This is so because efficient enterprises will have cost advantages over inefficient ones.

Profitability implies survival and growth of an industry. Thus, identifying factors that contribute or are associated with higher performance levels of efficiency are very vital for identifying growth industries. It is not easy, however, to find or relate such factors to efficiency performance levels. This is partly due to numerous interacting variables or attributes influencing the efficiency performance, including unknown chance factors that create unpredictable changes in performance levels.

In the following pages, attempts will be made to try to explain sources of differences in the levels of industry efficiency indices. The hypotheses and relevant variables examined here are the ones that were discussed in Chapter 4; hence, they are not repeated here. Because some of the variables are highly intercorrelated (e.g., educational background with record keeping and proprietor's age), it is difficult to come up with a functional relationship of significant coefficients (see Page, 1979, and Lecrew, 1980, for similar problems). This is particularly true with respect to the SSI group where different industries are also affected by different constraints. Thus, the functional relationships are supplemented with simple (zero-order) Pearson's correlation analysis between the LP efficiency index and other major categories of related variables. These major categories include firm size, proprietor training background, management practices, and production technique.

5.3.1 Tailoring: Explaining Technical Efficiency

In the tailoring group, the variables that gave the best fit for the LP efficiency index had the following simple linear relationship (T-values in parentheses):

$$\underset{}{IT} = 0.5550 + \underset{(2.754)^{***}}{0.1917(RK)} + \underset{(3.390)^{***}}{0.0057(DA)} - \underset{(-1.750)^{*}}{0.0021(MO)}$$

$\bar{R}^2 = 0.447$ df = 15 F = 5.857 F Significance = 0.7%

*** = Significant at 1 percent
** = Significant at 5 percent
* = Significant at 10 percent

where,

IT = LP efficiency index in tailoring; (ranging between 0 and 1)

RK = Record keeping dummy variable; RK = 1 if some records are kept, 0 otherwise

DA = Duration of apprenticeship training in months

MO = Percentage of total production that is "marketed on order," i.e., job shop work.

Thus, the three variables that help explain efficiency performance in tailoring account for about 45 percent of the total variation. Considering that this is from a cross-sectional data, the fit is quite good.

Looking at the individual variables, a firm that employes record keeping to any extent[1] should be more efficient since it could periodically compare and control average input productivities and overhead costs. It could also examine individual production areas and possibly eliminate those which are inefficient. Liedholm and Chuta (1976) also found that record keeping was significant at 1 percent in explaining profit variation in the small-scale industries of Sierra Leone.

Another variable which is important in explaining efficiency performance in tailoring is the length of the apprenticeship period (DS) for the proprietor. Presumably, the longer the training period, the more opportunity there exists for better knowledge of production,

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[1]When record keeping is crosstabulated with a number of variables, it seems what is important is not that a person keep complete records, but that some (important) variables are recorded.

marketing, input procurement, and even making important contacts with potential clientele.[1] Other researchers have used related variables, such as the age of the business (Liedholm and Chuta, 1976; and Page, 1980), as a proxy for on-the-job training (see below).

Another important variable, MO, or the percentage of total production marketed on customer order basis, is negatively related to efficiency. This is probably related to the level of marketing activity exerted by each producer. In a job-shop or production to order type of activity, the proprietor usually waits for the customer to appear, whereas production for inventory presumably would require for a more active marketing input. Such marketing input may include better displays of products, better salesmanship in interacting with potential customers and even distributors and the skillful use of clientele to promote one's products. In fact, Table 32 shows that the simple correlation between technical efficiency and the percentage of total hours spent on marketing activity in tailoring is positive and significant at 1 percent. While marketing activity may not be the only important factor here and the role of marketing activities will most probably vary among industry and product types, locations and enterprise sizes, it seems there may be some room for limited marketing activities before the cost exceeds the benefits from such activities.

Finally, Table 32 presents additional variables under major categories and their relationship to efficiency indices. Generally,

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[1]It will be noted later, as is indeed shown in Table 32, that this is not the case with woodwork and the SSI group.

TABLE 32.--Simple correlation (r) between the LP efficiency indices and other variables

Source of Variation in Efficiency	Tailoring: Number of Cases	Tailoring: Size of r	Tailoring: % Significance Level	Woodworks: Number of Cases	Woodworks: Size of r	Woodworks: % Significance Level	All Enterprises: Number of Cases	All Enterprises: Size of r	All Enterprises: % Significance Level
1. Enterprise Size									
a. Labor force (#)	20	.20	19.9	14	.13	33.2	64	-.13	15.0
b. Labor hours (#)	50	-.11	22.4	29	-.15	22.3	134	-.05	26.6
c. Total output ($)	50	.26	3.5	29	.39	1.7	134	.11	9.4
d. Value added ($)	50	.28	2.6	29	.34	3.5	134	.12	7.9
2. Proprietor Training or Experience									
a. Education	20	.03	45.5	14	.60	1.2	64	.20	6.0
b. Apprenticeship Training (ms.)	19	.43	3.1	14	-.52	2.9	62	-.09	24.8
c. Job experience (yrs.)	19	.44	3.1	14	-.33	12.6	63	-.05	36.0
d. Seminar attendance	20	.01	49.1	11	.40	11.0	46	.20	9.5
e. Proprietor age (yrs.)	20	-.19	21.5	14	-.53	2.4	64	-.26	2.0
f. Enterprise age (yrs.)	50	-.15	15.0	29	.01	49.1	134	-.04	32.7
3. Production Technique									
a. Rapair time (%)	50	-.05	37.1	28	-.07	36.0	134	.20	0.2
b. Production on order (%)	20	-.20	19.5	14	-.21	23.3	62	-.03	41.8
c. Marketing time (%)	50	.49	0.1	29	.08	34.2	134	.12	9.1
d. Supervision time (%)	50	-.06	34.7	29	.10	30.2	134	-.07	21.6
e. K:L ratio	50	-.11	22.7	29	-.11	28.6	134	-.16	3.4
f. Raw Material Purchase Frequency	50	-.19	10.0	29	-.18	18.0	61	-.28	1.4
g. Product Stock:Sales ratio	20	-.17	24.0	14	.05	43.0	64	-.21	5.0
h. Receivables:Sales ratio	16	-.41	6.0	14	-.07	40.0	51	-.19	8.6
i. Debt:Sales ratio	20	.11	33.0	14	-.02	47.0	60	-.03	40.2
j. Record keeping	20	.41	3.5	14	.20	24.2	64	-.03	40.2
4. Exogeneous Variables									
a. Material problem	18	.12	31.5	13	.30	15.9	57	-.10	23.0
b. Demand problem	18	-.04	43.6	13	-.30	15.9	57	.01	48.1
c. Urban location	50	.16	14.0	29	.15	21.6	134	.14	4.8
d. Unaccounted costs (%)	20	-.07	38.5	14	-.65	0.6	61	-.17	9.2

one can conclude enterprise size (using both labor force size and value of product) and efficiency are positively correlated (see also Tyler, 1979, for similar findings). However, the capital service/labor ratio (which is usually positively correlated with firm size) is negatively correlated with a significance level of 23 percent) see 3e of Table 32); the correlation coefficient between value of total production and the capital service/labor ratio is -0.03 with a significance level of 43 percent.

Two of the variables indicating training or experience have the expected sign and are significant at 3 percent. They are apprentice training, as already indicated, and prior outside experience in management position. Two other variables, proprietor and business ages have perhaps unexpected signs, though insignificant. Page (1980) also found that enterprise age was negatively correlated, but mostly insignificant, with technical efficiency for Nigerian wood manufacturing firms. Timmer (1971) found positive, but nonsignificant, correlation between these two. Although as already indicated, profit and technical efficiency may not vary in the same direction. Liedholm and Chuta (1976) also found that the age of the business was positively correlated with profit and significant at 5 percent. It is not clear why both proprietor ages and enterprise ages are negatively correlated here with efficiency; still more of the older enterprises (and relatively their older proprietors) are found in the rural areas. And the rural areas are less efficient relative to the urban ones (see Table 32). The main cause may be demand problems which seem more serious in the rural areas (see Fisseha and Davies, 1981). It is also possible that the urban (and some bigger) enterprises were better able to get their raw material needs than the rural ones.[1] For the amount of raw material per unit of labor is positively correlated with technical efficiency and significant at 1 percent. Although the significance level is about 32 percent, raw material problem was also conducive to higher levels of efficiency.[2]

The production technique variables shown in Table 32 are all negatively correlated, although none significantly with efficiency, except the marketing time variable. Thus, the more effort was spent on repair work, instead of production of new ones, probably the less it contributed to the overall efficiency (or revenue) of the enterprise. The underlying reason in the first case for doing more repair work could be due to shortages of both product demand and raw materials. As their incomes or purchasing power declined, consumers were forced to get by with repaired old items than buy new ones. Since repair work required relatively smaller material, this was also acceptable to proprietors who had raw material shortages.

As noted earlier, capital intensive enterprises (higher capital:labor ratio) seem less technically efficient, although the significance level for the correlation is only 23 percent.

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[1]Also rural areas being older on average, they tend to have older equipment and percent of equipment age expired is negatively correlated with efficiency and significant at 1 percent.

[2]The existence of material problem and high raw material per unit of labor are not mutually exclusive as the latter, induced by the former, can be achieved by laying off workers or reducing the number of hours worked.

Finally, the frequent purchase of raw materials and the two scales ratios (product inventory to sales and receivables to sales) were all negatively correlated to the efficiency index with significance levels of 10 percent, 24 percent, and 6 percent, respectively. The debt:sales ratio is positively correlated with efficiency and is significant at 10 percent.

It is not surprising why frequent purchase of raw materials is negatively correlated with efficiency and significantly at that. More frequent purchases imply more transportation costs, more hours on "nonproductive" labor time, and possibly more unlikely to benefit from trade discounts. Also both higher product inventory to sales and receivables to sales ratios imply that each dollar of sale was supported by higher levels of scarce funds, thus creating working capital constraints and possibly higher storage costs and credit losses; all of them could adversely affect the efficiency index via their effort on total sales and total costs. The debt to sales ratio is positively correlated with efficiency and this is not quite clear in view of the fact that product demand has been one of the major problems.

In summary, although a number of variables have been related here to efficiency for the sake of a more complete presentation, those that are related in a statistically significant way are few: record keeping, prior experience or training background, marketing activities, enterprise size (volume wise), and possibly geographical location.

5.3.2 Woodworks: Explaining Technical Efficiency

The variables that gave the best fit for the woodwork efficiency index are educational background, the ability of the proprietor to identify and consider all costs, and the percent of total time spent on workers' supervision. The regression results are as follows (T-values in parentheses):

$$IW = 0.3212 + \underset{(3.204)^{***}}{0.0471(ED)} - \underset{(-2.628)^{**}}{0.6640(CLO)} + \underset{(3.175)^{***}}{0.0039(ST)}$$

$\bar{R}^2 = 0.713$ df = 10 F = 11.782 F Sig. = 0.1%

*** = Significant at 1 percent
** = Significant at 5 percent
* = Significant at 10 percent

where,

IW = LP efficiency index in woodworks ($0 \leq IW \leq I$)

ED = number of years in school

CLO = the percentage of total costs left unaccounted for as described in Section 4.3.3.1 of Chapter 4

ST = percent of total time spent on supervision

None of the efficiency articles cited so far deal directly with the effect of education on technical efficiency. However, a number of studies have noted its effect on profitability (which in the present study is positively correlated with technical efficiency and is significant at 2 percent). Chuta and Liedholm (1979) cite some of these findings and in almost all cases the effect is negative. Nafziger (1971) also found that education was negatively correlated with profit. Watanabe (1970) found that there was no correlation between education and size of business among Japanese small-scale industries. Douglas (1976) says of small-scale industies in the United States, "Education apparently does not contribute directly to business success" (p. 44). In spite of the above findings though, many researchers believe education is vital for the overall management of the business. Coffey and Herrmann (1976) concur that education "helps develop the ability to analyze, synthesize, and evaluate" acquired knowledge (p. 1). Petrof (1980) would go as far as urging governments to develop educational programs since "it is essential that traditional managers be re-educated in both methods and outlook before they can create productive enterprises" (p. 56). In 37 studies that Lockheed et al. (1981) reviewed on the relationship between farm efficiencies and education, they also found 31 of the studies showed positive effect and usually significant; in the remaining six, the effect was negative and nonsignificant.

The second variable included in the regression is the percentage of the total relevant costs for a business that were left unaccounted in the cost identification inquiry discussed in Chapter 4. Thus, the ability of a proprietor to identify cost items as such and find ways of controlling them is very crucial for higher levels of efficiency performance. If some expenses or inputs such as own labor, utility, or transportation are not considered as costs or their importance is minimized to the extent that their contribution to the overall enterprise outlay is slighted, then there will be little incentive to economize their use and this will inevitably lead to wastage of resources and technical efficiency. This will be ultimately reflected in the profit picture of the enterprise. It is interesting to note that proprietors with education below the secondary level left four times as many costs unaccounted for as those with higher levels of education.

The last variable with a highly significant effect on the woodwork efficiency performance is the percentage of total time spent on the supervision of workers and preparation of production work plans. Apart from the proprietor very little supervision time is spent by the rest of the labor crew in the enterprise; thus, this refers mainly to proprietor work hours. It is not surprising that proprietors who spend relatively more hours on planning production tasks, closer supervision of workers and as a result, improving their technical expertise show higher levels of technical efficiency. It is not surprising also that this variable is more important in the woodwork industry, but not in the tailoring one. The average size of the labor force in a woodwork enterprise is almost double that of tailoring. Thus, compared to tailoring, it is more worthwhile for woodwork proprietors to spend a higher percentage of their time on supervision of their workers.

Finally, different industrial groups will be affected by the same variables to a varying degree, sometimes with opposite effects (see Table 32). Thus, the variables which were important in the tailoring regression are less so in woodwork with the exception of the apprentice training background variable. Apprentice training is not only negatively correlated in woodwork, it is also significant at 3 percent. This is rather puzzling, except since proprietor age is also negatively correlated with efficiency and length of apprenticeship is positively correlated with proprietor age, perhaps the older enterprises in woodwork are declining.

From the size indicators of Table 32, it can again be concluded that large enterprises are more efficient; the capital-labor ratio is negatively correlated and insignificant in wood too. Another important variable which is negatively and significantly related to efficiency is the age of the proprietor; one can almost say that there is no relationship between enterprise age and efficiency.

Looking at the variables of frequency of raw material purchase, the receivables to sales ratio and the debt to sales ratio, all are negatively correlated with efficiency in woodworks, with a significance level of 18 percent, 40 percent, and 47 percent respectively. The product inventory-sales ratio is, however, positively correlated with efficiency and has a significance level of 43 percent. These variables must be looked against raw material shortages and relatively less product demand problem setting in the woodwork industry. The variables that show production technique and those of exogeneous sources have in general similar effect on woodwork as they do in tailoring.

5.3.3 All (SSI) Industries: Explaining Technical Efficiency

Different industries being more affected by certain problems and opportunities than others, it is very difficult to come up with a functional relationship that explains efficiency performance in the subsector as a whole. To start with, there is the possibility that the SSI frontier function may not be a good approximation of the subsector as a whole. For example, the descending order of the different industries in their mean efficiency performance levels using the same SSI frontier function is as follows: woodworks (55 percent), repair works (54 percent), shoemaking (48 percent), craft (45 percent), tailoring (42 percent), metalworks (26 percent), and a diverse group (68 percent).[1] The common SSI frontier function may not affect the relative position or ranking of enterprises within an industry compared to the ranking, using their own industry production functions (i.e., the main difference may be mainly the intercept). But it does show how careful one has to be in trying to draw a common denominator of influences for all the industries in the subsector which may have different intra-industry distributions.

Keeping the above caveate in mind, the following regression seems to explain some variation in the SSI group (T-values in parentheses):

$$IA = \underset{}{0.6084} - \underset{(-1.476)}{0.1502(CLO)} - \underset{(-2.481)^{**}}{0.0043(PA)} + \underset{(3.218)^{***}}{0.2302(RW)}$$

$\bar{R}^2 = 0.201$ df = 57   F = 6.024   F sig. - 0.1%

*** = Significant at 1 percent
** = Significant at 5 percent
* = Significant at 10 percent

[1]The correspoinding medians are respectively 47 percent, 52 percent, 44 percent, 42 percent, 40 percent, 20 percent, and 18 percent.

where,

IA = LP efficiency index in the SSI group ($0 \leq IA \leq 1$)

CLO = the percentage of total costs left unaccounted for as described in Section 4.3.3.1 of Chapter 4

PA = age of the proprietor

RW = percentage of total revenue accounted for from repair works

In spite of the relatively low adjusted R-squared value, the regression is significant at 0.1 percent; similarly although the two-tail significance level for the CLO variable is only 14 percent, it is included here since it greatly improves the overall regression results (e.g., higher R-squared).

The most significant variable in the regression is the percentage of total revenue that came from repairing activities as opposed to from the production of new ones. The plausibility of this phenomenon has been already described: namely that it was caused by shortages in demand and raw materials. However, its significant effect is totally different from those found in tailoring and woodworks. This difference may be due to the fact that the main source of revenue for the repairing group of enterprises (which are in the SSI, but not in tailoring a woodwork) is actually repair work.

Looking at Tabel 32 again, enterprise size, using labor force as a measure, is negatively correlated with efficiency, but when values of production are used, the relationship is positive and significant at 10 percent. Still, large enterprises with a labor force of five or more achieved 27 percent higher efficiency index than the smaller ones. Thus, the conclusion can still be made that larger firms are generally more efficient. The explanations are as those already presented for tailoring in Section 5.3.1. Namely, the bigger the enterprise is, the more successful it was in acquiring raw materials either through bulk purchase or being more informed; also, being bigger, its marketing activities must have helped it relatively more.

Although it may seem puzzling why time spent on repair work is negatively correlated both in tailoring and woodworks (see Table 32) and yet positively and significant in the SSI group, the explanation probably lies in the fact that the repairing industries (e.g., auto repair) have a higher mean SSI efficiency levels as described above; their output was classified as repair work and since total output is positively correlated with efficiency, it could explain the apparent deviation. The remaining variables that indicate technique of production have generally the same effect here on efficiency as they did in tailoring and woodworks, except for recording keeping.

In conclusion, the picture that emerges from the aggregate (SSI) efficiency profile has the following characteristics: generally larger enterprises in the small-scale industries are more technically efficient than the very small ones (there is some evidence, however, this may not hold for the very large ones); thus, urban enterprises are also more efficient than rural ones; however, more capital intensive technique of production is relatively less efficient;[1] the

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[1]Commonly, more capital intensive (i.e., higher capital to labor ratio) technique of production is associated with larger enterprises and this seems to go counter the efficiency conclusion drawn above for large enterprises. There may be two reasons for this

correct identification and accounting of all the relevant enterprise costs are positively correlated with efficiency; education and seminar attendance may be highly conducive for more overall resource productivity; finally, some marketing activities are apparently effective in raising the overall efficiency and profitability of an enterprise.

5.4 Adjustment for Capacity Levels and Efficiency

In situations of great underutilization of production capacity, the levels of capital owned (controlled) and actually used may be two different things. Section 5.1 described the estimation of the production function using capacity-adjusted capital input. The effect of such an approach on all the input coefficients and on the corresponding standard errors was also described there. If the capital input had not been adjusted for levels of capacity utilization, then those enterprises producing substantially less than their fixed capital capacity would appear as using much more capital input than they actually did and subsequently less technically efficient. Since number of hours actually worked are used for labor the use of capacity unadjusted capital would have been inconsistent with this approach and the comparative analysis of the capital and labor output elasticities would have been similarly unsuitable.

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apparent discrepancy: one, it is not necessary that capital/labor ratio and size vary in the same direction in every case; two, the discrepancy may be due to the way the capital/labor ratio is measured--hours are used to measure labor (which is negatively correlated with efficiency) but not to measure the capital input.

The use of capacity-adjusted capital could, on the other hand, introduce some conceptual problems in the technical efficiency analysis. Firms may produce below capacity for a number of reasons (see Winston, 1974). They may, for example, choose to produce below capacity so as to avoid higher labor costs (e.g., night shifts) or to leave a margin of safety to meet unforeseen high surge of product demand. On the other hand, firms may be forced to produce below capacity due to deteriorating product demand or input acquisition problems such as raw material shortages. Finally, they may produce below their optimum capacity levels due to management weaknesses and incapabilities. Lack of imaginative use of resources, poor supervision, and poor planning based on inadequate information could cause the level of capacity utilized to be lower than would be the case with superior management input; it would be useful for comparative purposes to capture this type of underutilization of capacity.

Thus, technical efficiency based on capacity unadjusted capital was also estimated in the present analysis. The results of the "corrected" OLS regressions and the resulting distributions of the efficiency indices under the two types of capital are given, respectively, in Table 30 and 31. A visual comparative inspection of these distributions can be made from the efficiency histograms in the "b" parts of Figures 3 to 5 of pages 230-232.

One can assume that a substantial management deficiency subsumed under the capacity measure should be an important explanatory variable in explaining efficiency indices based on a regression of unadjusted capital.[1] However, when these new indices were regressed on the capacity measure variable and the explanatory variables previously used in the efficiency indices from capacity adjusted capital, not only was the capacity coefficient insignificant both for woodwork and the SSI group (at 70 percent and 27 percent levels of significance, respectively), but the adjusted R-squared was much lower in both cases (0.141 and 0.619). Furthermore, raw material per unit of labor variable in woodwork and the proprietor age in the SSI group became insignificant in the presence of the capacity variable. In tailoring, the capacity coefficient was significant at 0.3 percent and the adjusted R-squared was raised by one-third but only at the expense of the apprentice training and the "marketing on order" variables which became now insignificant. With respect to the "marketing on order" variable, this is not surprising due to its high negative correlation (r = -0.81) with the capacity variable and thus introducing multicollinearity problem. This is most likely due to the product demand situation: the higher the demand, the higher the level of capacity utilized and the lower the dependence of production levels on customer order basis.

In summary, it does not seem that the use of capacity adjusted capital failed to explain substantial management related inefficiencies subsumed under the capacity underutilization variable. If

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[1]Thus the capacity measure variable which was earlier encorporated (through its adjusting effect on capital) in the frontier production function, is now dropped and is included in the efficiency index for capacity unadjusted capital regressions to see its effect along with the other variables.

anything, it greatly proved the overall efficiency fit by starting with a frontier function formulation that is more consistent with the theoretical tenants of production economics--namely, the use of actual amounts of inputs to determine the production function.

Finally, it would be useful for policy implications to know the major factors contributiong to underutilization of capacity. Because of the small number of cases with a specific characterstic and the intercorrelation among the independent variables, it was difficult to isolate in regression the effects of some variables. For the small scale as a group, the variables that contributed to higher levels of capacity production were (a) the mode of product marketing employed, (b) the educational background of the proprietor, and (c) the level of demand for a product. Among these, the most important was the amount of effort a proprietor spends in marketing a product. Thus, proprietors who produced for inventory, as opposed to production on order, were producing at a higher level of capacity. Also, the number of hours spent on marketing were positively and significantly related to the level of capacity utilized. The level of capacity utilized and the marketing effort are also highly correlated in tailoring and woodworks.

The educational background seems highly conducive for higher production particularly in woodworks. In the case of tailoring, it is the practical training of apprenticeship or other job experiences that contribute to higher capacity.

The direct effect of demand on capacity utilization was pervasive throughout the small-scale industries. Shortage of raw materials although it was very crucial, varied from industry to industry. For example, woodwork industries had more material shortage problems than tailoring. Since certain overhead costs such as electricity, rent, and transportation costs don't change in direct proportion to the level of capacity utilized, enterprises operating at a lower capacity (i.e., due to demand shortage) will appear to be inefficient due to the incurring of unnecessary "fixed" overhead costs.

Other factors that contributed to higher levels of capacity utilization are the size of output achieved per unit of labor and the location of the business: both contributed to higher levels of capacity and are significantly related at 5 percent. Urban enterprises tended to operate at higher capacity (and thus were more technically efficient) than their rural counterparts. On the other hand, the sizes of the labor force and output were negatively correlated with the level of capacity utilization and were even significant at 2 percent for all the SSI group.

Specifically for tailoring and woodwork, the same variables mentioned above generally have similar effect on these industrial groups as they do on the SSI group. However, demand problem in tailoring and raw material shortages in woodwork are very important in addition to the amount of marketing effort applied.

5.5 Empirical Implications and Conclusions

This chapter started by identifying the inputs that go into the production function and the determination of the production parameters using both OLS and LP techniques. Using these parameters, three sets of relative technical efficiency indices among enterprises were constructed one set for each of tailoring, woodworks, and the small-scale industry (SSI) as a whole.

From the results of the LP technique, half of the enterprises managed to achieve less than half of what the most efficient enterprises were producing given the same levels of inputs. The general conclusion is that there is a wide gap between a few efficient enterprises and a very large number of inefficient ones. Part of this low level of achievement is due to the weighting scheme employed here where more weight or importance is given to the rural enterprises because of their numerical dominance. Part of the gap can also be attributed to some random or nonsystematic variation among enterprises. However, even after such allowances are made, the gap is so large that a substantial variation must still exist to be explained by the management input and other variables (some under its control).

The key variables that contributed to the variation in the efficiency indices can be grouped into three main categories: (a) proprietor characteristics such as education and/or on-the-job training and age, (b) management practices such as record keeping, mode of product marketing, and labor allocation between production and repair and (c) other variables such as raw material problems and the ability of a proprietor to identify all relevant enterprise costs. Other important variables are included in Table 32.

The empirical implication of the finding is that without spending additional scarce resources, the production levels of the small-scale industries can be either increased or else the production cost substantially reduced (provided these are desirable goals). In the face of both demand and raw material shortages, the second option is more appealing. Reduced cost or increased production from the same amount of resources means enterprises will be more profitable. This may, in turn, result in increased employment (and production) or at least in minimizing job losses. Thus, the incentive for policy to correct the efficiency gap is very compelling.

Since the variables that have the greatest effect on efficiency have been identified, it should be clar as to what type of policy measures are called for. In fact, one can readily point out the needed policy interventions in at least three main areas: (a) more information on production and marketing aspects (Cf. the record keeping and left out enterprise costs variables), (b) more proprietor training (Cf. the education and on-the-job experience variables), and (c) the provision of the basic necessities for production (Cf. the raw material variable). There are, of course, other important areas of conclusion, but the above three were prominent from the results of the efficiency regression results. The elaboration of those areas susceptible to policy measures will be the main content of the next chapter on conclusions and policy implications.

CHAPTER 6

CONCLUSIONS AND PROGRAM IMPLICATIONS

6.0 Introduction

This dissertation set out to accomplish four major objectives: (1) to describe the static and dynamic economic environment of the Jamaican small-scale industries subsector (SSI);[1] (2) to explain the management charactersitics and practices found in it; (3) to make a comparative analysis of technical efficiency performance levels achieved among firms in the subsector; and (4) to identify management variables that are important in explaining differences in technical efficiency performances among firms. The objective in this chapter is to distill the findings from this investigative effort in the hope that it leads to the formulation of concrete program guidelines.

To accomplish this task, a brief review of the Jamaican small-scale manufacturing (SSI) subsector will first be presented indicating its contributions and efficiency in resource use. This is followed by identification of important management variables related to productive efficiency and description of specific

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[1]Small-scale enterprises in the present study are defined as those that have a labor force of 25 or fewer. Informal enterprises such as higgling, push-cart vending, and other mobile business (e.g., shoe shining) are not included in this definition.

program courses of action to be followed to improve management efficiency. The chapter closes by pointing out priority areas of further research in the SSI subsector.

6.1 Contributions of the SSI Subsector

Before making policy inferences from the findings, it is proper to start by outlining the major facets of the Jamaican small-scale manufacturing (SSI) subsector. The subsector contributes in three important ways to the Jamaican economy: employment, training, and production. Reviewing briefly these contributions will help to justify the subsector's claim to such policy-oriented prescriptive recommendations as will be presented here.

One of the important contributions of the subsector is the provision of direct employment. Both the SSI subsector and its counterpart in the commercial or service area are dominated by rural one-person operations. In the urban areas, however, the average size of the labor force is about three; in the SSI enterprises alone, this average is four. About 50 percent of the enterprises are owned and run by female proprietors, the majority of whom are likewise in the rural areas. It appears, however, that the relative size of this particular group among the younger enterprise age cohorts is falling. This may be due, in part, to the declining dress-making and local food processing industries and probably to a shift of occupation into the higgling and other distributive fields.

The small-scale enterprises as a whole (both manufacturing and services) number about 38,000 enterprises and provide employment for about 80,000 people whose average age is 33 years. More than 80 percent of these enterprises are in the rural areas accounting for 70 percent of the total labor force.

If the informal or mobile enterprises are also included, the employment provided by the small-scale enterprises (i.e., including nonmanufacturing) probably reaches 85,000 to 90,000 or roughly about 9 to 10 percent of the total labor force in Jamaica. The SSI subsector alone employs nearly 30,000 or over 40 percent of the total labor force in the entire manufacturing sector. Female employment in the SSI subsector accounts for 15 and 43 percent of the nonproprietor labor force respectively in the urban and rural locations. The respective corresponding figures among proprietors are 12 and 58 percent. With respect to employment, it is important to reiterate that the large majority who are employed in the SSI enterprises start poor and with little formal skill to qualify them for employment in the larger scale and more developed industrial subsector. The average age of starting apprentices is 18 years. For many, the training in the smaller enterprises is their only stepping stone to employment opportunities with large firms or to start their own businesses.

Thus, training is the second major contribution from the small-scale industries. The extent of this benefit in grooming skilled workers and prospective proprietors is noted by the fact that for 75 percent of the proprietors, the apprenticeship system was the main vehicle of training before they acquired a trade or opened a business. Under this apprenticeship system, every enterprise on average produces one skilled worker every three years (who may turn out later to be a proprietor). This works out to about 4,500 fully trained skilled workers produced every year. About 56 percent of this figure is accounted for by the urban areas; more than 98 percent of it comes from the five major traditional areas of apprentice training: woodworks, auto repair, shoemaking, tailoring, and metal works in that order. The average length of apprentice training is about 21 months and ranges from 2 months for some craftwork to 40 months for auto repair work.

The third major contributions by the SSI subsector is the production of goods and services. The Jamaican industrial or manufacturing sector is quite developed compared to many other developing countries. Even so, the small-scale subsector accounts for more than one-fifth of the GDP from manufacturing and 3.5 percent of the total. Given that this contribution is from firms averaging about $10,000 for annual value of production, 2.2 for labor force size, and $1,255 capital/labor ratio,[1] the contribution is quite substantial. The subsector also generates 80 cents in value added from every dollar of gross sales.

Finally, other valuable contributions include extensive participation of proprietors in civic or voluntary type community activities, the indirect creation of employment for many in other sectors

[1]This ratio is using capital at its replacement value; if the deflated and depreciated equipment capital is used, the capital/labor ratio is only $770.

of the economy and the provision of services and goods at reasonable cost to people in the low income strata.

6.2 Problems of Production Efficiency in the SSI Subsector

There are a number of problems facing the small-scale industries (SSI) subsector. Chief among these are working capital constraints, lack of long-term investment funds, shortages of raw materials and stiff market competition partially caused by both imported items and declining consumer disposable income. Some of these are the result of rapidly rising raw material costs in the face of less than comparable increases in the product prices. For example, between 1975 and 1980, the prices of major raw materials increased almost five times while the corresponding increase for product prices was three times. In addition, both wages and the cost of machinery each increased by two and one-half times.

Despite these conditions, the subsector is maintaining its ground and sometimes gaining. The number of enterprises is growing at an estimated rate of 1 to 3 percent annually. The size of its labor force, and the number of both powered and nonpowered machines are all growing at an estimated rate of 3 percent per year on the average. Over the last half of the 1970s, the product demand levels for most of the industry groups have been also generally growing.

Even with the above accomplishments, the analysis undertaken in this study has revealed there is room for substantial improvement in productive efficiency. While small-scale industries may be matching or even excelling their large-scale counterparts on the average, there is considerable production inefficiency in many individual enterprises. Of greatest interest is a relative measure that shows the level of efficiency with which all resources in a business are being used in production. One such measure is commonly known as technical efficiency. The comparison is made among firms possessing the same kind and quantity of basic inputs or using the same technique of production.[1]

The performance in relative technical efficiency levels among firms in an industry was determined in the present study by first determining the frontier production function. The models used to accomplish this analysis are Ordinary Least Squares (OLS) and Linear Programming (LP) both appropriately modified to reflect the frontier input-output relationships or production function. The frontier function represents the most efficient level of production for all the firms in the sample. An enterprise's relative technical efficiency index then measures the degree that enterprise succeeds in achieving this efficient level of production. A perfectly efficient firm will score 100 percent in this index while a less efficient one will score anywhere below this 100 percent standard, depending on its level of inefficiency.

It should be pointed out that the level of standard efficiency by which the firms are judged was established using production information based on the best results observed in practice

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[1]By technique of production is meant there is the same level of basic inputs, namely: labor, raw materials, and capital.

among the firms themselves. Thus, the standard of measurement is not based on the highest ever possible in the theoretical or technical (engineering) sense. Furthermore, economies to scale should not play a role since firms of the same input levels are compared.[1]

For the Jamaican small-scale industries as a whole, the present study has demonstrated that the index of technical efficiency is less than 50 percent. Thus, they did not score even half of what is expected from them under efficient mode of production and using the available resources they have. Moreover, this calculation makes due allowances for underutilization of production capacity whatever the causes may be. Usually, capacity underutilization was caused by raw material and demand shortages; however, management weakness being a possible cause was also tested in this study. When the distribution of the technical efficiency indices are examined within an industry group such as tailoring or woodwork, the picture is slightly better for woodwork (with 69 percent) and almost the same for tailoring (52 percent).[2]

While the simple conclusion one draws from the efficiency performances is that there is room for a substantial improvement in

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[1]The provision of special services such as credit should not play a role too. Such services usually increase the size of the inputs available to a firm. As a result, the resource endowment of the firm is changed; this requires efficiency comparison be made now with the most efficient firm possessing the same level of inputs.

[2]Going outside firms of the same characteristics, useful comparisons can be made between urban firms scores versus rural, young firms versus old, male owners versus female, etc. In the present study urban firms (and hence larger ones), for example, are more efficient than the rural firms.

the efficiency with which available resources are being used, there are some limitations with the methodology that must be considered. The reservations with such kinds of studies or approaches are the following: (a) producers or proprietors may not have as their goal the maximization of output from given resources; (b) even if they want maximum output from the available resources, there may be factors beyond their control that mitigate against such an objective; and (c) there may be differences not in the quantity of a basic input but in the composition of it, e.g., typically capital. Theoretically, it is possible to construct a comprehensive model that would incorporate all the above concerns. In practice, there are usually data or analytical limitations that would prevent the construction of such a model. A brief review of how the above problems were viewed in the present study will now be presented.

With respect to the first concern, the present study did ascertain that for nearly 90 percent of the proprietors, the main current goal in business is to get income and employment. Also nearly 95 percent of them said they were producing below their desired capacity and that about 60 percent of them were dissatisfied with the low level of demand for their products.[1] Thus, while these facts in themselves don't necessarily imply that proprietors' main goal is to maximize output, one can safely conclude that getting the maximum output from the available resources may be among the top

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[1]The remaining 40 percent who voiced no lack of dissatisfaction implied that given the present economic conditions, they are not doing badly; but this is not the same as being satisfied.

priorities for them. Consistent with this view, one would expect them to make substantial effort to raise the level of production from the resources at hand. It seems, therefore, that the first concern is not crucial for the outcome of this study.

The second reservation that the level of output a firm achieves is also affected by factors beyond its control and not only by the resources it has is not crucial again in the present case. First, the effect of such uncontrollable factors is bound to be minimum for firms in the SSI subsector compared to, say, in large-scale manufacturing or in agriculture where producers have to contend with, among other things, changes in orders or weather. Second, the inefficiency gap is so large that even after allowing for such sources of differences, there would still be substantial gaps that need to be explained. For example, even if such outside factors can account for, say, 25 percent of the inefficiency among firms, they would still be achieving only about 75 percent of what they are capable of achieving. The remaining 25 percent is still a substantial gap. Third, attempts have been made in this study to make allowances for many of those variables that could be considered truly exogenous (i.e., except those relating to management attributes, such as educational level whose effects are specifically analyzed in the present study).

The third issue of concern deals with a potential problem inherent in all input-output analysis, namely the heterogeneity of inputs and outputs. One can never eliminate the problem completely, but its effect could be minimized. In the present study, by emphasizing the industry level differences, it is hoped its effect would be minimal; also in view of the large differences in relative efficiency scores, improving the homogeneity of the producing units may have only a marginal effect on the final outcome of the findings.

Much of the relative differences in technical efficiency among firms can be attributed to differences in management difficiencies among them. In many cases, the level of improved management practices is low (although probably better than similar subsectors found in other LDCs). Close to 75 percent of the total production is done under orders from customers (i.e., job shop arrangement). Very little time (about 8 percent) of the total is spent on marketing activities or supervision of work (1 percent). Only 10 percent of the proprietors keep complete records. They also fail to specifically identify or account for at least 20 percent of the total number of cost items in their business. Only half of them keep their business and non-business money separate. About 58 percent of them regularly siphon money generated from the business to support other businesses, such as farming; while the propriety of such a practice has to be examined against the objectives of the proprietor, there is no question, however, that such a practice saps the firm of its potentiality for growth. Only about 8 percent of them use profit-loss analysis as a measure of their business periodic performance. In fact, nearly a third make no checks at all on the relative performance of the business. It is thus not surprising that much of the inefficiency among the firms can be related to management variables such as the ones mentioned above.

The identification of the variables that are important sources of differences in efficiency performance will be presented in the next section which will be followed by formulation of a program consistent with the above identification. It should be pointed out, however, that program recommendations in the past have typically emphasized the macro issues and often overlooked the importance of the firm level or micro aspect such as the technical inefficiency identified in the present study. Program recommendations related to these macro issues such as import-export possibilities, trade protections, exchange values, interest rates, preferential subsidies and others are relevant issues for the well being and growth of the SSI subsector. However, program recommendations dealing with such macro issues usually have political problems that delay their implementation. Moreover, it has been suggested by other researchers that the pay-offs from improved technical or production efficiency may be comparable to those that would arise from eliminating price distortions. The wide gap in technical efficiency among the Jamaican SSI firms seems to corroborate this view. Hence, it seems prudent to give priority to improving the relative efficiency with which resources already available to proprietors are being utilized. At the very least, such efficiency-enhancing steps should be simultaneously undertaken along with the macro measures.

Before closing this section, there are five major points worth emphasizing from the discussions so far:

1. In the study, the level of technical efficiency index for a group is measured against a standard achieved by the efficient members of that group using the same quantity and quality of resouces--namely, labor, capital, and raw materials.

2. The gap in the technical efficiency index is so wide that even after allowing for some possible unaccountable sources of differences, there would still exist substantial room for improvement.

3. The simple conclusion from such differences is that the levels of output for many enterprises can be considerably increased without any additional outlay of the above resources.

4. The major causes of poor efficiency in production can be traced to a few key variables specifically related to the quality and quantity of management in the subsector.

5. Finally, many program recommendations emphasize the provision of certain services (e.g., credit) or the execution of certain corrective measures (e.g., distorted relative factor prices) and often overlook the fact that resources already available to proprietors may not be efficiently utilized.

In the following section the management variables that are important in explaining the level of inefficiency among the SSI enterprises will be discussed, which in turn, will lead to direct program recommendations.

6.3 Management Variables Affecting Firm Production Efficiency Performance

The ultimate objective of the technical efficiency analysis in this study is to relate the level of inefficiency among firms to specific variables which may be the subject of intervention for management or program improvement. This is not always easy in practice mainly for two reasons. One, different industries or different enterprises in the same industry are affected differently by the same variable. Second, the relevant variables are often interrelated (e.g., record keeping with educational level or education with age of the proprietor) so that an effect cannot unambiguously be attributed to a specific variable. Within this general context, attempts were made in this study to identify those variables most crucially related in determining the level of technical efficiency among firms. This was done through the use of Ordinary Least Squares (OLS) technique. Only the most important variables will be presented here.

The industries that are the subject of special analysis in the present study are tailoring (i.e., including dressmaking) and woodworks. The variables that are important in the tailoring industry are record keeping, length of apprenticeship training for the proprietors and the percentage of output produced under customer order (job shop) arrangements. The last variable is a proxy for the amount of effort spent on marketing or promoting products. In the case of woodworks, the important variables are education of proprietors, amount of total time spent on planning and supervision of work, and the extent to which a proprietor can correctly identify and account for the various costs incurred by the business. Finally, when all the industries are combined, additional relevant variables include the age of the proprietor and the percentage of total revenue accruing from repair work as opposed to production of new items. The last variable can also be directly related to shortages in raw materials and demand for new products. For example, the greater the raw material shortage, the more likely old items will be repaired and the less likely new items will be produced.

The crucial variables that affect technical efficiency can be grouped into three broad areas: (1) variables pertaining to management attributes such as educational level; (2) variables pertaining to desirable management business practices, such as more marketing efforts; and (3) variables pertaining to other aspects of the management such as seminar attendance. It should be pointed out that the third category of variables include other variables not incorporated in the regression models that were used to identify the variables most powerful in explaining inefficiency.

Since the causes of inefficiency have been traced mainly to a few management variables, the course of actions to take should be likewise few and clear. Even so, program interventions are likely to be constrained or ineffective by limited resources. It is necessary, therefore, to give priority to those management areas that promise the highest pay-off for given expenditure of resources and time. For example, committing resources to require or even encourage record keeping by every proprietor would have a low pay-off because there are many small enterprises that either don't need or can't afford such a level of business sophistication. Thus, considering the nature of the constraints, the size of the task, the usual resource limitations and the potential pay-off from the effort, the following approach could be suggested for program implementation: (a) more general recommendations relevant for all SSI enterprises as a group; (b) less general recommendations for the smaller and larger SSI enterprises--this almost always translates into corresponding urban-rural segments, and finally (c) specific recommendations for industry groupings with specific production and marketing modes. Dividing enterprises into different size groups can be accomplished using different size measures that suit the situation. The following criteria are often used: the size of the labor force, the value (or volume) of output, the size of fixed capital and some other variations of these such as capital per unit of labor. Both capital and value of output are difficult to measure, particularly capital. In the present study, value of output and labor force size were positively correlated and significant. What criteria to use and how firms should be classified using that criteria are questions influenced by each set of objectives, funds, and other variables. To give one possible classification, firms with a labor force above five could be considered large within the context of the SSI subsector. If it is desirable to give more weight to the value of output, then J$50,000 could be a good cut-off point.

Based on the above classification, program contents and frequency can be varied depending on objectives and available resources; additionally priorities of short-term and long-term nature should also be considered. These guidelines will be followed for specific program recommendations suggested in the following section.

6.4 Specific Recommendations for Program Intervention

Consistent with the key variables that affect management efficiency in production and the approaches to project or program applications identified earlier, specific measures can be offered to improve the economic welfare of the Jamaican small-scale industries (SSI). It should be pointed out, however, that the actual mechanics of implementing the specific recommendations suggested here and who should provide them are outside the scope of the present study. Thus, while the basis for making the following specific program contents is familiarity with the problems and an awareness of the level of business sophistication present among the proprietors, the actual modifications to suit a particular situation and budget constraints will depend on the targets to be achieved, the available resources and on some initial probing done to sense proprietors' response to such program contents. In fact, the necessity of involving proprietors in providing suggestions and feedbacks at all stages of policy formulation and implementation is crucial for the success of such an undertaking.

It should be pointed out also at the outset that the short-term recommendations presented below were chosen to deal with the identified problems because they are thought to be feasible, possibly cost effective and inexpensive relative to the task to be accomplished and the economic gains that can accrue from such programs. Whether in fact they are so may be another relevant issue worthy of consideration before resources are committed. Furthermore, the whole question of service delivery system is not as already indicated within the perview of the present study and it thus is also a relevant topic for a comprehensive examination.[1]

With the above caveats in mind, the following recommendations are presented for the different enterprise classifications noted earlier.

6.4.1 Measures Relevant to All SSI Enterprises as a Group

The issues raised here deal with problems that are common to all enterprises and which may be amenable to less specific and less intensive measures for management improvement.

1. The provision of information to producers on raw material and product markets through the continuous use of the public media supplemented occasionally by trade fairs and industry specific seminars and meetings. This could be handled, for example, through

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[1]There are other management aspects highly relevant at the micro level, such as product quality improvements, that have not been explicitly addressed in the present study because they don't directly follow from the findings of the present study. Their importance was clearly noticeable in the study.

regular radio programs as part of other relevant small business news. The small business organizations such as the SBA (Small Business Association) should be more strengthened and included in the delivery programs.

2. The provision of information to consumers on the availability of specific quality products that may be much cheaper than the imported items. Proprietors should be encouraged to take the first step of promoting their own products; this does not always have to take (in fact, can't always take) a full-fledged media advertisement. A simple sign, word of mouth, even taking a sample product to larger establishments (private and public) that may grant subcontracting could be adequate.

3. Finally, encouraging proprietors to participate in business organizational membership, particularly in industry specific cells within bigger organizations (e.g., SBA). This could help in organizing proprietors for mutual assistance and a cooperative exploitation of common resources, expertise, and advice. It also facilitates the dissemination of information among them.

6.4.2 Measures Relevant for Smaller SSI Enterprises

Considering the number, size, and location of the smaller enterprises, the program actions recommended for them are rather limited and relatively more general and somewhat at variance to their present importance in production and employment. Their potential growth into larger firms, however, should not be forgotten.

A rough check of firms that started small and grew showed that they were averaging about $200,000 a year in sales having started their business with as little as $350 on the average, and certainly none started with more than $1,000. The few selected options here were based on their relative homogeneity, the simplicity of some of their problems and the difficulty of trying to reach such a large group scattered all over the country with limited operational funds. With these in mind, the recommendations are as follows:

1. Holding industry specific seminars and meetings in parish centers to discuss with proprietors what costs are involved in their business and how they affect their incomes. Attention should be given, of course, to costs such as depreciation, own labor, transportation, and interest.

2. Discussion and demonstration to proprietors as a group of how keeping partial records of one or two major inputs or outputs and keeping business and nonbusiness money separate may improve their control over expenses and revenues or prices.

3. Finally, presenting advice to them that unduly siphoning business funds to promote other activities unrelated to it may mitigate against its viability and growth.

6.4.3 Measures Relevant to the Larger SSI Enterprises

Program recommendations for the larger enterprises will usually be product specific and sometimes enterprise specific. The enterprises that get this kind of services are of manageable number and usually located in the urban areas or larger towns. Still, a kind of limited extension type approach may be required for a successful policy intervention. With this parenthetical statement, the program actions that should greatly improve the management of this group of enterprises are the following:

1. Examination and suggestion for improvement of plant layout for a smooth, safe, and faster production process.
2. Encouraging and helping to keep adequate records that may need to be compiled every day, every week, or even every month as the case may be.
3. Supplying of quality-specific input and output price information.
4. Providing or encouraging market "research," particularly export markets.
5. Encouraging proprietors to engage in moderate product promotion in order to compete against imports.
6. Providing business trends on investment opportunities and business growth.
7. Finally, aiding proprietors to cope with new techniques of production so that they can make a smooth transition to a new machine, a new product, or a new system of production and marketing.

Regarding the larger enterprises, not only are specific problems dealt with usually at the enterprise level, but their larger roles and their tendency to voice their concern (i.e., relative to the smaller one), also bring them in direct contact, if not friction, with the macro policy issues mentioned earlier. While these policy issues are not directly essential to lower the level of inefficiency identified in the present study, their importance for the ultimate growth and viability of the SSI subsector as a whole must be recognized. How they could affect it is a subject that merits priority consideration. This leads to the question of what future investigations are implied by the present study.

6.5 Implications for Further Study

The present study has important implications for further research. One useful area of investigation could be a logical follow-up of the present one: taking two representative samples of efficient and inefficient firms and closely examining how exactly the management variables identified as the key sources of differential efficiency affect them.

Moreover, there are a number of ways the present study could be improved. For program objectives less comprehensive firms could be grouped into more homogeneous units within the same industry or enterprise types. Such a grouping could be based, for example, on (a) the type of output produced or input used (e.g., domestic raw materials), (b) the technique of production used, (c) the level of vertical integration exhibited in input procurement, production, or marketing, or (d) on the type of the market served. Such an approach could greatly improve the utility of the study if the objective is for a limited program of recommendations.

Finally, paying urgent attention to management variables to solve technical inefficiency problems may be adequate for the short-term. For a sustained long-term growth and viability of the sub-sector, however, there are crucial macro issues in addition to those pointed out earlier that deserve careful consideration for investigation and action. Some of these issues include the general improvement of the educational and work experience among proprietors and workers (such education could encompass attitudes to work), strengthening and promoting the apprenticeship system, eliminating administrative biases or inconveniences against the subsector, initiating a strong public and private base for a meaningful exploitation of the international market, facilitating inter-industry and inter-sectoral linkages at the SSI level, taking a hard look at the nonmanufacturing or service sector and its present and potential linkages with the SSI subsector, and above all, making a concerted effort to make the basic necessities for production such as raw materials, spare parts, and machinery available on the market. Such a comprehensive approach takes time, money, persistence, and political will. The diversity and complexity of such requirements add significance, however, to the importance of improving first the managerial capability of proprietors in the efficient use of resources now without at the same time losing the long-run goal of comprehensive approach.

APPENDICES

APPENDIX I

IMPROVISED INDUSTRIAL GOODS PRICE INDEX

TABLE 33.--Industrial goods price indices (Base Year = 1979/80)

Year	Index[b]	Year	Index
1979/80	100	1971/73	36
1978	91	1969-70	28
1977	78	1965-68	20
1976	65	1959-64	18
1975	51	Before 1959	13
1974	43		

Source: Computed from the purchase prices of inventories of equipment collected during the Jamaica flow data survey (1979/80)

[a]The improvised industrial goods deflating price indexes were constructed using the tailoring industry group as described in Section 3.2.2.

[b]Because of the weighting scheme used, the indices give more weight to the rural enterprises. Also, to the extent that equipment quality changes are important, the relative differences in the indices tend to be exaggerated.

TABLE 34.--Averages of capital stock values measured in different ways[a]

Equipment Capital Measure	Location (Strata)				
	Kingston	Major Towns	Rural Towns	EDs	Jamaica
1. Stock Value at purchase price	$1,173	8,971	1,153	744	1,090
2. Stock value at replacement price	3,196	26,009	2,818	1,742	2,760
3. Stock value, price-deflated[b]	2,925	23,903	3,393	2,040	2,956
4. Stock value, price-deflated and depreciated[b]	1,436	10,942	1,873	1,309	1,693

Source: Jamaica Flow Data Survey (1979/80).

[a]The price indices shown in Table 33 have a tendency to be biased downward as the age of an equipment gets older--this has the tendency to bias upward the capital value for the rural (older) enterprises as shown in entries 3 and 4.

[b]Entries 3 and 4 were compiled using the price indices shown in Table 33 as well as equipment-specific age information from the flow data.

APPENDIX II

PRODUCTION FUNCTION REGRESSIONS INCLUDING THE VINTAGE INDICATOR

TABLE 35.--Value of production (y) regression results of the Cobb-Douglas production function (including vintage indicator)[a]

Coefficient or Parameter	Unit	Industry Groupings		
		Tailoring	Wood	SSI[b]
Capital (k)[c]	1$	0.0339 (0.4275)	0.1695 (1.1060)	0.1443*** (2.8463)
Labor (l)	hour	0.6793*** (5.4896)	0.3039 (1.600)	0.3869*** (4.4497)
Material (m)	1$	0.3864*** (5.0298	0.4479** (2.1966)	0.5323*** (10.4680)
Vintage Indicator (i)		0.2852 (1.1315)	-0.9419 (-1.4289(	-0.3271 (-1.5435)
Constant (a)		1.5843	20.6605	4.4471
$\bar{R}^2$		0.751	0.709	0.825
df		45	24	127

Source: Jamaica Flow Data Survey (1979/80)

[a]The only difference of this table from Table 28 is the vintage indicator which is included here. The description of the variables is given in Section 5.1. The estimating equation is:

$$y = a(ke^{\alpha o i})^{\alpha_1} l^{\alpha_2} m^{\alpha_3}$$

where e is the base to the natural logarithm.

[b]SSI stands for the small-scale industry (manufacturing) enterprises as a whole.

[c]This is capacity-adjusted capital in replacement value.

TABLE 36.--Value added (va) regression results of the Cobb-Douglas production function (including vintage indicator)[a]

Coefficient or Parameter	Unit	Industry Grouping		
		Tailoring	Wood	SSI[b]
Capital (k)[c]	1$	0.1270 (1.3190)	0.3814 (2.6591)***	0.3875 (6.1042)***
Labor (l)	1 hour	1.0916 (7.9652)***	0.5124 (3.0739)***	(8.9214)***
Vintage Indicator (i)		0.2001 (0.6081)	-1.3503 (-2.0904)**	-0.6057 (-2.0471)**
Constant (a)		0.3775	24.2235	0.5457
$\bar{R}^2$		0.607	0.647	0.656
df		46	25	128

Source: Jamaica Flow Data Survey (1979-80).

[a]The only difference in variables of this table from Table 29 is that inclusion of the vintage indicator (i) here. The description of the variables is given in Section 5.1. The estimating equation is

$$va = a(ke^{\alpha_0 i})^{\alpha_1} l^{\alpha_2}$$

where e is the base to the natural logarithm.

[b]SSI stands for small-scale manufacturing subsector including tailoring and woodwork.

[c]This is capacity-adjusted capital in replacement value.

APPENDIX III

MAXIMUM LIKELIHOOD CES REGRESSIONS

APPENDIX III

MAXIMUM LIKELIHOOD CES REGRESSIONS

It was not possible to get converging parameter values for the total value of production CES (constant elasticity of substitution) regression both for woodwork and the SSI group. In the case of the woodwork, there is even a problem with the value added CES regression.

In the value added woodwork regression, none of the coefficients or parameters are within reasonable ranges. (Restricting some of them to certain relevant ranges did not improve the problem.) They are included in Table 36 simply for the sake of uniform presentation. One thing that could be a reason for the impreciseness of the woodwork parameters may be the high asymptotic correlation among the parameters (see Tsang and Persky, 1975).[1] This is shown in the parameter correlation matrix on the next page.

For comparative purposes, the maximum likelihood CES regression for the tailoring total value of production (y) is also included.

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[1]See Herbert H. Tsang and Joseph J. Persky, "On the Empirical Content of CES Production Function," Economic Record 51 (December 1975): 539.

	Efficiency Parameter	Capitol Coefficient	Elasticity Parameter
1. Capital Coefficient	-0.5760		
2. Elasticity Parameter	-0.8839	-0.8709	
3. Scale Parameter	-0.9797	0.6513	-0.9388

TABLE 37.--Maximum likelihood regression results of the constant elasticity of substitution (CES) function[a]

Coefficient or Parameter	Unit	Industry Groupings			
		Tailoring		Wood	S.S.I.
		Total Value	Value Added	Value Added	Value Added
1. Capital (k)	1$	0.1448 (2.004)**	0.4056 (3.488)***	0.0000 (0.003)	0.2564 (2.622)***
2. Labor (1)	hour	0.4256 (3.744)*	0.5944 (5.111)***	0.9999 (181.60)***	0.74356 (7.603)***
3. Material (m)	1$	0.4295 (2.359)**	--	--	--
4. Scale (v)		1.0575 (0.810)	1.4205 (3.774)***	0.7352 (1.621)*	0.8932 (1.166)
5. Substitution (ρ)		0.4136 (0.835)	0.2801 (0.607)	73.2786 (0.099)	0.1025 (0.209)
6. Efficiency (a_o)		3.8153 (1.680)**	0.1430 (2.077)	86.8529 (0.759)	14.0440 (1.184)
7. Degrees of Freedom		45	46	25	130
8. Number of iterations		23	98	219	23

Source: Jamaica Flow Data Durvey 1979/80.

* = significant at 10%
** = significant at 5%
*** = significant at 1%

[a]For comparative purposes, see Tables 28 and 29 and also pages 208 and 209. The estimating equations are the following (input coefficients are distributive parameters):

$$y = a_o(\sigma_1 k^{-\rho} + \sigma_2 \ell^{-\rho} + (1-\sigma_1-\sigma_2)m^{-\rho})^{-v/\rho}$$ for value of output

$$va = a_o(\sigma_1 k^{-\rho} + (1 - \sigma_1)\ell^{-\rho})^{-v/\rho}$$ for value added.

APPENDIX IV

ADJUSTMENT FOR HETEROSCEDASTIC WOODWORK DATA

APPENDIX IV

ADJUSTMENT FOR HETEROSCEDASTIC WOODWORK DATA

The possible problem of heteroskedasticity of the woodwork data discussed on pages 210 and 211 was corrected using the procedure suggested by Park (1966). He hypothesizes that the variance of each observations error term is proportional to the values of the independent variable causing the heteroscedastic problem. Thus the relationship,

$$\sigma^2_{u_i} = \sigma^2 k_i^r e^v \qquad \text{(A.1)}$$

where

$\sigma^2_{u_i}$ = variance of an observation error term U_i

σ^2 = the true regression variance

k_i = independent variable causing the problem, in this case capital at replacement value adjusted for capacity levels

r = a constant

e = base to the natural logarithm

v = a well behaved error term.

The equation implies that if the variance of the i'th error is divided (deflated) by K raised to the power of r, then the mean of the new value will be a consistent and asymptotically efficient estimate of the true constant regression variance or σ^2. (It can easily be converted into an unbiased estimator also, see Kmenta, 1971, p. 259). Thus, resulting in unbiased regression variance:

$$E\ [\sigma^2_{u_i}/k^r] = E[\sigma^2 e^v] = \sigma^2 \qquad (a.2)$$

Similarly, if the observation error term variance is deflated by k raised to the power of r/2 (thus extracting the square root on both sides), then σ_{u_i} will estimate the true regression standard deviation. It is this last procedure which is used to correct for the heteroscedasticity.

In order to get a good estimate of the $\sigma^2_{u_i}$, repeated observations of the dependent variable must be taken for a fixed value of capital. Since this is not usually possible or reliable in socio-economic research, he assumes that the variance of the error term can be estimated by using the square of the error term itself generated from an OLS regression of the untransformed or initial equation. Thus, each residual at a given capital value when squared estimates, its own variance at that capital level. The unknown parameters (σ^2 and r) can then be estimated using the log-linear model. Thus,

$$\ln(U_i^2) = \ln\ (\sigma^2) + r\ \ln\ (k_i) + v \qquad (a.3)$$

The result (from the OLS regression) is,[1]

$$\ln(U_i^2) = 7.3557 - \underset{(3.4325)}{5.0729}\ (k_i) \qquad (a.4)$$

or

[1]The value in bracket is T-value.

$$U_i = e^{3.6779} (k_i)^{-2.5365} \quad \text{(a.5)}$$

or

$$U_i/(k_i^{-2.5365}) = e^{3.6779} = \sigma \quad \text{(a.6)}$$

The coefficient of capital (k) is significant at 1% with 27 degrees of freedom (although the value of the adjusted R-squared is small). The sign of the coefficient is also as already indicated negative.

The correction factor for the residual or U_i (i.e., capital value raised to the power of -5.0729/2 = -2.5364) is then applied also to the remaining variables in the woodwork regression (i.e., to the constant or shift parameter, capital itself, labor and raw materials). Since, the constant is also similarly affected, there will be no intercept for the new regression of transformed variables. And thus the usual computer generated adjusted R-square cannot be used to check goodness of fit (see Kennedy, 1979, p. 25). It can be calculated however by finding the ratio between the sum of squares of the difference between the observed and the predicted value of Y(RSS) and the total sum of squares of Y(TSS); it should be adjusted for degrees of freedom. In the present case, adjusted R-squared improved from 0.70 in the original equation to 0.78 under the new one, but there was no improvement in the coefficient sizes.

After the variables were corrected for the heteroscedastic problem, both the OLS regression and CES maximum likelihood were estimated. The result was that the raw material continued to swamp the effect of both labor and capital in the OLS; the CES maximum likelihood estimate again failed to converge. The result for the OLS value-added regression was

$$V = \underset{(3.131)^{***}}{2.9118} + \underset{(2.082)^{**}}{0.3119(k)} + \underset{(3.781)^{***}}{0.5486(L)} \qquad (a.7)$$

$$\bar{R}^2 = 0.780$$

where variables are the <u>same</u> as those in Table 29.

Thus, the approach did not substantially improve the results. Both the labor and capital coefficients are lower (although of the same significance levels) and the size of the constant is 27% higher than in the original (untransformed) regression. This is in spite of the highly significant coefficient for the correcting variable, capital, shown in Equation a.4. Thus, the correction for heteroscedasticity was considered unnecessary and was dropped.

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