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Small Firm Dynamics: Evidence from Africa and Latin America

Carl Liedholm

This paper investigates the determinants of survival and growth among small and very small enterprises in Africa and Latin America. Location is found to be an important factor. Firms located in urban and commercial areas are more likely to survive during a given year than those located in rural areas or those being operated out of home. Urban and commercial location is also associated with faster growth, as measured by the number of employees hired in a given year. Studies are also cited to show that human capital matters, especially when it is in the form of vocational training or prior business experience.

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Small Firm Dynamics: Evidence from Africa and Latin America

Carl Liedholm

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Contents

Foreword *v*

Introduction *1*

Static Profile *2*

Dynamics of MSEs *5*

MSE Jobs and the Macroeconomy *13*

Policy Implications *15*

References *16*

Foreword

This paper was prepared for a project on the Role of Small & Medium Enterprises in East Asia. The project was organized by the World Bank Institute under the auspices of the Program for the Study of the Japanese Development Management Experience which is financed by the Human Resources Development Trust Fund established at the World Bank by the Government of Japan.

The principal objectives of this Program are to conduct studies on Japanese and East Asian development management experience and to disseminate the lessons of this experience to developing and transition economies. Typically, the experiences of other countries are also covered in order to ensure that these lessons are placed in the proper context. This comparative method helps identify factors that influence the effectiveness of specific institutional mechanisms, governance structures, and policy reforms in different contexts. A related and equally important objective of the Program is to promote the exchange of ideas among Japanese and non-Japanese scholars, technical experts and policy makers.

The papers commissioned for this project cover a number of important issues related to SME growth and performance in the region. These issues include: the productivity of small and medium enterprises, their adaptability to shocks and crises, their contribution to innovation and technological advance, their link to such features of the business environment as subcontracting and agglomeration, their impact on employment and equity, and their responsiveness to public policy.

Farrukh Iqbal, Program Manager
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Small Firm Dynamics: Evidence from Africa and Latin America

Carl Liedholm

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Introduction

This paper examines the recent evidence from Africa and Latin America on the dynamic role of micro and small enterprises (MSEs). The contribution of MSEs in generating employment and income has become increasingly recognized around the world. To some observers, this is an encouraging sign: markets are working, and people are finding opportunities to participate in ways that empower and nourish many, particularly including those who are otherwise most disadvantaged. To other observers, however, this increase in the number of people engaged in micro and small enterprises is a sign of a failure of the economy to provide productive jobs; that is, people are forced to take refuge in activities that provide only minimal, subsistence support. Sorting out these differences is of great importance to those who wish to address the problems of poverty and growth.

Until recently, however, relatively little has been known about the dynamic contributions of MSEs. Such enterprises typically are hidden from view and easily elude the standard statistical nets. Although baseline surveys of MSEs have enabled static portraits of these enterprises to be drawn for many years, the surveys have shed little light on MSE's dynamic properties.

There is a growing interest in micro-level studies of firm dynamics. A recent review of the subject (Caves 1998) highlights the outpouring of dynamic studies in the past decade, but notes that "the bulk of the research pertains to the United States and Canada" (p. 1948). Yet, a sizeable number of studies using new survey techniques have been conducted outside of the United States and Canada that can now provide new illumination concerning the patterns of enterprise births, survival or closure, and growth, along with the determinants of these change components. This paper will report on the findings of those dynamic studies that have been undertaken in Africa and Latin America.¹

Among the data collection innovations that have enabled such studies to be undertaken in these areas have been the introduction of "closed" MSE surveys, continuous panel surveys, "tracer" surveys of MSEs that existed in the past, and modified baseline surveys that provide information concerning the growth of enterprises since its startup. Modified baseline surveys along with closed enterprise surveys were conducted in the Dominican Republic and in five countries in eastern and southern Africa: Botswana, Kenya, Malawi, Swaziland, and Zimbabwe. These surveys were all national in coverage and were based on a complete enumeration of all enterprises those areas (or clusters) chosen by stratified random sampling techniques. Modified baseline surveys, but without the closed enterprise surveys, were undertaken in Lesotho, Jamaica, and South Africa (two townships only). Panel surveys were conducted in Jamaica, the Dominican Republic, Kenya, and Zimbabwe, and tracer surveys were executed in Nigeria, Kenya, and Sierra Leone.²

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1. This paper was commissioned for the project on "The Role of Small & Medium Enterprises in East Asia", organized by the World Bank Institute (WBI). The data and evidence surveyed in this paper are from studies undertaken in these regions by GEMINI project, which was supported by USAID and under the overall supervision of staff from Michigan State University.
 2. The sources for the country survey reports are listed in Liedholm and Mead (1999).

The universe of enterprises covered in these surveys includes all enterprises engaged in nonprimary activities (i.e., excluding agriculture, forestry, hunting and fishing, and mining and quarrying, but including the transformation, transport, and marketing of primary products), where at least 50 percent of the output is sold (i.e., excluding products made primarily for home consumption), and engaging up to 50 workers (including unpaid family members, working proprietors, apprentices, and part-time workers). This means that this definition of micro and small enterprises (MSEs) encompasses establishments consisting of one person weaving baskets for sale in the market, and also includes factories with 40 or 50 workers using complex machinery. Microenterprises cover the smaller end of the MSE range; that is, enterprises with 10 or fewer workers.

The outline of this paper is as follows. A brief static picture of MSEs in Africa and Latin America that emerge from these surveys will be presented first. A dynamic overview of MSEs in these areas follows next, highlighting the new evidence on the turbulent process of MSE creation and closure as well as MSE expansion. The interrelationships between MSEs and the macroeconomy will then be explored. An examination of the policy implications will conclude the paper.

Static Profile

The existing structure of MSEs provides a useful context for examining dynamic issues. Since much of this information is somewhat familiar by now, only the major features need be highlighted.

Magnitude

A key finding from the house-to-house baseline surveys is that the micro and small enterprise sector is far larger than is reported in most official statistics, which often cover only registered firms. In nation-wide surveys, the share of households reporting that some member of the household operated a micro or small enterprise ranged from about 20 percent in Botswana to over 40 percent in Malawi and Kenya. Survey results reveal that 17–27 percent of the working age population are employed in MSEs (see Table 1 for all aspects of this static overview). Employment densities—the number of people engaged in MSE activities per 1,000 persons in the population—ranged from 70 to 90 in Botswana, Kenya, Lesotho, and Malawi to well over 100 in Zimbabwe, Swaziland, the Dominican Republic, and Swaziland. The estimated MSE employment in the surveyed African countries is nearly twice the level of total employment in registered large-scale enterprises and the public sector.³ Clearly, micro and small enterprises are a major source of livelihood for a significant proportion of the population in these areas.

Size Distribution of MSEs

Most MSEs are very small. Typically, the majority of MSEs consist of one person working alone (see Table 1). Self-employment is thus a central element in these economies. If one defines the MSE universe as those firms with 1–50 workers, the upper end of the tail—those with 10–50 workers—constitute less than 2 percent of the businesses in virtually all the surveyed countries in Africa. The Dominican Republic, however, does not fit this pattern, with a substantially smaller number of sole proprietorships and with a larger number at the upper portion of the small enterprise spectrum.

3. For details, see Liedholm and Mead (1999). South Africa, for which countrywide data were not collected, is not included.

Table 1. *Characteristics of Microenterprises*

	<i>Botswana</i>	<i>Kenya</i>	<i>Lesotho</i>	<i>Malawi</i>	<i>Swaziland</i>	<i>Zimbabwe</i>	<i>South Africa</i>	<i>Jamaica</i>	<i>Dominican Republic</i>
MSE employment/population age 15–64 (%)	17	18	17	23	26	27	na	na	19
MSE employment per 1,000 persons in the population	71	83	84	92	118	127	81	na	109
Share of all MSEs that are one-person enterprises (%)	65	47	79	61	69	69	47	62	22
Share of all MSEs with 10–50 workers (%)	3	2	1	1	2	2	1	2	18
Share of hired workers (%)	39	24	10	18	15	16	19	33	36
Locational breakdown of MSE employment (%)									
Urban areas	24	15	18	12	25	30	na	26	46
Rural towns	28	7	10	4	10	6	na	13	18
Rural areas	48	78	72	84	65	64	na	36	36
Sectoral breakdown of enterprises: Urban areas only (%)									
Manufacturing	15	18	35	29	33	64	17	39	21
Commerce	71	74	41	62	56	30	70	61	63
Sectoral breakdown of enterprises: Rural areas only (%)									
Manufacturing	34	27	62	36	70	75	na	35	15
Commerce	64	66	27	60	24	16	na	65	75
Share of enterprises owned by females (%)	75	46	73	46	84	66	62	49	46
Share of all workers that are females (%)	67	40	76	40	78	57	78	52	38

Source: Liedholm and Mead (1999).

Labor Force Characteristics

The MSE labor force in the region is made up primarily of working proprietors and unpaid family members. With the majority of enterprises operating as one-person undertakings, it is not surprising that the largest employment category is working proprietors, a group that comprises more than half the MSE work force in most countries. When unpaid family members are added, the numbers reach three-fourths of the workers in most places. Only in a few countries do hired workers comprise as much as 20 percent of the MSE labor force. The two Latin American countries and Botswana stand out in this regard, and in those countries a third or more of the labor force is made up of hired workers. Trainees and apprentices add a significant share of workers in some locations, particularly in West Africa; in southern Africa, as in Latin America, apprentices constitute under 10 percent of the MSE labor force.

Location

Most MSEs in the region operate in rural areas. The share of all enterprises in urban locations, cities and towns with at least 20,000 inhabitants, reaches as high as 46 percent in the Dominican Republic, but was 30 percent or less in the other countries (see Table 1). Even adding enterprises in rural towns—generally, concentrations with 2,000–20,000 persons—still generally leaves well over half the enterprises in strictly rural areas of most countries. It is important to keep these facts in mind since many programs focus on enterprises in urban areas, where they are often more obvious and easier to reach.

Composition of Activities

While many MSEs in Africa and Latin America are engaged in trading, a significant number are involved in manufacturing activities. It is a common perception that micro and small enterprises are overwhelmingly made up of vendors and other small traders. There is some truth to this perception, since in the two Latin American countries and in several southern African countries the majority of enterprises are engaged in commerce. It is important to recognize, however, that in all countries small manufacturing activities are also an important component of the MSE sector. Manufacturing activities are particularly significant in rural areas. In fact, in each of the African countries manufacturing enterprises constitute a higher share of MSEs in rural than in urban areas. By contrast, manufacturing was more prevalent among urban enterprises in the two Latin American countries.

Three activities have consistently been identified as the most important categories among micro and small manufacturing enterprises: textiles and wearing apparel, food and beverages, and wood and forest products. Survey results suggest that these three categories comprise about 75 percent of manufacturing enterprises in urban areas of many developing countries and nearly 90 percent of the enterprises in rural areas. Yet these apparent regularities hide wide variations from country to country and between urban and rural areas as to which activity is most important, as well as the nature of the most prevalent activities within each of these three broadly defined sectoral groupings.

Gender

Large numbers of MSEs in Africa and Latin America are owned and operated by women. Indeed, it is a striking fact that in five of the nine countries women outnumber men as owners and operators of micro and small enterprises (see Table 1). Furthermore, since working proprietors are the single largest category of the labor force, the great majority of workers in such enterprises are also women. MSEs headed by women tend to be concentrated in a relatively narrow band of sectors or activities, such as beer brewing, knitting, dressmaking, crocheting, cane work, and retail trading. Finally, MSE's headed by women are more likely than their male counterparts to operate from the home (Liedholm and Mead 1997). Since it is the home-based MSEs that tend to be hidden and overlooked, women owners of MSEs are more likely to be “invisible entrepreneurs.”

Market Linkages

The market linkages between firms in Africa and Latin America are rather limited. The vast majority of MSEs in these areas sell directly to final consumers rather than to other firms. Results from the surveys in Malawi, Swaziland, and Zimbabwe, for example, reveal that over 96 percent of the MSEs sell primarily to individuals, while in Jamaica 87 percent of MSE output is sold directly to final consumers (Liedholm and Mead, 1999). These same studies have indicated that MSEs in these areas that sell to traders and manufacturing firms are more likely to grow than those that sell directly to final consumers.

Subcontracting and clustering are two institutional arrangements that can enable MSEs to move beyond a direct sale of their output to final consuming. Subcontracting has been much less prevalent in Africa and Latin America than in Asia. This may be due to the somewhat smaller markets as well as to the propensity of the larger firms to import a large share of their needed inputs (Liedholm and Mead 1987). Examples of successful subcontracting efforts, however, have begun to surface in several African countries where commercial, market-based linkages have been forged between independent enterprises (Grierson, Mead, and Moyo 1997). Many types of enterprise competence can be purchased in the market, and this should be encouraged and not stifled and undercut through subsidized provision of the same services by governments or NGOs.

There has also been a growing worldwide interest in clusters. A number of analysts have argued that these geographical concentrations of enterprises in related activities have provided significant benefits to those who participate in them (Van Dijk and Rabellotti 1997). While the great advantages that some enterprises have derived from such networks have been acknowledged in other parts of the world, virtually no evidence of the advantages of such networks have emerged from the African and Latin American survey results to date (Liedholm and Mead 1999). When the limited examples of clustering in Africa are described, they tend to involve independent firms in the same industry selling directly to final consumers. Parker (1994) contends that linkages between firms in these clusters tend to be minimal owing primarily to the low levels of trust that exist in these areas.

Efficiency

Substantial differences in economic efficiency by enterprise size have been detected in earlier studies that have analyzed detailed sales and production costs of MSEs in several developing countries (Liedholm and Mead 1987). In particular, the data indicate that returns per hour of family labor are significantly higher for enterprises with two to five workers when compared with enterprises with only one person working alone. This increase in economic returns continues for the next higher size group, those with six to nine workers. Thereafter, the number of observations is small and the results more ambiguous. Similar results were found in a recent survey of MSEs in Kenya (Daniels and Mead 1998). In all of these studies, the data suggest that one-person enterprises generate the lowest returns to the enterprise; even a small increase in size is associated with a substantial increase in economic efficiency, which for these very small enterprises is closely associated with the level of income generated for those who work in the enterprise.

DYNAMICS OF MSEs

Micro and small enterprises are constantly churning. Most of these changes are missed, however, if one focuses just on the aggregate changes in the level of MSE activity over time. It is only when the individual components of these changes are scrutinized that the magnitude of this churning becomes apparent. Not only are new firms being created (new starts or births) while others are closing, but existing (surviving) firms are expanding and contracting in size. These components of change are sometimes summarized in two concepts: net firm creation, which is new starts (births) minus closures (deaths), and “mobility” or net firm expansion, which is firm expansion less firm contraction. Since the individual components move in opposite directions, however, these aggregate or net measures of change mask the magnitude of the flux that is taking place among MSEs.

New MSE Starts

The evidence on new business starts (firm creation) in Latin America and Africa has been virtually nonexistent until recently. New findings, which are summarized in Table 2, on new business starts in six countries reveal that the rate of new MSE starts is substantial. The annual rate of MSE new starts in these survey countries

averages over 20 percent, ranging in a narrow band from 19.3 percent in Zimbabwe to 25.2 percent in Botswana.⁴ Although the figures are still somewhat crude in most cases, they are broadly indicative and, given the techniques used, provide *lower-bound* estimates of the orders of magnitude involved.⁵ These surprisingly high figures are substantially above the 10 percent rate typically reported for small enterprises in industrialized countries.⁶ The majority of the churning is taking place among the smallest firms.

Table 2. *Annual MSE New Starts Rate by Initial Size, Africa and Latin America*

Country	Year	Enterprise size (number of workers), %			Overall average
		1	2–9	10 +	
Botswana	91	32.9	11.5	4.2	25.2
Kenya	92	33.7	10.3	1.6	21.2
Malawi	91	26.9	14.1	13.1	21.7
Swaziland	90	26.3	10.8	2.4	21.7
Zimbabwe	90	22.8	10.6	18.7	19.3
Dominican Republic	93	na	na	na	20.6
Average		28.5	11.5	8.0	21.6

Source: Computed from individual country survey data. Averages are unweighted across the six countries.

Most of the new firms being created are one-person establishments. Not only is the new start rate higher for one-person firms than for larger ones as revealed in Table 2, but there are also typically more self-employed firms in existence. Not much is known about the central forces driving the MSE new start rate. A recent study by Daniels (1995) for MSE in Zimbabwe indicates that the determinants of new starts differ between high and low return (profit) activities. For high return activities, initial capital requirements, experience of entrepreneurs already in the industry, and level of regulation—all of which are barriers to entry—are found to be all inversely related to the new start rate. For low return activities, the rate of new starts is related (*inversely*) only to the aggregate level of economic activity; for these firms, the lower the level of aggregate economic activity, the higher the rate of new starts, reflecting the importance of the push-factor in firm creation.

An important implication of these findings is that there is no overall scarcity of entrepreneurs in the Schumpeterian sense of individuals willing to incur the risk of establishing a new venture. Most of these new starts are one-person firms, which are typically the least efficient and remunerative of the MSEs. These firms tend to enter in greater numbers when the overall economy is weak.

MSE Closures

The information on business closure rates in Africa and Latin America is somewhat limited. The most accurate figures come from the Dominican Republic, where researchers returned to the same locations over time to record business closures. By using this approach, researchers found that closure rates

4. A more recent survey of starts in Zimbabwe for the year 1997 reports a MSE birth rate of 20.3 percent (McPherson 1998).
5. New start (birth) rates are typically calculated by dividing all new firms appearing in a given time period (usually one year) by the number of firms already in existence at the beginning of the year. The number of firms at the end of the year served as the base. Given the net increase in the number of firms, this creates one source of downward bias. A second source of downward bias, present in all countries, is the omission of the short-lived firms that appear and the disappear within the year. A study of short-lived firms in the Dominican Republic indicates that if these are included in the analysis the birth rate in the Dominican Republic would have increased by 6.5 percentage points. For more details of these methodological issues, see Liedholm and Mead (1993).
6. The birth rate is higher for smaller than for larger firms. For industrialized countries, the annual average birth rate for all firms is approximately 6.5 percent (Caves 1998).

exceeded 20 percent per year in the early 1990s.⁷ The Dominican Republic findings, which are probably not atypical, highlight the extreme volatility of MSE activity, where simultaneously one large segment is starting just as another large segment is closing. Why do MSEs close? A somewhat surprising survey finding is that only a portion, frequently a minority, of the closures can be attributed to the traditional “business failure,” where the firm is not financially or economically viable. Somewhat less than one-half of the MSE closures in the region were due to such “business failures.” Lack of demand and shortage of working capital were the two most frequently mentioned underlying causes of these business failures.⁸ Why then did economically viable enterprises close? Approximately one-quarter of the MSEs closed for “personal reasons,” such as illness or retirement, while the remainder closed because of even “better options” or because the “government forced them to close.”

When are MSEs most likely to close? Most closures occur in the early years of a firm’s existence. In Botswana, Kenya, Swaziland, and Zimbabwe, over 50 percent of the MSE closures had occurred within three years of startup.⁹ MSE closures peaked before the end of the first year in Botswana and Swaziland, and between years one and two in Kenya and Zimbabwe. Clearly, MSEs are particularly vulnerable during the fragile initial years when they are learning how to operate the business.

What are the characteristics of the MSEs that close and how, if at all, do these differ from the characteristics of the survivors? The results of systematic analyses of closure patterns of MSEs in Botswana, Malawi, Swaziland, Zimbabwe (McPherson 1995), and the Dominican Republic (Caballero 1995) make it possible to paint an initial portrait of the type of enterprise that is most likely to survive. These studies employ “hazard analysis” to ascertain the key factors that determine the closure and survival patterns of such enterprises. The dependent variable in this analysis is the “hazard rate,” which is the probability that a firm will close during the given year. The independent variables used to explain this rate are such variables as the age, sector, and location of the firm. Econometric techniques are used to estimate the relationships.¹⁰

What are the key characteristics of MSEs that are most likely to survive? In addition to age, the past growth patterns, initial size, sector, location, and gender of the owner might be expected to play a role.

An important finding from these studies is the recognition that growing MSEs are more likely to survive than those that remained the same size. The results from Zimbabwe, for example, indicate that for every 1 percent increase in employment, the MSE reduced its likelihood of closing during the year by approximately 5 percent (McPherson 1995). Such findings are consistent with the notion that expanding MSEs have become more efficient—or perhaps, were more efficient to start with—and are thus more able to survive.

Somewhat surprisingly, however, the expected direct relationship between the MSE’s initial size and its survival chances that is predicted by Jovanovic’s learning model of firm growth (Jovanovic 1982) is not supported by the data. In the Dominican Republic (Caballero 1995), Malawi, Swaziland, and Botswana (McPherson 1995) enterprise size has no significant influence on firm survival. In Zimbabwe, however, a statistically significant inverse relationship exists; that is, firms that started the smallest, other factors

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7. Specifically, on the basis of area-based panel surveys, the annual closure rate was 29 percent in 1992 and 22 percent in 1993 (Caballero 1995). In Zimbabwe, a closure rate of 11.5 percent per year (from 1991 to 1993) was reported from a similar area-based panel survey of MSEs (Daniels 1995); 42 percent of the firms, however, could not be located in the resurvey, so this closure rate must be considered a lower-bound estimate. The area-based panel surveys, where all enterprises in the same areas are surveyed over time, generate much more accurate closure rates than those generated from either tracer or closed enterprise surveys, both of which are subject to severe selectivity biases that understate the closure rates. Annual closure rates derived from tracer surveys range from 1.3 in Nigeria (Kilby 1995) to 4.1 percent in Jamaica (Fisseha 1994), while those from closed enterprise surveys hover around 6 percent per year.
 8. In Kenya (Parker 1994), those who closed for demand reasons were much more likely to start a new enterprise than those who closed because of a lack of working capital. Indeed, overall, of those who closed, 60 percent subsequently opened new business, 15 percent worked in agriculture, 8 percent accepted paid employment, and 17 percent were no longer economically active.
 9. More incomplete data from Malawi indicate that approximately one-third of the MSEs had closed three years after startup.
 10. The hazard analysis is more attractive than other statistical techniques for examining such patterns, because it not only permits time varying explanatory variables to be included in the analysis but also deals with the sample censoring problem that arises because not all the firms in the data set have closed. The observations about them are thus incomplete and these observations are called “censored.” Standard econometric analyses, such as ordinary least squares, ignore this fact and count these firms as if they had closed and thus yield results that would be quite misleading. Hazard analysis, on the other hand, only included information on those firms that are at risk of failing. The “hazard rate” is defined as the probability that the firm will close during the period, usually one year, given that it has survived until the beginning of the period. It is computed by dividing the number of firms that closed in a period, by the number of those firms that have not yet closed at the beginning of the period. For more details see, Liedholm and Mead (1993).

being held constant, are more likely to survive than their counterparts that started larger. These findings indicate that smallness, by itself, is no impediment to survival in these countries.

Another key result is that MSE survival rates varies significantly by sector. Retail trading MSEs in all three countries faced the highest closure risks. Such firms were almost 30 percent more likely to close during the year, for example, than their counterparts in woodworking. Real estate, wood processing, wholesale traders, and nonmetallic metal enterprises were the least likely to close, while trading, transport, and chemical MSEs were the most likely to do.¹¹

Location also plays a central role in determining MSE survival. Urban MSEs, for example, had an almost 25 percent greater chance of surviving the year, holding all other factors constant, than their counterparts in rural areas.¹² Moreover, MSEs located in commercial districts were more likely to survive than those operated out of the home. Proximity to growing markets would thus seem to be an important factor in enterprise survival.

Does the gender of the entrepreneur affect the survival chances of MSEs? Overall, female-headed MSEs were less likely to survive the year, all other factors constant, than their male-headed counterparts. Relatively high percentages of the closings of female-headed MSEs in these countries, however, were due to personal and other nonbusiness failure reasons. When only closings caused by pure business failures were analyzed separately, the gender of the entrepreneur was no longer found to be significant determinant. Thus, in terms of closings caused by business failures only, female-headed and male-headed MSEs were equally likely to survive.

MSE Expansion

To these changes resulting from the establishment of new firms and the closure of others must be added the growth from the net expansion of existing enterprises over time. The net expansion depicts the expansion less the contraction of those MSEs that survive and summarizes two opposing dynamic forces at work.

The change in the number of workers since startup is the indicator typically used to measure the magnitude of the net expansion of MSEs. This measure tends to be favored because it is most easily and accurately remembered by the entrepreneur and does not need to be deflated.

Recent studies have begun to shed light on the types of biases that might arise from the use of employment as a measure of expansion rather than alternative indicators such as changes in sales, output, or assets. Parker's (1994) analysis of the growth in Kenyan MSEs, for example, indicated that net increases in real sales were almost double the growth in employment. A similar pattern was detected in the Jamaican Quarterly Panel Survey of MSEs (Gustafson and Liedholm 1995), where the change in real sales was twice the change in employment. Such findings highlight the lumpy nature of employment, which appears to increase with a lag after a sizeable growth in real sales, and indicate that the employment growth measures provide a lower-bound estimate of net firm expansion.

The high overall growth rates exhibited by the existing (surviving) MSEs is one of the most striking findings to emerge from the various surveys. Table 3 reveals that the average annual compound employment growth rate since startup across these six countries was 13.6 percent per year.¹³ The country variations around this average are large, however, ranging from 4 percent in Swaziland to 24 percent in Kenya. These high growth rates are all the more impressive when it is recognized that, except for Botswana, they are at

11. The complete sector ranking of MSEs by survival probabilities from highest to lowest in Swaziland and Zimbabwe combined was (McPherson 1992) as follows: real estate, wood processing, wholesale trade, nonmetallic minerals, textiles, other services, food and beverage processing, construction, miscellaneous manufacturing, metal fabrication, hotels and restaurants, chemicals, retail trade, and transport. The rank differences, however, were not always statistically significant.

12. The rural-urban distinction, however, was not statistically significant in the Dominican Republic analysis (Caballero 1995).

13. The compound growth measure provides a lower-bound estimate of the growth rate compared with the average growth rate measure, which uses initial employment in the base. An absolute measure, the annual change in jobs per firm, is also presented in Table 3; it can be particularly useful in assessing the overall contribution of the smallest firms to job creation. The data for all the growth measures were generated by asking entrepreneurs retrospective information (event histories) about their firms.

least double the overall growth in GDP in these countries during the 1980s. Moreover, even in absolute terms, the annual number of jobs created per firm is impressive (see Table 3, column 4).

Table 3. *Annual Employment Growth Among Small Enterprises, Alternative Measures*

	<i>Average annual growth rate (simple averages, i.e., noncompound), %</i>	<i>Average annual growth rate (compound), %</i>	<i>Percent that grew</i>	<i>Average number of workers added per enterprise per year (all enterprises)</i>
Botswana	8.4	6.3	20.1	0.12
Kenya	29.0	24.0	34.8	0.26
Malawi	10.5	9.0	22.8	0.12
Swaziland	6.6	4.1	19.9	0.08
Zimbabwe	7.4	5.6	19.3	0.08
Dominican Republic	15.1	12.6	29.1	0.08
Overall average	16.7	13.7	26.7	0.14

Source: Mead and Liedholm (1998).

Notes: Simple average growth rates are calculated as follows: [(current employment - initial employment)/initial employment]/enterprise age.

Compound growth rates are calculated as follows: [(current employment/initial employment)^(1/firm age) - 1].

Overall averages in each case are weighted averages, based on the number of enterprises in the category and country.

These rapid growth rates are even more impressive, however, when it is realized that the majority of the MSEs in the survey countries did not grow at all since startup. Slightly more than one-quarter of the MSEs added workers, while over two-thirds remained the same size (see Table 3).¹⁴ MSE employment expansion was the exception rather than the rule, and this expansion was thus being propelled by a minority of the MSEs.

Of those MSEs that grew, over 90 percent added fewer than four workers. About 5 percent of the expanding MSEs “graduated” from the microenterprise seedbed and ended up with more than 10 workers. Thus, most of the employment expansion was due to the a relatively small share of all MSEs that grew. But of those that grew, most expanded by adding only a few workers.

Analysis of the Determinants of Enterprise Growth

What are the determinants of the growth of existing small enterprises? Economic theory in this area is surprisingly sparse and is of only limited assistance.¹⁵ By combining the theoretical insights with those that can be gleaned from the examination of the available empirical evidence, it is possible to identify the key variables that should be incorporated into the analysis.

14. About 5 percent of the enterprises had declined in size since startup (see Liedholm and Mead 1995).

15. For an review of the relative theoretical literature as well as the available empirical evidence, see Liedholm and Mead (1999).

Two key determinants small enterprise growth would be the age and initial size of the enterprise. “Learning models” of enterprise growth along with empirical evidence from the United States and the developing world support an *inverse* relationship between these two variables and enterprise growth.¹⁶

Sector would be another important determinant of enterprise growth. From the theoretical perspective, it is likely that firms in different sectors would face different product demands and encounter different cost structures on the supply side. The empirical evidence of sectoral differences in growth rates is quite extensive (Liedholm and Mead 1999).

Another variable likely to affect the growth of existing enterprises would be location. Complementary enterprises grouped close together or enterprises located close to the final demand sources might be expected to grow more rapidly than their more isolated counterparts.¹⁷ Enterprises of this type would more likely to be found in urban areas, particularly in commercial districts away from the home. Initial empirical evidence from Africa has indicated that urban enterprises typically grow more rapidly than their rural-based counterparts (Liedholm and Mead 1999).

Various socioeconomic variables relating to the entrepreneur might also be expected to influence enterprise growth. Economic theory suggests, for example, that increases in “human capital,” such as through increases in the experience or education of the entrepreneur, should lead to increases in enterprise growth.¹⁸ The empirical evidence of this relationship, however, has been mixed (Liedholm and Mead 1991). In addition to “human capital,” proprietor gender might also be thought to be an important determinant of enterprise growth. Downing and Daniels (1992), for example, posit that female entrepreneurs in Africa are more risk averse and thus less like to grow in comparison with their male counterparts. Initial empirical evidence would tend to support this view.

Finally, country should be a key determinant of the growth of small enterprises. In addition to marked differences in their political, cultural, and historical context, countries differ widely in their overall economic conditions, particularly in their aggregate levels and changes in per-capita output. Empirical evidence on the wide differences in country growth rates has already been presented.

The relationship between these key variables and enterprise growth has been analyzed recently by several scholars. McPherson (1992) examined this relationship by applying formal statistical methods to the baseline enterprise data generated from several African countries.¹⁹ Parker (1994) used similar techniques to examine this relationship in Kenya, while Cabal (1995) extended the analysis to the Dominican Republic baseline data.²⁰ In these studies the individual contribution of each of the key variables thought to influence growth can be specifically determined while holding the effects of the other variables constant.

To provide an added perspective on these studies, similar statistical techniques were used to examine the determinants of enterprise growth in the six African countries with countrywide baselines: Botswana, Kenya, Lesotho, Malawi, Swaziland, and Zimbabwe. The data from these countries were analyzed by estimating an ordinary linear ordinary least squares regression of growth.²¹ The growth measure used as the dependent variable was an absolute one: the annual jobs generated since startup per enterprise. Except for age and initial

16. Jovanovic's (1982) “learning model” of enterprise growth, which supersedes the “stochastic” models in which growth and size are independent, posits that the older firms grow more slowly than younger ones because managers learn more accurately over time about their efficient size of operation. It also predicts larger firms will grow more slowly than their smaller counterparts.

17. See, for example, the work of Piore and Sable (1984) on the importance of these agglomeration externalities.

18. Pakes and Ericson (1998) have extended Jovanovic's model to allow the manager's efficiency level to be changed through human capital formation.

19. An updated version is reported in McPherson (1996)

20. Parker (1994) also used ordinary least squares estimation techniques to examine the growth relationship in Kenya. In addition to the linear function employed by McPherson, she also used two additional functional forms, log-log and log-log with weights. Moreover, her dependent variable was the annual number of workers added by the enterprise since start rather than the percentage growth rate used by McPherson. Cabal (1995) used an ordered logit analysis in which the dependent variable was increased employment, decreased employment, or no change in employment since startup.

21. In addition to the linear function reported in this paper, alternative functional forms were run, including a log-log formulation as well as one with a complete set of firm age-firm size quadratic and interaction terms included. These yielded similar findings, but the overall results were somewhat less robust than the ones reported in the paper.

size, all the independent variables to explain growth were entered as dummy variables.²² Because data from only the “surviving firms” were examined, the possibility of sample selection bias was investigated by using the Heckit model. Fortunately, the bias turned out to be insignificant in this case.²³

Table 4. *Determinants Of Enterprise Growth: Growth Regression Results from Botswana, Kenya, Lesotho, Malawi, Swaziland, and Zimbabwe*

<i>Variable</i>	<i>Coefficient</i>	<i>t-statistic</i>
Firm Age	– .009427 *	–15.112
Initial Size	– .015904 *	–6.337
Sector Dummies (Base: trading)		
Manufacturing	+ .076250 *	5.373
Services	+ .11285 *	5.124
Strata Dummies (Base: urban)		
Rural towns	– .10046 *	–6.962
Rural villages	– .05121 *	–2.731
Locational Dummies (Base: home)		
Traditional market	– .00857	–.458
Commercial district	+ .29822 *	15.401
Roadside	+ .12190 *	5.052
Mobile	– .00658	–.283
Country Dummies (Base: Zimbabwe)		
Botswana	+ .14149 *	4.904
Kenya	–.06780 *	–3.001
Lesotho	+ .03987	1.160
Malawi	+ .02504	1.462
Swaziland	+ .01613	0.764
Proprietor Gender (Base: female)		
Male	+ .12688*	9.461
Constant term	+ .12222 *	6.983

Regression statistics: $n = 20544$; $F = 51.59$: Adjusted $R^2 = .24$

* = significant at 1% level.

The results of this particular analysis are summarized in Table 4. The following variables are found to be important determinants of enterprise growth:

1. Enterprise age: The variable is statistically significant and negative, indicating a strong *inverse* relationship between enterprise age and growth. Thus, it is the younger firms that are more likely

22. Specifically, the estimated equation was as follows:

$$\text{GROWTH} = + (\text{INITIAL SIZE}) + c (\text{ENTERPRISE AGE}) + d (\text{SECTOR}) + e (\text{LOCATION}) + f (\text{GENDER}) + e (\text{COUNTRY}) =$$

where

SECTOR = three dummy variables representing ISIC industries 3,6,9.

LOCATION = eight dummy variables representing various aspects of the MSE's location.

GENDER = two dummy variables representing male and female MSE entrepreneurs.

COUNTRY = six dummy variables representing Botswana, Kenya, Lesotho, Malawi, Swaziland, and Zimbabwe.

23. The Heckit tests were run on the data from Zimbabwe and Swaziland. The estimates of lambda were 15.77 (25.70) for Zimbabwe and 22.34 (20.66) for Swaziland (the standard errors are in parentheses).

generate more expansion jobs per firm. Similar findings are reported from Parker's (1994) Kenyan study, Cabal's (1995) Dominican Republic study, as well as McPherson's (1992) study.

2. Initial size: This variable is also statistically significant and negative, revealing a strong *inverse* relationship between initial size and growth. The smaller enterprises at startup thus add more expansion jobs per firm than their larger scale counterparts, a powerful finding for those concerned with employment creation. Again, parallel findings have been reported by other researchers (Parker 1994) and McPherson (1992), although a positive relationship between initial size and growth was found in the Dominican Republic (Cabal 1995).
3. Sector: The sector in which an enterprise operates helps explain growth as well. At the most aggregate level, it would appear from Table 4 that enterprises in the manufacturing and service sectors are more likely to experience higher rates of growth than those in the reference category "trading." Yet, at a more disaggregated level, the specific sectors that were likely to generate more MSE expansion varied from country to country. In Swaziland, for example, enterprises in nonmetallic mineral grew less rapidly and enterprises in transportation grew more rapidly than retail trade. Parker (1994) found that sectoral differences were significant in Kenya, with all sectors except repairs growing more rapidly than trading. Cabal (1995) also reports that differences between sectors were significant in the Dominican Republic; that is, services were growing less rapidly and manufacturing growing more rapidly than trading. What these findings suggest is that sectoral differences are significant at the country level in explaining growth, reflecting perhaps each country's comparative advantage. At the same time, no universal sectoral growth patterns seem to emerge.
4. Location: Several of the locational variables also prove to significantly influence enterprise growth. Firms located in rural towns and villages grow less rapidly than their urban-based counterparts. Moreover, enterprises operating in commercial districts or along roadsides show markedly stronger growth than those based within the home. The findings from the other studies are generally similar, but with a few exceptions. McPherson (1992), for example, finds that firms in traditional markets also grow more rapidly than home-based enterprises. Parker (1994) reports that in Kenya firms operating in rural towns grow less rapidly than those in rural villages, and Cabal finds that size of location has no statistically significant affect on enterprise growth. In general, location has a strong influence on enterprise growth, although the specific effects sometimes vary at the country level.
5. Country: This variable is also found to be important in explaining enterprise growth. A glance at Table 4, for example, reveals that enterprises in Botswana grow *more* rapidly and those in Kenya grow *less* rapidly than their counterparts in Zimbabwe, the base country. Thus, even after controlling for enterprise age, size, sector, locational, and other factors, country effects still proved to be statistically significant. The positive coefficient for Botswana may be due, at least in part, to its high level of per-capita income as well as its exceptional growth in per-capita income.
6. Gender of entrepreneur: This socioeconomic variable proves to a significant determinant of enterprise growth. As indicated in Table 4, male-run enterprises grow more rapidly than those run by females, even after controlling for the effects of all the other variables. Similar results are reported by McPherson (1992) and Parker (1994). While these results provide support for the Downing and Daniels (1992) hypothesis that females are more risk averse than their male counterparts, they also could reflect the existence of some form of discrimination against female entrepreneurs.
7. Human capital: Although data limitations precluded the inclusion of "human capital" variables in the six country growth analysis, other recent growth studies provide some evidence that human capital does significantly affect enterprise growth. McPherson (1992) found, for example, that proprietors with vocational training had firms that grew 9 percent faster than firms run by proprietors without such training. For Kenya, Parker (1994) reports that entrepreneurs who had

previously worked in another business showed markedly higher growth than those who had previously been unemployed.²⁴ She also found that business with workers trained formally at vocational schools show statistically significantly higher growth than those businesses with untrained workers once all other variables are controlled. Perhaps proprietors are able to overcome their own technical shortcomings by hiring such workers. With respect to the effect of formal schooling on enterprise growth, however, the results are somewhat mixed. Cabal (1995) finds in the Dominican Republic that entrepreneurs who had completed secondary school grew more rapidly than those who did not. A similar result is reported in Parker's (1994) study of Kenyan entrepreneurs. McPherson (1992) also reports a similar finding for Zimbabwe, but discovers the relationship is not significant in Botswana or Swaziland. Whether or not the entrepreneur completed primary education did not prove to have a statistically significant effect on enterprise growth in any of the survey countries.

In summary, these analyses have revealed that several key variables are important determinants of the expansion of existing small enterprises. Controlling for the influence of other variables, enterprise growth in most cases is inversely related to initial size and age of the enterprise. In addition, variables such as the sector, location, country, and the human capital characteristics of the enterprise are shown to significantly influence its ability to add workers. Armed with this information on the many common characteristics of expanding firms, policymakers can now begin to identify from the large and heterogeneous population of small enterprises the important segment that is generating the expansion jobs.

MSE Jobs and the Macroeconomy

New jobs, as was noted earlier, come into being in micro and small enterprises in two different ways: through the creation of new businesses and through the expansion of existing enterprises. It can be hypothesized that the balance between these two sources of new jobs is strongly influenced by the state of the macroeconomy. When the economy itself is strong, MSEs are also thriving, expanding by engaging additional workers for their work force. At the same time, significant numbers of people close existing MSEs, since they are able to move on to other, more rewarding activities. Consequently, when the overall economy is strong, one might hypothesize that relatively more jobs will be created from net firm expansion than from net firm creation.

By contrast, when the economy is languishing, MSEs also face hard times; that is, few are expanding their employment levels, and in fact many may be laying off workers. But new people are still entering the labor force. This means that there is increased pressures on people to start new businesses, even if these yield only marginal returns. With fewer options available, more existing enterprises continue to persist in business, no matter how low the incomes they generate. Thus, when the economy is languishing, one might hypothesize that relatively more jobs will be created from net firm creation than from net firm expansion.

Findings from recent surveys in several countries provide support for this view of the impact of the macroeconomy on the patterns of MSE expansion. Table 5 presents the results from analyses derived from panel surveys conducted in the Dominican Republic and Zimbabwe over periods when the overall economy was both strong and weak.

24. There was no statistical evidence in Kenya, however, that entrepreneurs who had previously been civil servants or employed in either the formal or informal sector grew differently than those entrepreneurs who were previously unemployed.

Table 5. *Patterns of Employment Growth: The Dominican Republic and Zimbabwe*

<i>Periods of rapid growth</i>	<i>Growth rate, GDP/cap (% per year)</i>	<i>Percent change per annum in employment in MSEs</i>		
		<i>From net firm creation</i>	<i>From expansion of existing enterprises</i>	<i>Total: net overall change in MSE employment</i>
Dominican Republic, March 1993	+5.5%	-1.7%	+12.4%	+10.8%
Zimbabwe, October 1993 to March 1998	+3.8%	-6.0%	+12.5%	+6.0 %
Periods of slow or negative growth				
Dominican Republic, March 1993 to March 1994	+0.5%	+1.7%	-3.2%	-1.5%
Zimbabwe, September 1991 to October 1993	-3.0%	+5.5%	+1.5%	+7.0%

Source: Computed from data generated by Cabal (1995) for the Dominican Republic and by Daniels (1994) and McPherson (1998) for Zimbabwe.

The impact of the macroeconomy on pattern of employment growth is quite striking. During periods of rapid growth, expanding employment from existing enterprises made a major contribution to overall employment growth in both countries, while the contribution to overall employment from net firm creation was actually negative. By contrast, when the macroeconomy was languishing, the contribution of existing enterprises to overall employment growth declined substantially. Employment growth from net firm creation, however, switched from negative to positive and contributed more to overall employment than did the expansion of existing firms. Further support for the hypothesized relationship between the macroeconomy and net firm creation is provided by Daniels (1995), who found by means of regression analysis on Zimbabwe data over the 1988–93 period that a 1 percent increase in GDP growth was associated with a 0.37 percent reduction in the rate of net firm creation.

A recent Kenya study reports a similar pattern (see Daniels and Mead 1998). In 1994, a year in which real GDP per capita declined by almost 1 percent, about 70% of the net new jobs came into existence as a result of net firm creation, with only 30% coming from expansions. In 1995, a year in which the real GDP per capita increased by approximately 1 percent, these figures were reversed; that is, only about 30% came from net firm creation, and close to 70% came from an expansion of new enterprises.

The Kenyan study also provides some important insights into the net returns generated by these firms. The enterprises that expanded their employment in 1994 or 1995, the study reports, generated incomes that were more than twice the returns earned in those that were newly established during these two years.

This result is consistent with the previously described findings on firm dynamics and efficiency. The vast majority of new starts are one-person enterprises, which earlier studies have indicated is the least efficient size category. MSEs that are able to survive until the overall economy improves and are able to expand, adding even one or two workers, will be moving into a size category where their economic efficiency and net income is significantly higher. Moreover, the jobs created should be more permanent and possibly generate a higher wage.²⁵

In sum, these data suggest that, when the economy is more buoyant, a significant number of new employment openings in MSEs come from an expansion of existing enterprises, resulting in jobs that

25. See Liedholm and Mead (1987), for the cross section evidence. See Parker (1994) and Parker, Riopelle, and Steel (1995) for time series evidence.

produce better incomes for those working in the enterprises. Closure rates may go up as well, as people are able to move out of marginal activities into other jobs that yield higher returns. In times of national stagnation, by contrast, large firms as well as existing MSEs tend to cut back on their employment; fewer enterprises close, and a larger percentage of new jobs result from inefficient one-person enterprises being started. MSEs, however, act as a “shock absorber” when the economy is languishing, because overall employment in MSEs continues to expand.

Policy Implications

An array of policy and project implications flow from these survey findings of MSE dynamics. At the general policy level, broad-based macro policy reform aimed at creating a more dynamic economy can be an effective vehicle for fostering the productive expansion of existing MSEs. Conversely, when the overall economy is distorted or stagnant, relatively little of this kind of expansion takes place.

The influence of specific government rules and regulations on the MSE growth is the subject of some debate. Snodgrass and Biggs (1996), for example, argue that most governmental regulations fail to reach the smallest firms; that is, as these firms increase in size, however, they become more visible and more subject to government regulation and taxation, thus introducing a disincentive to expand beyond a certain threshold. DeSoto (1989) has described the high transactions costs associated with registration in Peru. Yet, MSEs enumerated in our African or Latin American surveys rarely mention direct governmental controls or taxation as problems of central concern and were rarely cited as a binding constraint for these enterprises (Liedholm and Mead 1999). Indeed, recent evidence from Africa indicates that taxes, when measured in terms of taxes actually paid by firms, were regressive by enterprise size and that registration and other governmental regulations did not inhibit the growth of MSEs in the countries studied (McPherson and Liedholm 1996).

There is evidence, however, that governmental policies often discriminate against MSEs relative to their larger scale counterparts in the areas of access to and the prices of inputs. Numerous examples of overall policy distortions that are not neutral by enterprise size have been cited in the literature (see, e.g., Haggblade, Liedholm, and Mead 1986; Liedholm and Mead 1987). The differential effects of the import duty structure provides a useful illustration. Large enterprises can typically import their capital equipment at low or zero import duty rates through investment promotion schemes. Small firms typically do not qualify for such schemes and also find that their capital equipment, such as sewing machines and outboard motors, is classified in the tariff code as a luxury consumer good and is taxed accordingly. Eliminating such distortions “with simply the stroke of the pen” can and has done much to foster the growth of MSEs (Haggblade, Liedholm, and Mead 1987).

At the project assistance level, one of the most important implications from the survey findings is the recognition that the clients of these assistants, the MSEs, are *heterogeneous*. Among the MSEs there are different target groups, each with different opportunities and different needs. Those designing MSE assistance programs must recognize these differences and craft interventions that are appropriate to the needs of that particular group.

Enterprises that are starting up, for example, face different problems and constraints than those of existing firms seeking to expand. In view of the already large number of new starts in the region each year, along with the high attrition rates in early years of an enterprise’s life and the multiple needs of new enterprises, one might seriously question whether many scarce resources should be allocated to facilitating new starts. If there are strong pressures to support this group, then it would be important to build on any existing experience of these new entrepreneurs.

Existing firms that have survived the first three years or that have grown even slightly would appear to be more likely candidates for assistance. Even in this instance, however, a distinction might usefully be made between three categories of existing MSEs: those that are not growing, those that seek to grow just a little, and those that seek greater growth or even to “graduate” to the upper end of the small enterprise scale.

These different types of existing MSEs have different contributions to make to the dual objectives of poverty alleviation and growth. Nongrowing MSEs, for example, are primarily survival activities and thus are a particularly appropriate target group for those concerned with poverty alleviation. Programs aimed at this group can increase the likelihood that such enterprises can survive or earn somewhat higher levels of income. Assistance focused on enterprises that seek to add to their labor force, by contrast, makes its major contribution in the area of growth.

For the first two categories of existing enterprises, small amounts of a single missing ingredient, working capital, are often all that is required to sustain the enterprise or to enable it to expand slightly. Until recently, there were few proven cost-effective mechanisms for making such funding available to MSEs. Fortunately, the innovative microenterprise credit schemes that originated in Asia have now been adapted and applied with some success in Latin America and Africa. The Get Ahead Foundation in South Africa, the Kenya Rural Enterprise Program, Banco Sol in Bolivia, and ADEMI in the Dominican Republic, for example, have demonstrated that it is possible to reach relatively large numbers of MSEs with credit schemes that are at least operationally self-sufficient and that can generate borrower repayment rates exceeding 95 percent (Otero and Rhyne 1994).

What about those MSEs that seek greater growth or even to “graduate” to an enterprise with more than ten workers? Although only 1 percent of all MSEs succeed in managing this transition, this is an important group since it provides substantial numbers of jobs, is a major source of today’s intermediate enterprises, and is often most closely attuned to market opportunities. Findings from the survey countries reveal that the “graduated” enterprises tend to exhibit a higher level of “human capital” (including both experience and education), to more likely be engaged in manufacturing than in trading, and to be involved with more complex marketing patterns (for both inputs and outputs) than their counterparts that have not graduated. (Liedholm and Mead 1999). Efforts to assist entrepreneurs seeking to “graduate” must thus address a more complex set of requirements than the simple provision of working capital. Business Development Support institutions typically have played a central role in providing much of this assistance, particularly by addressing the nonfinancial constraints to “graduation.” One of the key and difficult challenges facing such institutions is finding ways to ensure that the needed services are provided to this extensive and widely dispersed client group in a reasonably cost effective manner. Recent experience has shown that a subsector approach, which focuses on the interrelationships between enterprises in a particular subsector (such as furniture), may be one way of meeting this challenge.²⁶

In summary, MSEs are a major feature of the economic landscape of Latin America and Africa. There is much churning and diversity within this MSE universe. Policies and projects grounded on a solid understanding of this changing universe can help ensure that the important contributions of MSEs to the development process in these areas can be fully realized.

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26. Subsector analyses examine the vertical marketing and production channels within each sector, identify the links between large and small firms, analyze the competitive forces between and within channels, and identify those points that provide the greatest leverage for growth. Many times these leverage points act indirectly on the targeted MSEs. In Botswana, for example, the leverage point was the establishment of a commercial malting firm, which lowered the cost of malt to the small sorghum beer producers and enabled them to compete effectively with the large scale beer producers. See Boomgard and others (1992).

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