
What Have We Learned from a Decade of Manufacturing Enterprise Surveys in Africa?

Arne Bigsten • Måns Söderbom

In the early 1990s the World Bank launched the Regional Program on Enterprise Development (RPED) in several African countries, a key component of which was to collect data on manufacturing firms. The data sets built by these and subsequent enterprise surveys in Africa generated considerable research. This article surveys the research on the African business environment, focusing on risk, access to credit, labor, and infrastructure, and on how firms organize themselves and do business. It reviews the research on enterprise performance, including enterprise growth, investment, and exports. The article concludes with a discussion of policy lessons.

The idea that better private-sector performance in Africa can reduce poverty remains central in policy discussions. Even though the performance of Africa's manufacturing sector has generally been quite poor over the last 10–15 years (Mauritius is a conspicuous exception), many people still believe that manufacturing can act as an engine of growth on the continent, by creating skilled jobs and positive spillover effects and, more generally, by modernizing the economy. In the early 1990s, to get a better idea of why things were going wrong in the manufacturing sector and how to improve them, the World Bank fielded extensive data collection projects in many African countries. Such data collection has subsequently become a regular exercise in at least some African countries. This article reviews the findings that have emerged from this research, focusing primarily on research published after peer review.¹

The results reported in this survey are thus based on enterprise survey data. The article argues that the availability of such data has greatly improved our understanding of Africa's manufacturing sector. Certain research questions cannot be answered by relying on aggregate data. It may be that the researcher has to analyze

differences across firms within an economy to estimate, say, productivity dispersion—a conventional indicator of the degree of competition—or to find out whether credit-constrained firms invest less than unconstrained firms. It is arguably in cases like this, when heterogeneity across firms is of central interest, that firm data are most useful. The more heterogeneity, the more pertinent are questions relating to the causes and consequences of such differences across firms, and the more pressing, the need for enterprise data. Panel data, which follow the same firms over time, are especially powerful in this context. They permit drawing stronger conclusions about causal effects, because time-invariant unobserved heterogeneity can be controlled for. As shown below, panel data also provide a good basis for analyzing firm dynamics, for example, productivity growth and firm survival. One of the recurring themes of this article is that enterprise data indicate substantial heterogeneity in choices and outcomes across firms within countries in Africa.² Indeed, while most African firms have not fared well during the last decade, some have performed extremely well.

In recent years there has been a rapidly growing interest in documenting differences in the investment climate across regions and countries and investigating whether such differences can be linked to differences in outcomes across and within countries (Batra, Kaufmann, and Stone 2003; World Bank 2004, 2005).³ Survey data have played a key role in this context. It is often argued that the poor investment climate in Africa results in high transaction costs and particularly disadvantages the manufacturing sector and its ability to export, because manufacturers are intensive users of investment climate services (Collier 2000). This is problematic because exporting may present a promising route to growth and development in Africa. Domestic markets for manufactured goods are typically very small, so if African industry is to grow, generate new jobs, and contribute to poverty reduction, a substantial share of its output needs to be oriented toward exports. There is also evidence from the survey data that firms become more productive as a result of exporting. This is the so-called learning by exporting effect, first documented for Africa by Bigsten and others (2004) and subsequently confirmed on a larger sample by Van Biesebroeck (2005a). This is discussed in more detail below.

The following section briefly describes the main data collection projects that have been fielded in Africa since the early 1990s and comments on the quality of the data. The article then reviews the research results on manufacturing firms in Africa, looking first at the business environment, especially at risk, access to credit, labor and skills, and infrastructure. It turns next to how firms that operate in such an investment climate organize themselves and how firms do business. It looks in some detail at what has been learned about three key aspects of firm performance: growth, investment and technology acquisition, and exports. The final section presents some lessons.

African Enterprise Survey Data

In the last 10–15 years five major research programs have collected survey data on African enterprises on a large-scale. The first was the Regional Program on Enterprise Development (RPED), which carried out surveys in Burundi, Cameroon, Côte d'Ivoire, Ghana, Kenya, Tanzania, Zambia, and Zimbabwe between 1992 and 1995. Each survey typically covered about 200 firms, and the same firms were surveyed three years in a row in most countries, thus yielding panel data. The surveys covered large and small firms, including informal firms, in the food, wood, textiles, and metal industries. Data were collected on a wide range of variables, including sales and output, capital stock, entrepreneur characteristics, employment by occupational category, labor turnover, wages, and management–worker conflict.

Data collection as part of the RPED slowed for a while after 1995. The World Bank subsequently initiated the Firm Analysis and Competitiveness Surveys (FACS), a large data collection program oriented toward larger firms outside sub-Saharan Africa. Morocco was the only African country surveyed. However, at the end of the 1990s and in the early 2000s, new survey initiatives took place in sub-Saharan Africa, as Investment Climate Surveys and the World Business Environment Survey (WBES) were fielded across a wide range of countries. The Investment Climate Surveys carried out so far in sub-Saharan Africa have covered Cameroon, Côte d'Ivoire, Eritrea, Ethiopia, Kenya, Mauritius, Mozambique, Nigeria, Senegal, Tanzania, Zambia, and Zimbabwe. These surveys were similar to the earlier RPED surveys in firm and sector coverage, but the survey instruments were oriented more toward investment climate issues, such as governance, regulations, economic policy, and public services. The WBES was launched in 80 countries and one territory in 1999 and 2000, including 17 countries in sub-Saharan Africa (Batra, Kaufmann, and Stone 2003). The surveys in sub-Saharan Africa covered 52–137 firms per country and included both manufacturing and nonmanufacturing firms.

Another research program involving enterprise surveys was implemented by the Centre for the Study of African Economies (CSAE) at Oxford University. These surveys followed up on the RPED surveys in Ghana, Kenya, and Tanzania and have extended the panel data.⁴ The panel data from the early RPED surveys include at most three observations per firm. The CSAE surveys have made some of these panels much longer. In the case of Ghana, for instance, the time-series dimension of the panel is currently 12 years.

The data sets generated by these surveys constitute the most comprehensive source of information on African manufacturing firms available. Still, several limitations need to be borne in mind when interpreting the results of the research based on these data. First, because large firms are typically oversampled, the samples generated by these surveys are generally not representative of the population of firms. And because sampling weights are typically either not available or are based on outdated

registers of firms (Van Biesebroeck 2005b), results based on the survey data may not generalize beyond the samples. Second, most results pertain to four industrial sectors (food, wood, textiles, and metal), and it is not clear whether the findings would apply to other sectors. Third, the quality of the data is not perfect. The financial data are likely to be particularly noisy. Consider the capital stock data, for example. Firms report the replacement value of plant and machinery, and sometimes they are asked to do this every year. Information on investment is also collected, so with two data points on capital and one on investment, the capital stock in period two should be approximately equal to the capital stock in period one (perhaps adjusted for depreciation) plus investment. In practice, however, there are sometimes large differences between the reported value of the capital stock and the value implied by last year's value plus investment. Measurement errors in the data may lead to serious biases.

What Have We Learned?

This section looks at the business environment in which African manufacturing firms operate and then examines three key aspects of firm performance: growth, investment, and exports.

The Business Environment

The business environment has emerged as the prime suspect for poor enterprise performance in Africa. Improving the investment climate is seen as a policy priority for the continent (World Bank 2004, 2005).⁵ Batra, Kaufmann, and Stone (2003) analyze the obstacles to business based on the WBES data. The leading constraint cited by enterprise managers in Africa is financing, followed by corruption, infrastructure, and inflation. Pooling data across all regions, the researchers find a negative and statistically significant relationship between taxes, regulations, and financing, and the growth in sales and investment. Quantitatively, the largest effect is that of financing constraints on sales growth. Over a three-year period average sales growth is 4.6 percentage points lower for a firm identifying itself as financially constrained than for an unconstrained firm, everything else equal.

What can be inferred from these results? First, given the nature of the explanatory variables, it is important to distinguish between correlation and causality. There is almost certainly some bias caused by omitted variables or reverse causation. Financing, in particular, seems very likely to be endogenous: firms that perform badly and grow slowly will have difficulty getting financing. Batra, Kaufmann, and Stone (2003:71) acknowledge this and recommend interpreting the results as “empirical associations” rather than causal effects. Second, even if viewed as causal effects, the quantitative significance of the business environment effects is rather small compared

with the substantial variation in growth rates across firms in this data set. Third, the inclusion of country fixed effects makes the parameter estimates robust to omitted variables that vary across, but not within, countries. This could well be important. The fixed effects approach also implies the need for caution when comparing cross-country differences. The results are best interpreted as showing that a good *local* investment climate is good for *local* business performance. The results do not show whether firms in countries with poor average business conditions have lower or higher average growth rates of sales and investment than firms in countries with good average conditions.

One implication of a poor business environment is that the costs for certain services important to manufacturers will be high. Eifert, Gelb, and Ramachandran (2005) show that African firms have high indirect costs (transport, logistics, telecommunications, water, electricity, land and buildings, marketing, accounting, security, and bribes) compared with firms in Asia and that African firms suffer substantial losses from power outages, crime, shipment losses, and the like. Furthermore, economic risk in Africa is typically high, credit is expensive or unavailable, skilled labor is relatively expensive, and domestic markets are typically very small. It seems reasonable to suppose that these factors present significant problems for manufacturers in Africa. What do the enterprise data show about these characteristics of the business environment?

Risk. Entrepreneurs in Africa face considerable uncertainty with regard to prices (including foreign exchange), demand, customer payment, reliability of infrastructure, and corruption. Investigating the effects of risk empirically is difficult, however, because risk is not easily measured. In macroeconomic analysis, this is commonly done by using some measure of volatility in demand or the exchange rate. Gunning and Mengistae (2001) point out that this may be misleading, however, because the standard deviation of the exchange rate may not capture the credibility of the government's exchange rate policy. The African enterprise surveys, however, have included questions about expectations of macroeconomic variables (inflation, interest rates, and exchange rate) and enterprise variables (employment and output). Questions were asked, for example, about expectations of the extent of depreciation in the exchange rate during the next 12 months.

Such data have enabled researchers to get a much better understanding of the effects of perceived risk. Using data on Ghanaian manufacturing firms, Pattillo and Söderbom (2001) find that firms that face considerable uncertainty about future demand tend to have lower profit rates than firms facing less uncertainty. The researchers argue that high risk makes firms choose a conservative product mix, with a lower expected profit rate.

Fafchamps, Gunning, and Oostendorp (2000) show that Zimbabwean firms respond to risk by increasing their inventories, another example of how risk leads to

conservative behavior and additional costs. The most commonly cited effect of risk, however, is on investment. Gunning and Mengistae (2001) conclude from their review of the evidence that investments in African manufacturing have been held back by high risk rather than low returns on investments. This is discussed further below.

Access to credit. Bigsten and others (2003) look at formal credit market participation and credit constraints based on 1991–95 survey data on firms in Burundi, Cameroon, Côte d’Ivoire, Ghana, Kenya, and Zimbabwe. The researchers use data on firms’ demand for external funds and on whether loan applications were approved. Summary data on the frequency of loan applications and outcomes suggest that demand for formal loans among African manufacturers is low: less than 20 percent of the firms in the sample had applied for a formal loan in the year before the survey (table 1). Among those applying, most firms obtained loans, but there are large differences by firm size. Loan applications are less common among small firms, and the success rate is lower than among large firms.

Of course, a firm may be credit constrained even if it does not apply for a loan. A firm may expect an application to fail precisely because there are credit constraints and may therefore decide to avoid the transaction costs and not apply. Based on information on why firms did not apply for a loan, Bigsten and others (2003) identify three groups of firms: those without credit demand and, among those with credit demand, constrained and unconstrained firms. Of the firms in their sample, 55 percent have no credit demand, 33 percent are credit constrained, and 12 percent are unconstrained (table 2). The differences are large across firms of different sizes. Close

Table 1. Formal Credit Market Participation by Firm Size (Percent)

	<i>Micro</i>	<i>Small</i>	<i>Medium</i>	<i>Large</i>	<i>All</i>
Did not apply	92	82	80	75	82
Applied and did not receive	6	11	9	5	8
Applied and received	2	7	11	20	10

Source: Bigsten and others (2003):table 2.

Table 2. Credit Constraints by Firm Size (Percent)

	<i>Micro</i>	<i>Small</i>	<i>Medium</i>	<i>Large</i>	<i>All</i>
No credit demand	33	50	67	66	55
Demand, but rejected ^a	64	42	21	10	33
Received loan	3	8	12	23	12

^aIncludes firms that suggested that a loan application would be rejected by banks.

Source: Bigsten and others (2003).

to two-thirds of the small firms appear constrained, but only 10 percent of the large firms. About two-thirds of the large firms choose not to participate in the credit market compared with only a third of the small firms. That the smallest firms are credit constrained is supported by regression results indicating that, controlling for other important factors such as expected profitability and indebtedness, the likelihood of a successful loan application varies with firm size. Although this suggests that banks are biased against small firms, the researchers note that this result may reflect banks' transaction costs. In any case, the size effect is substantial: for a small firm to have the same chance of getting a loan as a large firm, the small firm needs to have an average return on fixed capital more than 200 percentage points higher than the large firm.

In another study analyzing the links between formal credit and company investment, Habyarimana (2003) uses matched bank–firm data from Uganda to estimate the effect on firm performance of losing a banking relationship. Four Ugandan banks were closed between September 1998 and May 1999 because of imprudent banking practices. As a result, 30 percent of the firms in the sample lost one or several banking relationships. Habyarimana estimates that over the three years following the banking crisis, the average annual growth rate of employment among firms that lost a banking relationship was 2.3–4 percent lower than the average annual growth rate of unaffected firms, controlling for firm fixed effects and sector-specific time effects. Furthermore, firms affected by the banking crises are more likely to report being credit constrained, suggesting that losing a banking relationship hampers investment.

Labor and skills. Labor costs and the supply of labor in general and specific skills in particular are important for firm performance. Two general results in this area have emerged from the research on the African survey data, one related to earnings and education and one to earnings and firm size. The first is that earnings are positively correlated with education. Jones (2001) uses matched employer–employee data from Ghana to see whether wage differentials between workers with different levels of education reflect genuine productivity differentials. She estimates a productivity equation and an earnings equation and investigates whether the coefficients on education in the two equations are consistent with the hypothesis that earnings differentials reflect productivity differentials—whether the marginal product of labor is equal to the wage for given levels of education. In both equations the estimated coefficient on education is close to 0.07, and there is no statistically significant difference between the relative wages paid to workers and their relative productivity levels. This result, which appears robust to alternative specifications, supports the notion that education raises productivity.

Jones (2001) assumes that the return to education is constant. Söderbom and others (2006) relax this assumption and investigate whether the return to education

varies across different levels of education in Kenya and Tanzania during 1993–2001. It is often argued that the earnings function is concave in education, implying that the marginal return to education decreases with the level of education (Psacharopoulos 1994; Psacharopoulos and Patrinos 2002). The results reported by Söderbom and others (2006), however, indicate that the earnings function is convex, so that the marginal returns to education are lowest for individuals with the least education. This result is robust to endogeneity of education. One implication is that giving priority to investment in primary education may have little impact on poverty unless those affected proceed to higher levels of education. The researchers speculate that the convexity may be part of the explanation for why the rapid expansion of education in Africa has generated so little growth.

The second general result that has emerged from the research on enterprise data and labor is that wages differ significantly across different size firms, even when comparing workers with similar levels of human capital. In an early study documenting this, Velenchik (1997), using manufacturing data from Zimbabwe collected in 1993, estimates a wage-size elasticity of 0.26 for the sample of 1,609 observations. This indicates a very high size–wage gap. For instance, it implies that the average wage in a firm with 100 employees is about 80 percent higher than the average wage in a firm with 10 employees. The underlying regression does not control for other factors that might affect wages, so this result can be viewed as a reference point.

Velenchik (1997) goes on to investigate whether the size–wage gap can be attributed to omitted variables. She considers a very wide range of observable factors, including experience, tenure, education, training, gender, location, industry, occupation, various working condition variables, unionization, ownership, profitability, and productivity. Although the estimated wage–size elasticity falls as a result of controlling for these variables, it never drops below 0.10 and is always significantly different from zero. Thus, even conditional on this large set of observable variables, a quantitatively important size–wage gap remains.

It could be, of course, that the size–wage gap documented by Velenchik is driven by omitted *unobserved* factors. As she notes “[t]he basic labor quality difference argument is that larger firms hire ‘better’ workers, and therefore pay higher wages” (Velenchik 1997:311). If worker ability is partially unobserved, this would set up a correlation between size and wages. Recent evidence based on panel data suggests that this is not the case, however. Söderbom, Teal, and Wambugu (2005) show that, conditional on all observed and unobserved worker skills that are fixed over time, workers’ earnings in Ghana and Kenya vary positively with firm size. Again, the estimated effect is economically large. In the preferred specification for Ghana, the estimated elasticity of wages with respect to firm size is 0.15; in Kenya it is 0.08. The point estimates imply that as a firm grows from, say, having 20 employees to having 40, wages will increase 11 percent in Ghana and 6 percent in Kenya.⁶

These results suggest that earnings rise with firm growth. Because rapidly rising labor costs are likely to constrain firm growth, it is important to understand why this is observed. Underlying Velenchik's empirical approach are many economic theories (e.g., rent sharing; Teal 1996), but as seen, these do not appear to be the whole explanation for the size–wage gap. One possibility is that, as in efficiency wage models, large firms pay relatively higher wages to provide workers with incentives to exert effort.⁷ Fafchamps and Söderbom (2006) derive a theoretical model in which the size–wage relationship is generated by the rising cost of monitoring workers as firm size increases, and they estimate the structural parameters using worker–firm-matched data across 10 African countries. The implications of their findings are discussed in the following section.

Although it may not be entirely clear why there is a size–wage gap in the data, there is fairly strong evidence that the gap is not simply an artifact of omitting unobserved skills from the regressions. There is also good evidence that the size–wage gap is quantitatively large. In the case of Ghana, for instance, Söderbom and Teal (2004) estimate that if a firm with 350 employees faced the same wage as a firm with 20 employees, total costs in the large firm would fall by 20–25 percent. One implication of the large size–wage gap is that firm growth is associated with rising labor costs, which, everything else held constant, will tend to erode firms' profits.

So how can growing firms remain profitable? One way would be through improved performance in the form of higher productivity. Söderbom and Teal (2004) look for evidence of increasing returns to scale in Ghanaian manufacturing. Thus as firms grow, higher average labor costs would be offset by higher input productivity. Söderbom and Teal report production function estimates that are robust to unobserved time-invariant heterogeneity across firms (fixed effects) and endogeneity in the factor inputs. They find only weak evidence for increasing returns, and constant returns to scale is not rejected. They argue that the reason large firms can remain profitable is that they face lower capital costs than small firms. One possible reason is better access to formal credit.

Infrastructure. Based on several studies of growth determinants in Africa, Collier and Gunning (1999) argue that poor infrastructure is a serious constraint to growth on the continent. Compared with other regions, public expenditure as a share of gross domestic product (GDP) has been higher in Africa, whereas service provision has been worse. The poor infrastructure in Africa is likely to be a particularly severe constraint to manufacturing growth. Many firms spend their own resources directly to buy infrastructure services or provide it on their own. One reason for the prevalence of small manufacturing firms in Africa (see *Enterprise Organization* below) is that transport infrastructure is poorly developed, which creates pockets of demand that tend to generate small-scale localized producers. To be able to take advantage of

international trading opportunities and to engage actively in the emerging system of outsourcing, firms require reliable and cheap infrastructure.

The firm surveys have generated information about how firms perceive infrastructure problems and recently also about the time and monetary costs of different bottlenecks. Bigsten and others (1999a) show that attempts to use data on perceptions to explain productivity is problematic, however. Firms that rank infrastructure problems as very severe are the most productive ones, arguably because these firms sell on larger markets and are therefore more dependent on infrastructure. The use of objective measures (e.g., days in customs, days without telephone connections, days without electricity) is a more promising approach, but so far little analysis is available on the impact of infrastructure on manufacturing firm productivity.⁸

Enterprise Organization and the Business Environment

Enterprise organization. A conspicuous characteristic of Africa's manufacturing sector is the preponderance of very small and informal firms, which operate side by side with few large factories. The impact on the efficiency of resource allocation is pertinent. Bigsten, Kimuyu, and Lundvall (2004) investigate whether there are productivity differentials between formal and informal firms in Kenya, where the bulk of manufacturing employment is in the informal sector. Using a production function approach, these researchers find no significant productivity difference between small informal and small formal African-owned firms. A reallocation of firms from the informal to the formal sector would thus not necessarily affect aggregate productivity. Nevertheless, there is little investment and little exporting in the informal sector, and so growth in this sector is unlikely to be a source of significant modernization. Furthermore, wages in the informal sector are low, and contributions to tax revenues miniscule. There is therefore a case for policies to encourage the formalization of informal firms.

In view of this need, why small informal firms do not grow is an important question. Bigsten, Kimuyu, and Lundvall (2004) note that formal firms in Kenya have experienced significant problems in dealing with the authorities relating to corruption, regulatory red tape, and lack of security. In a similar vein Sleuwaegen and Goedhuys (2002) report that the proportion of firms that perceive regulations as an obstacle to growth is lower in the informal than in the formal manufacturing sector in Côte d'Ivoire (the opposite is true for market conditions). With cost increases and no productivity gains from becoming formal, it may thus be rational for African entrepreneurs to choose to start or remain informal. To see a shift in the size distribution from small to medium and large firms, the incentives probably need to change. This topic is discussed again later.

Fafchamps and Söderbom (2006) offer a different perspective on organization, using a principal agent framework to analyze the consequences of inadequate incentives for

workers. A key assumption in their model is that the costs of monitoring workers rise with firm size. As a result of losing control of workers as firm size increases, firms need to motivate workers by raising their wages instead. The theoretical model consists of a system of equations in which the wages of supervisors and workers are determined simultaneously with the number of supervisors and workers employed by the firm. That is, both firm size and wages are treated as endogenous variables. Estimates of the parameters of the structural model indicate that a doubling in the number of production workers will increase the labor cost per unit of effort by 9 percent for Morocco and 11–14 percent for sub-Saharan Africa—the penalty large firms incur to motivate workers. Thus the incentive problem appears to be more severe in sub-Saharan Africa than in Morocco.

Fafchamps and Söderbom (2006) further find that an increase in total factor productivity leads to an increase in worker effort in Morocco but a decrease in sub-Saharan Africa. Firms in sub-Saharan Africa with high total factor productivity hire fewer workers and supervisors (and produce less output) than they would have done had the incentive structure been similar to that in Morocco. Quantitatively, this effect on output is large: a 1 percent increase in total factor productivity raises output 2.9 percent in Morocco but only 1.3 percent in sub-Saharan Africa. If Fafchamps and Söderbom are right in arguing that this is because a firm with high total factor productivity finds it more difficult in sub-Saharan Africa than in Morocco to manage and supervise its labor force, the implications for firm growth are potentially quite significant.

Business environment. The business environment also affects how firms do business. Widespread market failures imply that firms face many “holes” in important markets, such as those for insurance and credit. This is especially pronounced for the smallest firms. Fafchamps (2001) identifies two types of responses that aim to reduce the resulting transaction costs: developing relationships and sharing information within networks. Essentially, when search and verification costs are high, it makes sense to establish long-term relationships and share information with other market participants to economize on such costs. The enterprise data have been extensively used to shed light on these mechanisms.

Trade credit is a good example of how supplier relationships can fill in some of the holes in the formal credit market. Fisman (2001) argues that trade credit plays an important role in enterprise financing in Africa, mainly by enabling firms to manage raw material inventories more efficiently and by reducing the likelihood of raw material shortages. Trade credit may therefore contribute to higher productive efficiency. Fisman analyzes these issues using the first wave of RPED data from Côte d’Ivoire, Kenya, Tanzania, Zambia, and Zimbabwe. Trade credit is the dominant form of payment to suppliers for about a third of the firms. There is much variation across countries, however. Trade credit is the dominant form of payment for 8 percent

of firms in Tanzania but for 69 percent in Zimbabwe. Trade credit appears to be more important in countries where the average firm size is larger, suggesting that large firms are more likely to use trade credit than small ones. In the formal empirical analysis Fisman finds that firms that use supplier credit have significantly higher capacity utilization than firms that do not and are less likely to have raw material stockouts. Furthermore, he finds that these results are particularly strong among firms that are constrained in their access to formal credit. These results are robust to the potential endogeneity of supplier credit, which may arise if firms use trade credit because they have high capacity utilization or substantial inventories, for instance.

Fisman (2001) suggests that these results imply the possibility of substantial productivity gains from an increase in the availability of supplier credit. He also makes the point, however, that without understanding why some firms have access to credit while others do not, it will be difficult to provide solid advice to policymakers. If lack of access to trade credit is driven by market failures—perhaps lack of public information on creditworthiness or poor contract enforcement—policy measures to fix these problems would probably have the desired results, but if firms do not get trade credit because they are unreliable, pose a big credit risk, or do not want trade credit, then it is not clear that improving access should be a policy priority.

Fisman and Raturi (2004) investigate whether various firm and entrepreneurial characteristics affect the likelihood that firms in Ghana, Kenya, Tanzania, Zambia, and Zimbabwe get trade credit. The main focus of this analysis is to see whether trade credit is more common among firms that purchase inputs from suppliers that face considerable competition. The researchers find this to be the case and interpret this finding as evidence that suppliers operating in a competitive market use credit to create buyer loyalty. Fisman and Raturi argue that this is consistent with a situation in which firms that want trade credit must establish creditworthiness and, because of information imperfections, must do so every time they switch suppliers. This form of market failure creates rents for suppliers and increases costs for manufacturers.⁹ A related result, documented by Fafchamps (2000), is that Asian and European entrepreneurs have better access to trade credit than African entrepreneurs. His hypothesis is that this is due to ethnic networking in contract enforcement.

There is still no complete picture of why African firms get trade credit, and this research suggests that strengthening credit market institutions may be important. In the specific context considered by Fisman and Raturi (2004), the policy implication is that establishing efficient credit rating agencies that keep a record of companies' credit histories would erode the de facto monopoly power of suppliers and reduce costs for manufacturers.

Enterprise Growth

From a policy point of view a good understanding of the relationships between growth and certain enterprise characteristics is important, because it can offer guidance

to policymakers about what types of firms are likely to be more successful and better at creating jobs in the future. The relationship between enterprise size and growth is of particular interest for the African manufacturing sector, because most firms in Africa are very small. How realistic is it to hope that some of these firms will grow and become successful large firms? The relationship between firm age and growth is also important. For example, if young firms grow quickly, policy measures aimed at encouraging entry may have significant growth effects in the short and medium term.

A common way of investigating the relationships between growth on the one hand and size and age on the other is to run regressions of the growth rate of employment between two periods on the explanatory variables employment and age in the initial period. Several such studies have found a negative relationship between size and growth (Ramachandran and Shah 1999; Mazumdar and Mazaheri 2003).

Sleuwaegen and Goedhuys (2002) argue that such regressions may be too restrictive by not allowing for nonlinear relationships. When these researchers augment the basic growth model with terms nonlinear in size and age, they find strong evidence of a positive effect on growth of the interaction between age and size. Everything else equal, the relationship between age and growth is less negative (or more positive) for large firms than for small firms, and the relationship between size and growth is less negative (or more positive) for old firms than for young ones. Thus, a firm that is small when it enters the market grows relatively fast initially, but growth rates slows over time and eventually the firm may start to contract. For a large firm entering the market, the pattern is the opposite. Growth rates are low initially—in fact, employment may fall rapidly in the initial years of operation—but eventually the favorable age effect (driven by the positive interaction effect between size and age) kicks in, and growth rates increase. The implication of the results is that small and large firms have very different growth patterns: high growth tends to be observed mostly among the small and young firms and the large and old firms. These results square with descriptive statistics indicating that few small firms ever grow up to become large (Biggs, Ramachandran, and Shah 1999; Biggs and Shah 2003).

Although interesting, these results should probably be interpreted with a dose of caution because it is possible that the estimated correlation between size and growth is spurious. The problem, dubbed “the Regression Fallacy” by Davis, Haltiwanger, and Schuh (1996), arises whenever there are transitory fluctuations in size or transitory measurement errors in observed size. The resulting bias in the estimated relationship between initial size and growth is negative, so failure to address this problem can produce a picture of the growth of small firms that is too good. The researchers propose that one way of dealing with the problem is to use average size over the observed period rather than initial size as the measure of enterprise size. Adopting this procedure, Mazumdar and Mazaheri (2003) present descriptive statistics

indicating at most a weak negative relationship between size and growth in Cameroon, Côte d'Ivoire, Ghana, Kenya, Tanzania, Zambia, and Zimbabwe.

Enterprise characteristics other than size and age have been shown to matter for growth as well. Ramachandran and Shah (1999) find that firms in Kenya, Tanzania, Zambia, and Zimbabwe that are controlled by minority entrepreneurs (Asian or European) did better than those controlled by indigenous entrepreneurs.¹⁰ The coefficients on secondary and university education are highly significant and positive for African entrepreneurs, whereas none of the entrepreneurial variables was significant in the non-African model. The researchers hypothesize that non-Africans benefit from various advantages of being a minority, such as access to informal networks, credit, and informal contractual mechanisms, and that for African entrepreneurs education may substitute for access to networks. Mengistae (1999) uses data for Ethiopian manufacturing firms to show that there also are significant differences between indigenous ethnic groups in terms of entrepreneurial success. Related to firm growth is firm survival. Exit rates in African manufacturing are high, and they are highest among the smallest firms. Frazer (2005) documents strong empirical evidence of a positive association between productivity and the likelihood of firm survival among Ghanaian manufacturing firms. The results imply that a one standard deviation increase in total factor productivity is associated with a 1.8 percentage point fall in the likelihood of firm exit over the subsequent two-year period, a reasonably large effect considering that the average exit rate is 6.3 percent. A related study by Söderbom, Teal, and Harding (2006) based on pooled panel data on firms in Ghana, Kenya, and Tanzania over a five-year period finds that total factor productivity affects firm survival among large firms but not small ones. In other words, being relatively more productive does not prevent firms from going out of business if they are small. Among larger firms, however, exit rates do depend on productivity, which is consistent with a survival of the fittest process, as documented in the United States, the United Kingdom, and many middle income countries. This result is also consistent with the findings reported by Frazer (2005).

Investment

This section reviews the empirical literature on investment in Africa's manufacturing sector, focusing on financial constraints and risk.¹¹ African financial markets are the least developed in the world, and development economists have long held the view that this impedes growth. For investment the main problem is that firms with profitable investment projects often cannot use external funds to finance such projects.

That there are financial imperfections in Africa can hardly be disputed, but such imperfections translate into binding constraints only if firms have a desire to invest. Bigsten and others (1999b) is one of the first studies analyzing whether investment

among African firms is hampered by lack of external finance. That study follows a fairly conventional approach in the empirical investment literature, testing whether investment is sensitive to changes in cash flow among firms observed in the early and mid-1990s in Cameroon, Ghana, Kenya, and Zimbabwe. The evidence indicates that there is a statistically significant profit effect on investment, which suggests the presence of credit constraints. With point estimates on the profit term ranging between 0.06 and 0.10, the magnitude of the effect is small, however: only between \$0.06 and \$0.10 cents of an additional \$1 earned in profits are invested.

Subsequent research based on RPED data confirms that investment is not particularly sensitive to changes in profits. In an in-depth analysis of the manufacturing sector in Zimbabwe 1992–94, Fafchamps and Oostendorp (1999) show that the sensitivity of investment to cash flow is low, even among small firms. Söderbom (2002) obtains a similar result for Kenya. Mazumdar and Mazaheri (2003) use a sample of six countries [adding Côte d'Ivoire and Zambia to the set of countries considered by Bigsten and others (1999b)] and report an estimated profit coefficient of 0.08, which is very similar to that of Bigsten and others (1999b). Mazumdar and Mazaheri also split the sample by firm size and obtain a profit coefficient of 0.09 in the subsample of small firms. They interpret the larger profit coefficient among small firms as evidence of greater credit constraints among small firms than large ones, which seems likely. Reinikka and Svensson (2001) obtain a profit coefficient of 0.08 based on a sample of Ugandan manufacturing firms for 1996–97. These researchers too find a larger profit effect among smaller firms, which is consistent with the notion that credit access is more of a problem for small firms. However, the point estimate of the coefficient on profits among small firms is 0.11, and so quantitatively the effect is not particularly large even for small firms.

The second-hand market for used machinery in Africa is shallow at best, and so investment expenditures are often “sunk” (investment is irreversible). Theories of irreversible investment under uncertainty predict that investment will be slower to respond to demand shocks if uncertainty is high. As mentioned, testing empirically for the effects of risk is difficult, as risk is not easily measured. The design of innovative survey questions has been a major step forward. Pattillo (1998) uses panel data on Ghanaian manufacturing firms from 1994 and 1995 to test hypotheses from models of irreversible investment under uncertainty. Based on data on entrepreneurs' subjective (or perceived) probability distribution over future demand, Pattillo calculates the variance of demand and uses this as the measure of uncertainty. Empirical results indicate that uncertainty has a negative effect on investment, an effect that is more pronounced for firms with more irreversible investment. Darku (2001) undertakes a similar inquiry based on firm-level data from a survey in Uganda in 1998. Measuring uncertainty in the same way as Pattillo (1998), Darku finds a negative relation between uncertainty and investment and documents that this effect is stronger among firms with more irreversible

investment. These studies provide direct evidence of a negative effect of perceived uncertainty on investment.

High uncertainty results in a high risk premium in the required return on invested capital, suggesting that African manufacturing firms have high opportunity costs of capital. Bigsten and others (1999b) argue that this is indeed the case, reporting much higher average returns to capital than among firms in more developed countries (table 3). There is a striking similarity in average investment rates across both the African and the European countries considered, but the rates of return on capital are much higher in the African countries. The researchers infer from this that the cost of capital is relatively high in Africa and maintain that this is consistent with a negative effect of uncertainty on investment. Fafchamps and Oostendorp (1999) take a similar view by arguing that uncertainty is a plausible explanation for why investment remained low in Zimbabwe.

Using the same data set as in the 1999 study, but adding Zambia, Bigsten and others (2005) examine whether investment is affected by irreversibility and fixed adjustment costs. If so, one would expect to see a significant share of zero investments. Combining the information presented by Bigsten and others (2005) and that of Reinikka and Svensson (2001) on Uganda, table 4 summarizes the proportions of nonzero investments in this data set by country and firm size. With the exception of Uganda and Zimbabwe, the proportion of positive investment is lower than 0.5 across all size categories, meaning that most firms in these categories do not invest at all during a typical year. There is a weak positive relationship between firm size and propensity to invest, although among the largest firms in Ghana only one in five firms invest in a representative year. Investment activity is generally higher in Zimbabwe than in the other countries, although a third of firms in the Zimbabwean sample still

Table 3. Investment Rates and Returns on Fixed Capital in Selected African and European Countries (Percent)

	<i>Investment rate</i>	<i>Average return on fixed capital</i>
Africa		
Cameroon	0.11	1.36
Ghana	0.13	3.63
Kenya	0.11	1.82
Uganda	0.12	0.75
Zimbabwe	0.12	0.85
Europe		
Belgium	0.13	0.18
France	0.11	0.12
Germany	0.12	0.16
United Kingdom	0.12	0.13

Source: All countries except Uganda (Bigsten and others 1999b); Ugandan (Reinikka and Svensson 2001).

Table 4. Proportions of Nonzero Investments Among Firms in Six African Countries, by Firm Size

<i>Number of employees</i>	<i>Cameroon</i>	<i>Ghana</i>	<i>Kenya</i>	<i>Uganda</i>	<i>Zambia</i>	<i>Zimbabwe</i>
1–5	0.21	0.31	0.44	n.a.	0.29	0.53
6–20	0.29	0.44	0.40	n.a.	0.29	0.51
21–100	0.24	0.48	0.41	n.a.	0.28	0.63
101 or more	0.38	0.20	0.44	n.a.	0.38	0.71
Total	0.29	0.32	0.42	0.52	0.31	0.66

Source: Bigsten and others (2005) and Reinikka and Svensson (2001).

refrain from investing in a typical year. The researchers also show that investment is “lumpy”; whenever firms do invest, they invest a lot. This suggests that fixed adjustment costs may be important. However, more formal analyses of the decision to invest using a dynamic discrete choice model point to irreversibility as the main explanation for low investment in Africa. Reducing uncertainty, or improving the market for second-hand fixed capital, is therefore likely to positively affect investment.

Exports

As mentioned, manufacturing firms in Africa operate in small domestic markets. To expand production, firms may have to orient part of their production toward exporting. What factors prevent African firms from entering export markets? And are there any benefits, other than market enlargement, associated with exporting? In particular, is there any evidence that firms become more productive as a result of exporting, perhaps because of contacts with foreign customers or exposure to international competition?

At least two key factors determine whether a firm participates in the export market: the level of entry barriers and the firm’s cost efficiency. In an influential study of the decision to export, Roberts and Tybout (1997) argue that entering the export market for the first time may be associated with a fixed entry cost. For instance, the firm may need to set up a marketing department to investigate marketing channels and meet export orders. Although entry costs are typically not observed, Roberts and Tybout argue that state dependence in exports—that lagged participation affects the likelihood of current participation—may constitute indirect evidence of entry costs. Thus in the absence of entry costs, firms will switch in and out of the export market independently of whether they have exported in the past. If there are significant entry costs, however, firms that have incurred these costs in the past (and thus will not have to incur them again) will be more likely to export in subsequent periods than firms that have not, because exporting is less costly for insiders than for outsiders.

In testing for state dependence in exports, it is important to recognize the possibility that lagged exporting status is not strictly exogenous. In particular, if there is unobserved time-invariant heterogeneity across firms in the propensity to export, failure to control for such heterogeneity will tend to bias the results toward state dependence. Roberts and Tybout deal with this issue, often referred to as the initial conditions problem, using techniques developed by Heckman (1981). In their empirical application, which is based on data on manufacturing plants in Colombia, Roberts and Tybout find strong evidence that insiders are more likely to export than outsiders. This indicates that entering the export market is associated with significant fixed costs.

Bigsten and others (2004) carry out a similar analysis based on RPED data from the early 1990s for Cameroon, Ghana, Kenya, and Zimbabwe. Controlling for some factors, including firm-specific time-invariant unobserved heterogeneity, they find that past export status has a significant effect on the propensity to export. The magnitude of this effect is large: for the average firm that did some exporting in the previous period, the likelihood of exporting in the current period is about 0.57, whereas the likelihood of exporting for an otherwise identical firm that did not export in the previous period is 0.18. Thus, for a nonexporting firm with the average characteristics, entering the export market raises the probability of exporting in the next period from less than one in five to more than one in two. This is attributed to large entry costs. Van Biesebroeck (2005a) obtains similar results for a larger sample of nine sub-Saharan Africa countries using a similar approach.

The second factor that determines whether a firm will export is its cost efficiency. Clerides, Lach, and Tybout (1998) derive a model in which exporting is associated with a fixed cost that is incurred in every period of exporting. In this model firms with marginal costs below some threshold choose to export, whereas firms with marginal costs above the threshold remain focused on the domestic market. Thus, this model predicts that relatively efficient firms will self-select into the export market. The study by Bigsten and others (2004) looks for evidence of self-selection in export markets and finds this effect to be relatively weak. Van Biesebroeck (2005a) finds a somewhat stronger self-selection effect in a larger sample. Both studies report results suggesting that causality runs in the other direction, from exporting to efficiency.

The fact that exporters tend to be more efficient than nonexporters is a common result in both rich and poor countries. Mengistae and Pattillo (2004) report a positive correlation between productivity and exporting among firms in Ethiopia, Ghana, and Kenya. Whether this is because exporting actually causes efficiency gains has received considerable attention in the literature recently. From a policy perspective whether firms in developing countries learn from exporting is an important issue because learning by exporting can reduce the competitiveness gap endogenously through increased international trade. One methodological challenge in

testing for learning by exporting is that exporting will be endogenous if efficient firms self-select into the export market: efficiency and exports may be correlated even in the absence of learning effects.

Clerides, Lach, and Tybout (1998) develop an econometric framework for teasing out the relative importance of learning effects and self-selection effects. Key features of this approach are that exports are determined by efficiency and that there is a common unobserved time-invariant factor that affects both the propensity to export and firm-level efficiency. Using the econometric framework proposed by Clerides, Lach, and Tybout (1998), Bigsten and others (2004) find relatively strong evidence of learning effects in that participating in export markets has positive effects on total factor productivity in subsequent periods. Van Biesebroeck (2005a) uses similar methods and confirms the presence of learning effects. The quantitative effect of exporting appears to be large. The estimates reported by Bigsten and others imply that exporting is associated with a productivity gain of 7–8 percent in an output production function, which corresponds to productivity gains in terms of value added of 20–25 percent in the short run and up to 50 percent in the long run. These estimates are in line with the results reported by Van Biesebroeck (2005a).

Conclusions, Future Research, and Some Thoughts on Policy

A decade of surveys in Africa has greatly improved our understanding of the factors that drive the choices and outcomes in the manufacturing sector. Four main findings emerge from the research.

First, investment in physical capital has remained low, more because of uncertainty than because of a severe credit constraint. There is some evidence that lack of credit has been a problem for small firms, but although the profit effect on investment is larger for small than for large firms (Reinikka and Svensson 2001), it is still quite small. Analysis of firms' borrowing behavior paints a similar picture: on average the desire for formal credit has been relatively modest, although demand for credit is relatively high among very small firms. The most likely explanation for why a lack of credit has not been a major factor in explaining the low levels of investment over the last decade is that few firms could identify strong investment opportunities during this period. This does not mean that the financial sector reforms implemented in many African countries in the 1990s were unnecessary but only that the constraints that were relaxed were not binding at the time. When firms expand and the need for formal borrowing increases, the financial reforms may turn out to have a higher payoff.

Second, exports have remained low throughout the period, and research indicates that the high costs of entering the export market may be part of the reason. This has two potentially important policy implications. First, if incentives can be created for

firms to enter the export market, firms are likely to remain in the export market for some time. Second, high entry costs imply that there is a large set of firms that remain focused on the domestic market even though they are internationally competitive. Reducing entry costs will give these firms access to a larger market.

Third, evidence is fairly strong that exporting leads to efficiency gains—there is learning by exporting. Studies looking at this issue in other regions tend not to obtain this result (Clerides, Lach, and Tybout 1998; see Blalock and Gertler 2004 for a counter example). One possible explanation is that the potential gains from exporting are large in Africa because of high trade restrictions in the past and a large technological gap with developed countries. Exporting thus offers maximum scope for the increased discipline of competition, and contact with foreign customers provides maximum scope for learning opportunities. Arguably, if exporting induces efficiency in any environment, it should do so in Africa. This implies that Africa may have much to gain from orienting its manufacturing sector toward exporting.

Fourth, there is strong evidence that earnings vary across individuals with similar skills and thus that labor costs vary across firms even though the quality of labor may be similar. Wages are higher in large firms than in small, but this can be attributed only partly to differences in worker characteristics. Why this is so is not fully understood, but the effect is quantitatively large.

Improving our understanding of why these results are observed seems an important area for future research. Other issues also need further research. Although much has been learned about enterprise growth from the enterprise data, there is still uncertainty about the association between enterprise size and growth. It may be that growth rates are independent of enterprise size, in which case policymakers should not expect systematically higher growth rates in certain size segments of the sector. To address some of the methodological challenges discussed, researchers will need to use data covering firms over a relatively long period. Access to panel data with a reasonably long time dimension is therefore important. Furthermore, whether the fact that small and relatively productive firms have high exit rates (Söderbom, Teal, and Harding 2006) is a cause for concern depends on why this result is observed. It would be socially wasteful if exits were involuntary, because of some uninsurable and temporary shock. However, if exit is voluntary, the result of the entrepreneur finding a more profitable occupation elsewhere, it is less clear that this is a problem.

The research results based on the African enterprise data have implications for policy. More jobs can be created only if the industrial sector expands. With domestic markets still very small, most expansion will probably have to be through exports. The survey data indicate that the rewards from participation in international markets may be substantial but also that firms are reluctant to enter the export market because of high costs. Facilitating exporting would thus appear an important part of the policy package. With poor infrastructure and a weak regulatory system, Africa is

at a disadvantage, so reforms in these areas would seem important. That good policies can make a difference is clear from Madagascar, for instance, where the creation of an efficient export processing zone led to a very rapid expansion in the textiles and garment sector in the 1990s.

Furthermore, to be internationally competitive, more investment is needed.¹² Because the survey data support the notion that uncertainty hampers investment, sound and credible policies consistently pursued over time should reduce the risk perceived by entrepreneurs. Governance is likely to be central, because without good governance, uncertainty will persist and investors' response to other initiatives will be weak. Stringing together several years of good governance and good policies can be hard in a situation where people do not see quick results, and resisting policy reversals and populist policies will therefore be a challenge.

In addition, scarce resources—land, skills, physical capital, and raw material—need to be channeled to firms that are productive and in a good position to export. An important question is what to do with the large informal manufacturing sector in Africa. Based on Kenyan enterprise data, Bigsten, Kimuyu, and Lundvall (2004) argue that the informal sector is large primarily because being formal is costly. Thus, addressing the basic governance and investment climate issues would help encourage entrepreneurs to move from the informal to the formal sector.

Of course, that shift will not occur over night, and during a transition period steps could be taken to improve performance within the informal sector. Enterprise data show that some of the key economic fundamentals, such as total factor productivity, are reasonably good in informal firms (Bigsten, Kimuyu, and Lundvall 2004). However, vocational training and other capacity-building efforts have so far been directed mainly to the formal sector while largely neglecting the needs of informal firms. One likely welfare loss stems from the lack of access to credit, and hence forgone investment, for informal firms, because of their ambiguous legal status and lack of proper accounts, as well as the lack of credit-rating procedures relevant to informal firms. Because of the small absolute size of the loans required by informal firms, it should be feasible to support alternative procedures for the provision of credit.

Although most African firms have experienced limited success at best, there is also a class of firms that has performed very well. This general finding suggests that African manufacturing firms have the potential to perform well. To enable firms to improve their performance, key goals for African industrial policy should be to facilitate the adoption of new technology and the penetration of new markets. Countries that cannot break out of the current situation—in which most manufacturing firms focus on supplying the domestic market with low value-added products—are unlikely to see a significant expansion of jobs in the manufacturing sector or to have manufacturing play a major role in reducing poverty.

Notes

Arne Bigsten is a professor of economics in the Department of Economics at Göteborg University; his e-mail address is arne.bigsten@economics.gu.se. Måns Söderbom is a research officer at the Centre for the Study of African Economies in the Department of Economics at the University of Oxford; his e-mail address is mans.soderbom@economics.ox.ac.uk. The authors thank Shantayanan Devarajan, three anonymous referees, John Nasir, Adrian Wood, and participants at seminars at Göteborg University and Oxford University for helpful comments on earlier drafts of the article. They are thankful to the World Bank for funding the research.

1. This is not the first study to take stock of what can be learned from data on manufacturing firms in Africa. Tybout (2000) reviews the research on firm performance in developing regions, including Africa. Mazumdar and Mazaheri (2003) focus exclusively on African manufacturing. Collier and Gunning (1999) discuss the problems faced by Africa's manufacturing sector as part of their survey paper on Africa's general economic problems. All of these studies cover data on African firms over the period 1991–95, the period covered by the first wave of data from the RPED. More recently, Kingdon, Sandefur, and Teal (2004) and Fafchamps and Söderbom (2004) have provided overviews of the conditions for job creation and labor demand in Africa, drawing on the firm surveys among other sources. This review is based on more recent data than that of Collier and Gunning, Tybout, and Mazumdar and Mazaheri and in looking at a wide range of results that have come out of the research on the firm data it has a broader focus than the reviews by Kingdon, Sandefur, and Teal and Fafchamps and Söderbom.

2. For instance, Bigsten and others (1999b) analyze data on manufacturing firms in four African countries and report that profit to capital ratios are more than four times lower than the median for one in four firms and more than four times higher than the median in one in four firms (and this is not a result primarily of cross-country differences). A similar finding of large variability across firms holds for most of the key performance variables in the data (productivity, export intensity, and investment).

3. Investment climate is a very broad concept. Its key components are the institutional, policy, and regulatory environment in which firms operate (Dollar, Hallward-Driemeier, and Mengistae 2005). Examples of recently studied dimensions of the investment climate include the quality of infrastructure, the nature of business regulations and their enforcement, the prevalence of credit constraints, the quality of governance, general conditions for private investment and enterprise growth, economic freedom, country credit ratings, human development, environmental sustainability, and civil rights.

4. See <http://www.csae.ox.ac.uk/datasets/main.html>.

5. Enterprise surveys are not the only useful data for analyzing the role of the investment climate. In fact, because many aspects of the investment climate are constant across firms within an economy, it will sometimes be better to measure the key dimensions of the investment climate at the country level—perhaps by means of a few case studies—and then to conduct the empirical analysis at the aggregate level. One major project based on such a procedure has generated the World Bank and International Finance Corporation Doing Business Database (World Bank 2005), which contains data on aspects of the regulatory environment facing private firms in a large number of countries and economic regions—for example, how long it takes to start a business, how hard it is to hire and fire workers, how well contracts are enforced, and so on. The construction of these data is based on case studies of laws and regulations in each country and does not involve surveying individual firms.

6. Ghana: $\exp(0.15\ln(40) - 0.15\ln(20)) - 1 = 0.11$. Kenya: $\exp(0.08\ln(40) - 0.08\ln(20)) - 1 = 0.06$.

7. The idea that efficiency wages drive the wage–size gap is considered by Velenchik (1997), but not tested directly.

8. See Dollar, Hallward-Driemeier, and Mengistae (2005) for such analysis based on firm-level data from Bangladesh, China, Pakistan, and India.

9. There is also evidence that ethnicity plays a role in whether firms use trade credit at all (Fisman 2003). This too may be consistent with information imperfections.

10. In an early study of the relations between minorities and entrepreneurial success, Kilby (1983) argues that minority entrepreneurs often have superior initial endowments of capital, technology, and knowledge of markets and have acquired traditions that help them raise productivity.

11. One of the main objectives of investment is to get access to better technology. Direct transfers of technology through technology contracts and the like to African manufacturing firms have been very limited (see, e.g., Bigsten and Kimuyu 2002, on Kenya).

12. Currently, foreign investors do not appear to see Africa as a promising location for investment, and many Africans share this view and keep a large share of their wealth outside Africa (about 40 per cent according to Collier, Hoeffler, and Pattillo 2001).

References

- Batra, G., D. Kaufmann, and A. H. W. Stone. 2003. *Investment Climate Around the World: Voices of the Firms from the World Business Environment Survey*. Washington, D.C.: World Bank.
- Biggs, T., and M. Shah. 2003. "The Problem of African Entrepreneurial Development." In G. S. Fields and G. Pfeffermann, eds., *Pathways Out of Poverty: Private Firms and Economic Mobility in Developing Countries*. Boston: Kluwer Academic Publishers.
- Biggs, T., V. Ramachandran, and M. Shah. 1999. "The Determinants of Enterprise Growth in Sub-Saharan Africa: Evidence from the Regional Program for Enterprise Development." RPED Discussion Paper 135. Washington, D.C.: World Bank.
- Bigsten, A., and P. Kimuyu, eds. 2002. *Structure and Performance of Manufacturing in Kenya*. London: Palgrave Macmillan.
- Bigsten, A., P. Kimuyu, and K. Lundvall. 2004. "What to Do with the Informal Sector?" *Development Policy Review* 22(6):701–15.
- Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, J. W. Gunning, A. Oduro, R. Oostendorp, C. Pattillo, M. Söderbom, F. Teal, and A. Zeufack. 1999a. "Economic Infrastructure and Productivity in Sub-Saharan Africa: A Firm-Level Analysis." Göteborg, Sweden: Göteborg University.
- Bigsten, A., P. Collier, S. Dercon, B. Gauthier, J. W. Gunning, A. Isaksson, A. Oduro, R. Oostendorp, C. Pattillo, M. Söderbom, M. Sylvain, F. Teal, and A. Zeufack. 1999b. "Investment in Africa's Manufacturing Sector: A Four Country Panel Data Analysis." *Oxford Bulletin of Economics and Statistics* 61(4):489–512.
- Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, J. W. Gunning, A. Oduro, R. Oostendorp, C. Pattillo, M. Söderbom, F. Teal, and A. Zeufack. 2003. "Credit Constraints in Manufacturing Enterprises in Africa." *Journal of African Economies* 12(1):104–25.
- . 2004. "Do African Manufacturing Firms Learn from Exporting?" *Journal of Development Studies* 40(3):115–71.
- Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, J. W. Gunning, R. Oostendorp, C. Pattillo, M. Söderbom, and F. Teal. 2005. "Adjustment Costs and Irreversibility as Determinants of Investment: Evidence from African Manufacturing." *Contributions to Economic Analysis & Policy* 4(1):1–27.
- Blalock, G., and P. J. Gertler. 2004. "Learning from Exporting Revisited in a Less Developed Setting." *Journal of Development Economics* 75(2):397–416.
- Clerides, S., S. Lach, and J. Tybout. 1998. "Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco." *Quarterly Journal of Economics* 113(3):903–48.
- Collier, P. 2000. "Africa's Comparative Advantage." In H. Jalilian, M. Tribe, and J. Weiss, eds., *Industrial Development and Policy in Africa*. Cheltenham, UK: Edward Elgar.
- Collier, P., and J. W. Gunning. 1999. "Explaining African Economic Performance." *Journal of Economic Literature* 37(1):64–111.

- Collier, P., A. Hoeffler, and C. Pattillo. 2001. "Flight Capital as a Portfolio Choice." *World Bank Economic Review* 15(1):55–80.
- Darku, A. B. 2001. "Private Investment, Uncertainty, and Irreversibility in Uganda." *African Finance Journal* 3(1):1–25.
- Davis, S. J., J. C. Haltiwanger, and S. Schuh. 1996. *Job Destruction and Destruction*. Cambridge, Mass.: The MIT Press.
- Dollar, D., M. Hallward-Driemeier, and T. Mengistae. 2005. "Investment Climate and Firm Performance in Developing Economies." *Economic Development and Cultural Change* 54(1):1–32.
- Eifert, B., A. Gelb, and V. Ramachandran. 2005. "Business Environment and Comparative Advantage in Africa: Evidence from the Investment Climate Data." RPED Report 126. Washington, D.C.: World Bank.
- Fafchamps, M. 2000. "Ethnicity and Credit in African Manufacturing." *Journal of Development Economics* 61(1):205–35.
- . 2001. "Networks, Communities, and Markets in Sub-Saharan Africa: Implications for Firm Growth and Investment." *Journal of African Economies* 10(Suppl.2):109–42.
- Fafchamps, M., and R. Oostendorp. 1999. "Investment." In J. W. Gunning and R. Oostendorp, eds., *Industrial Change in Africa: Micro Evidence on Zimbabwean Firms Under Structural Adjustment*. London: Macmillan.
- Fafchamps, M., and M. Söderbom. 2004. "Climate for Job Creation." In *Employment Issues—Regional Stocktaking Review*. Washington, D.C.: World Bank.
- . 2006. "Wages and Labor Management in African Manufacturing." *Journal of Human Resources* 41(2):346–79.
- Fafchamps, M., J. W. Gunning, and R. Oostendorp. 2000. "Inventories and Risk in African Manufacturing." *Economic Journal* 110(466):861–93.
- Fisman, R. 2001. "Trade Credit and Productive Efficiency in Developing Countries." *World Development* 29(2):311–21.
- . 2003. "Ethnic Ties and the Provision of Credit: Relationship-Level Evidence from African Firms." *Advances in Economic Analysis and Policy* 3(1):1–18.
- Fisman, R., and M. Raturi. 2004. "Does Competition Encourage Credit Provision? Evidence from African Trade Credit Relationships." *Review of Economics & Statistics* 86(1):345–52.
- Frazer, G. 2005. "Which Firms Die? A Look at Manufacturing Firm Exit in Ghana." *Economic Development and Cultural Change* 53(3):585–617.
- Gunning, J. W., and T. Mengistae. 2001. "Determinants of African Manufacturing Investment: The Microeconomic Evidence." *Journal of African Economies* 10(Suppl.2):48–80.
- Habyarimana, J. 2003. *The Benefits of Banking Relationships: Evidence from Uganda's Banking Crisis*. Cambridge, Mass.: Harvard University.
- Heckman, J. J. 1981. "The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process." In C. F. Manski and D. McFadden, eds., *Structural Analysis of Discrete Data with Econometric Applications*. Cambridge, Mass.: The MIT Press.
- Jones, P. 2001. "Are Educated Workers Really More Productive?" *Journal of Development Economics* 64(1):57–79
- Kilby, P. 1983. "The Role of Alien Entrepreneurs in Economic Development." *American Economic Review* 73(2):107–11.
- Kingdon, G., J. Sandefur, and F. Teal. 2004. "Patterns of Labor Demand." In *Employment Issues—Regional Stocktaking Review*. Washington, D.C.: World Bank.

- Mazumdar, D., and A. Mazaheri. 2003. *The African Manufacturing Firm*. London: Routledge.
- Mengistae, T. 1999. "Indigenous Ethnicity and Entrepreneurial Success in Africa: Some Evidence from Ethiopia." Policy Research Working Paper 2534. Washington, D.C.: World Bank.
- Mengistae, T., and C. Pattillo. 2004. "Export Orientation and Productivity in Sub-Saharan Africa." *IMF Staff Papers* 51(2):327–53.
- Pattillo, C. 1998. "Investment, Uncertainty, and Irreversibility in Ghana." *IMF Staff Papers* 45(3):522–53.
- Pattillo, C., and M. Söderbom. 2001. *Do Risk Averse Entrepreneurs Get Lower Profits?* Oxford: University of Oxford.
- Psacharopoulos, G. 1994. "Returns to Investment in Education: A Global Update." *World Development* 22(9):1325–43.
- Psacharopoulos, G., and H. A. Patrinos. 2002. "Returns to Investment in Education: A Further Update." Policy Research Working Paper 2881. Washington, D.C.: World Bank.
- Ramachandran, V., and M. K. Shah. 1999. "Minority Entrepreneurs and Firm Performance in Sub-Saharan Africa." *Journal of Development Studies* 36(2):71–87.
- Reinikka, R., and J. Svensson. 2001. "Confronting Competition: Investment, Profit, and Risk." In R. Reinikka and P. Collier, eds., *Uganda's Recovery*. Washington, D.C.: World Bank.
- Roberts, M., and J. Tybout. 1997. "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs." *American Economic Review* 87(4):545–64.
- Sleuwaegen, L., and M. Goedhuys. 2002. "Growth of Firms in Developing Countries, Evidence from Côte d'Ivoire." *Journal of Development Economics* 68(1):117–35.
- Söderbom, M. 2002. "Investment Behaviour." In A. Bigsten and P. Kimuyu, eds., *Structure and Performance of Manufacturing in Kenya*. London: Palgrave Macmillan.
- Söderbom, M., and F. Teal. 2004. "Size and Efficiency in African Manufacturing Firms: Evidence from Firm-Level Panel Data." *Journal of Development Economics* 73(1):369–94.
- Söderbom, M., F. Teal, and A. Harding. 2006. "The Determinants of Survival Among African Manufacturing Firms." *Economic Development and Cultural Change* 54(3):533–56.
- Söderbom, M., F. Teal, and A. Wambugu. 2005. "Unobserved Heterogeneity and the Relation Between Earnings and Firm Size: Evidence from Two Developing Countries." *Economics Letters* 87(2):153–9.
- Söderbom, M., F. Teal, A. Wambugu, and G. Kahyarara. 2006. "The Dynamics of Returns to Education in Kenyan and Tanzanian Manufacturing." *Oxford Bulletin of Economics and Statistics* 68(3):261–88.
- Teal, F. 1996. "The Size and Sources of Economic Rents in a Developing Country Manufacturing Labour Market." *Economic Journal* 106(437):963–76.
- Tybout, J. 2000. "Manufacturing Firms in Developing Countries: How Well Do They Do, and Why?" *Journal of Economic Literature* 38(1):11–44.
- Van Biesebroeck, J. 2005a. "Exporting Raises Productivity in Sub-Saharan African Manufacturing Firms." *Journal of International Economics* 67(2):373–91.
- . 2005b. "Firm Size Matters: Growth and Productivity Growth in African Manufacturing." *Economic Development and Cultural Change* 53(3):545–83.
- Velenchik, A. D. 1997. "Government Intervention, Efficiency Wages and the Employer Size Effect in Zimbabwe." *Journal of Development Economics* 53(2):305–38.
- World Bank. 2004. *World Development Report 2005: A Better Investment Climate for Everyone*. New York: Oxford University Press.
- . 2005. *Doing Business in 2005: Removing Obstacles to Growth*. Washington, D.C.: World Bank, International Finance Corporation, and Oxford University Press.