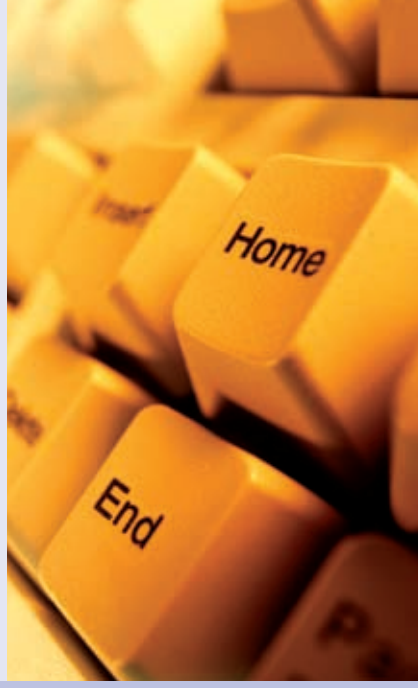
Can Expanding the Use of Computers Improve the Performance of Small Minority- and Women-Owned Enterprises?



Robert I. Lerman

Caroline Ratcliffe

Harold Salzman

Douglas Wissoker

Jennifer Gaudet

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ROBERT I. LERMAN

CAROLINE RATCLIFFE

HAROLD SALZMAN

DOUGLAS WISSOKER

JENNIFER GAUDET

THE URBAN INSTITUTE

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Background and Key Findings

A thriving small business sector is an important national objective. So, too, is the development of healthy businesses owned by women and minorities. Currently, African Americans, Hispanic Americans, and women fall well short of achieving the business success that white men attain. Wide ethnic and gender gaps in self-employment demonstrate this trend. As of 2000, nearly 1 in 7 employed white men worked in their own business, as compared with about 1 in 18 employed African American men, 1 in 12 employed Hispanic men, and 1 in 14 employed women.[1] Minorities and women are less likely to own businesses than are white males and the businesses they do own generate far lower sales (figure 1). Even among small business owners, minority- and women-owned enterprises (MWEs) are less likely to survive and prosper (Fairlie and Robb 2003).

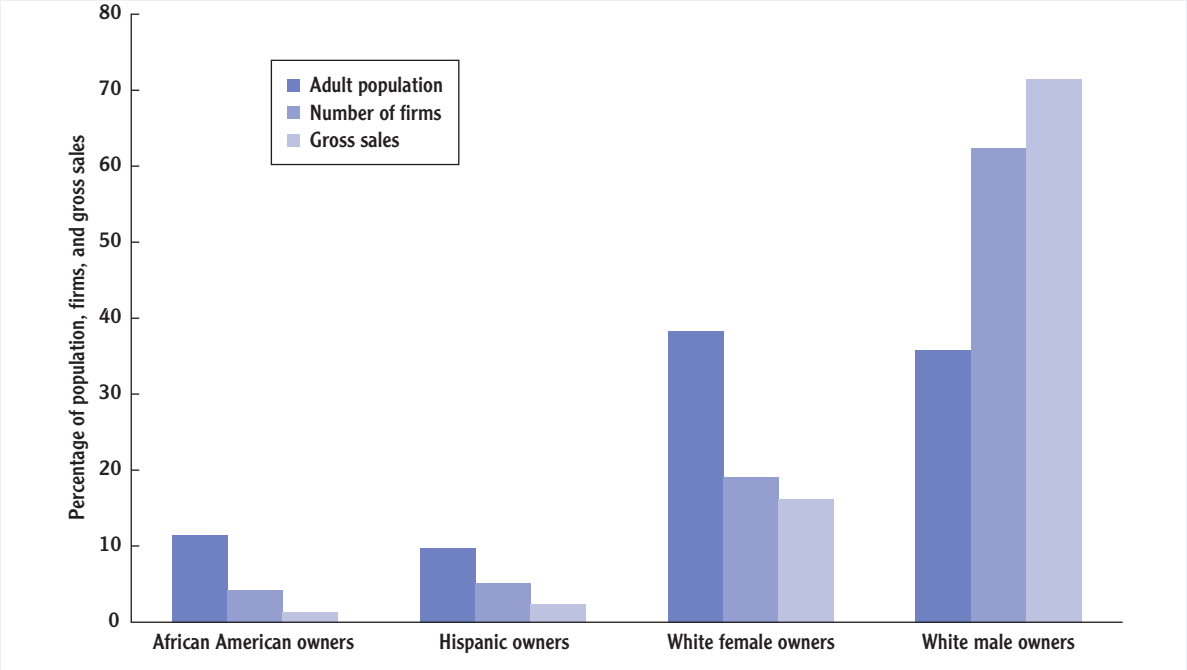
Helping small businesses in general and MWEs in particular can promote economic growth and improve the relative economic position of minorities and women. To pursue these goals, the federal Small Business Administration offers loans and technical assistance, and federal and state governments engage in preferential contracting policies. These existing policies represent a national commitment to creating and channeling contracts to MWEs. However, only limited resources have been devoted to helping these businesses achieve the high levels of productivity, profitability, and dynamism necessary for them to contribute significantly to economic and employment growth. Since public support may hinge on how well these businesses enhance growth and avoid becoming a drain on public resources, it is critical that policymakers understand what is helping and what is hindering small businesses and MWEs.

The effective use of computer technologies is one factor that may influence the business success of small firms and especially small MWEs. Past studies have found lower computer use among MWEs than among white-male-owned firms, though not for all uses (Bitler 2001). Numerous studies have examined the complex relationship between computer use and firm performance and productivity. While most studies point toward a positive impact of computer use on performance, others present conflicting results.[2] In any event, no existing studies provide up-to-date evidence on the differences among small firms in computer use and the effects of such differences on firm performance.

This study aims at increasing our knowledge in this area by obtaining and analyzing new data to answer three key questions:

1. What performance and productivity gains are achieved when small businesses and MWEs implement information technology? What are the potential economic benefits of improving MWEs' use of information technology?
2. What are the factors that lead some MWEs to take great advantage of computer technologies and that lead others to utilize computers only in a limited way? What are the barriers to MWEs' adoption and effective use of technology? In particular, how significant are the impacts of constraints on capital, on knowledge of the technology and its possible role in improving businesses, and on the ability to train workers?

FIGURE 1. Small Business Ownership and Sales Are Low for Minorities and Women Relative to Their Populations, 1998



SOURCES: Authors' tabulations from Federal Reserve Board 1998 Survey of Small Business Finance and the March 1998 Current Population Survey.
NOTE: Firms owned by both a male and female or by individuals of "other" races are not included in this figure.

3. Is there a gap in computer use that separates small MWEs and small, white-male-owned enterprises? Are MWEs falling behind in adopting and implementing information technologies for important business functions?

Answers to these questions can identify ways of helping MWEs and other small businesses become more productive and profitable. In particular, this study's review of actual use of computers, barriers to more effective use, and effects of computer use on business success can guide new public and private initiatives.

Computers are tools that can assist business adoption of modern management practices. Although businesses are diverse, they all participate in such tasks as paying workers and suppliers, accounting and tax reporting, and interacting with customers. Applying computers to these tasks is nearly universal in large businesses but not necessarily in small firms.

This study focuses on differences among small enterprises in the application of computers to administrative and core business activities, not simply on differences in the presence of computers. The study also reveals several findings about the use of computer technologies by small firms:

Performance and productivity gains

- Using computers for more business functions and/or more intensively for business functions raises the productivity and the profitability of small MWEs. Moving businesses from the bot-

tom to the top third of computer users raises productivity by about 41 percent and profitability by 49 percent.

- Extrapolating the gains in value added per worker to all small MWEs in the nation suggests an increase in potential output of between $100 billion and $200 billion per year.

Factors driving technology use

- Computer intensity in small firms increases with the owner's education and personal involvement with technology, with the number of workers, with being in an industry that exhibits extensive use of computers, and with operating in national or regional markets and in multiple locations.
- The main barrier that modestly limited computer use was "having the skills to use computers a great deal in the business." Only about 20 percent of MWEs agreed that they could not afford computers or that they lacked the capital to purchase computers.

Gaps in technology use

- Most small firms use computer technologies for several business functions, especially accounting but also core work activities.
- Small MWEs show no tendency to use computers less than small firms owned by white men.

Obtaining the Information

The project collected data from a telephone survey of 1,123 firms and from 45 in-depth one-on-one field interviews with business owners on site. The telephone survey (or CATI, computer-assisted telephone interview) reached firms with 1 to 50 employees in six metropolitan areas—Chicago, Los Angeles, Miami, New York, Seattle, and Washington, D.C. The sample was stratified so that African American, Hispanic American, or women business owners would make up about 75 percent of all respondents. The sample included only firms operating for at least two years and using at least one computer (very few firms were screened out for this reason). The subjects interviewed by telephone came from a sample of 8,640 firms supplied by Dun and Bradstreet. About one in three of these firms did not qualify for the survey because the sample member did not own a computer, was out of business or had its phone disconnected, had not been in business two years earlier, and/or had too many (over 50) or no employees. About half of the businesses either refused to participate (about 20 percent) or could not be reached after a few tries (30 percent). The overall response rate was 40.1 percent. Still, the survey reached many MWEs, including 351 African American companies, 272 Hispanic American businesses, 197 white-female-owned establishments, and 270 white-male-owned firms.

The in-depth interviews, conducted with a sample of the CATI respondents, probed the motivations of business owners and the use of computer applications specific to three industries (construction, retail trade, and health care services). These industries had high proportions of MWEs and high potential for making efficient use of information technology. These discussions provided new information on the adoption and effective use of computers, the ways computers improve productivity, and the potential gains from additional computer use. The

interviews also served to verify the validity of the interpretations and conclusions drawn from the telephone survey.[3]

The Methods Used to Answer the Questions

Measuring Computer Use

We measure computer use based on each firm's application of computers to a specific business function, such as payroll, accounts payable, inventory management, scheduling, and core business activity. For each of these functions, respondents reported their extent of computer use on a four-point scale: "almost entirely," "moderately," "a little," or "none at all." In addition, the survey measured computer use in attracting and interacting with customers and in performing various accounting functions. The survey questions covered computer use at the time of the survey (September 2003 through November 2003) and two years earlier (in 2001). To capture differences in computer use as a whole, we developed a summary computer intensity index that incorporates the number of functions involving computers and the intensity of their use.[4] In addition, we examined the amount of money spent on computers.

Estimates of potential gaps in computer use by race, ethnicity, and gender require good measures of computer use, sound statistical methods, and an understanding of broader factors affecting computer use. To capture the gross differences, we first compare the average amounts of computer use in a variety of categories and in index. Next, we use a statistical test to estimate whether any observed differences were likely to have arisen by chance. The next step is to consider the potential variations based on *net* differences in computer use—gaps that remain after accounting for differences in firm location, industry, size, and age.

Understanding Broader Factors Affecting Computer Use in Small Firms

A multivariate statistical model isolates the independent role of various factors affecting computer use. This model isolates the impact of several determinants of computer use, including *owner characteristics* (e.g., age, educational attainment, race/ethnicity, and gender) and *worker and firm characteristics* (e.g., number of workers, number of firm locations, years in business, marketplace for goods or services, metropolitan area, and industry). In addition, the analyses take account of the owner's experience and comfort with computers and other digital technologies.

How Computer Use Affects Firm Performance and Productivity

Computers are tools for solving business problems and for accomplishing business functions efficiently. In principle, computers can improve a firm's performance by reducing the number of workers required for a given task and by increasing a firm's sales without substantial increases in labor costs or other costs. The best indicator of firm productivity is value added per worker. In practice, however, this measure is difficult to obtain because it requires data on the costs of intermediate goods and services as well as data on sales. Instead, this analysis focuses on two other measures of firm performance: sales per worker (net of outlays on computers) and profits (holding constant for number of workers).[5]

Estimating the effect of computers on firm performance is complicated by the difficulty in determining whether computer use is causing or is simply correlated with business success. The fact that high computer use goes together with high levels of firm performance is suggestive but not definitive in demonstrating a positive impact of computer use. The positive correlation *may* result from the impact of computer use on firm performance. However, another explanation is that high levels of firm performance increase the use of computers. For example, a firm with high profits for reasons unrelated to computer use may be more able and likely to invest in computers than a firm with little or no profits.

One way to deal with this two-way direction of causation involves a two-stage process. This approach identifies factors (called *instrumental variables*) that exert a direct effect on computer use but do not directly influence firm performance. The key to estimating this model is finding and including such variables; we chose to include three. First is the percentage difference in the number of years owners have used computers.[6] Second is owners' use of handheld computers, or personal digital assistants (PDAs). Both variables indicate something about owners' personal involvement with computers and their propensity to emphasize computers in their businesses. However, neither variable should exert a direct effect on firms' sales or profitability. A third instrumental variable is an index of computer use by detailed industry. The higher the average use of computers in a given industry, the higher the expected computer use by a firm in that industry would be. In other words, this analysis involves a first stage, in which the instrumental variables and other variables predict the intensity of computer use, and a second stage, in which *predicted* computer use and other variables determine firm performance. The size and statistical significance of the predicted computer use variable should capture the causal effect of computer intensity so long as the instrumental variables work as expected in predicting computer use without having a direct effect on firm performance.

Applying the basic two-stage model to our study involved additional decisions about which other variables to consider and which groups of firms to include in each analysis.[7] To control for factors affecting firm performance other than computer use, we included the owner's age, education, race, Hispanic origin, and sex as well as the firm's metropolitan area, number of workers, industry, number of locations, market coverage (local, regional, national, international), and ownership form (proprietorship or corporation). Given that the study focuses primarily on minority- and women-owned enterprises, some analyses were conducted using only firms owned by African Americans, Hispanics, and white women. Because the one-on-one interviews indicated that gains from intensive computer use were likely to materialize only among firms with at least a minimum scale, we focused on separate estimates for firms with at least $5,000 in labor costs.[8] Although we estimated many specifications in the course of this project, this report presents only a small subset of the many statistical analyses estimated for the project.[9]

Conducting the One-on-One Interviews

The interviewers used a semistructured protocol in 60- to 90-minute meetings with small business owners at their company locations. The researchers began each meeting with questions about the background of the business, its growth strategies, and its use of computers (an inventory of computer equipment and applications). The next questions dealt with firm's computer use in four functions: (1) customer acquisition and management; (2) service and product

delivery; (3) internal operations; and (4) interactions with suppliers or other inputs. In addition, the interviews covered computer use for accounting and for the firm's core technology.

The respondents were asked to describe their operations in each area (e.g., "How do you get new customers?" "What are the primary ways you increase your business?"). Next, they were asked specifically about computer use in these areas. Interviewers found out how respondents made computer purchase and upgrade decisions, how they maintained their computers, and what other experiences firms had with their computers. We concluded the interviews with questions about any barriers to computer use the businesses were experiencing and the factors most important in increasing competitiveness and profitability of their businesses. Interviews were audio recorded, transcribed, and coded for analysis.

The Characteristics of Firms and Business Owners

The sample firms vary widely by industry, years in operation with the current owner, size, and market area. As table 1 reveals, the typical firm has about six employees, has been operating for about 10 years (15 years for white male owners), and mostly operates in one location. Surprisingly, over half of the firms see themselves as reaching beyond the local market to regional, national, and even international markets. The firms typically employ college-educated managers, while the median non-manager has only a high school education. About two out of three of the firms are organized as corporations and nearly all the rest are sole proprietors. About half of the firms are in a service industry, while construction and the retail trade are the next largest industries, though the proportions vary substantially by gender.

Reports by owners or other firm representatives reveal a wide variation in sales, profits, and costs. Reported sales for 2003 reached more than $1 million per year for the top 25 percent of firms but only $120,000 per year for the bottom 25 percent. The profit level of the top 25 percent of firms ($272,000) was nearly 14 times the level of the bottom 25 percent ($20,000).

The owners are well educated. Note in table 2 that, except for Hispanics, most owners are college graduates and about 20 percent have a graduate degree. The education attainment gap between African Americans and whites is minimal. The high educational level among African Americans is noteworthy, given the much lower levels of education attained by the overall African American population. The owners in the middle of the age distribution are in their mid- to late 40s. About half of the African American and white male owners are between the ages of 39 and 56. Hispanic owners are slightly younger but still average in their early 40s. By implication, most respondents became business owners in their early to mid-30s.

The absence of an education gap between African Americans and whites, as well as the relatively high levels of education among Hispanics, raise questions about the nature of this sample of business owners. To examine whether this pattern reflects the requirements for entering the sample—firms with 1 to 50 employees, with a computer, and in business for at least two years—we tabulated and compared relative educational levels in this sample with those from the Survey of Small Business Finances (SSBF). The results are interesting. First, educational levels of *all* small business owners are quite high, but African American owners have somewhat lower college graduation rates than white owners (44 percent vs. 51 percent). Second, among small firms with 1 to 50 employees and in business for at least two years, the educational levels

TABLE 1. Firm Characteristics in 2003, by Race and Gender of the Majority Owner

Firm characteristic	African American female	African American male	Hispanic female	Hispanic male	White female	White male
Median firm size (Number of employees)						
All workers	6.0	7.0	5.0	6.0	5.0	6.0
Number of owners working for pay	1.0	1.0	1.0	1.0	1.0	1.0
Managers	1.0	2.0	1.0	1.0	1.0	1.0
Non-managers	3.0	4.0	3.0	4.0	2.0	3.0
Median years in business with current owner	9.0	11.0	9.0	10.0	11.0	15.0
Average number of firm locations	1.2	2.0	1.2	1.2	1.2	1.5
Marketplace for goods or services						
Local	50.8%	40.3%	50.0%	47.4%	45.7%	47.9%
Regional	23.8	27.1	23.7	30.1	20.8	26.0
National	19.2	23.1	10.5	10.2	18.8	15.1
International	6.2	9.5	15.8	12.2	14.7	10.9
Industry						
Agriculture	1.5%	1.4%	1.3%	1.0%	3.0%	2.2%
Construction	3.8	15.4	1.3	14.8	4.6	12.6
Manufacturing	2.3	6.3	11.8	9.2	7.6	6.7
Transportation	8.5	6.3	6.6	5.6	5.6	3.7
Wholesale trade	1.5	5.9	14.5	10.7	6.1	7.4
Retail trade	10.0	4.5	10.5	10.7	15.7	12.2
Finance	6.2	5.4	6.6	4.1	4.1	8.1
Business services	20.8	22.2	18.4	11.2	19.3	8.9
Health	4.6	2.3	7.9	5.1	3.6	5.6
Legal	3.1	0.9	1.3	3.1	3.0	9.3
Engineering, accounting, and management	20.0	22.2	9.2	13.3	10.7	11.9
Other services	17.7	7.2	10.5	11.2	16.8	11.5
Median educational attainment of employees (Years)						
Managers	14.0	15.0	14.0	14.0	14.0	14.0
Non-managers	13.0	13.0	12.0	12.0	13.0	12.0
Number of firms	130	221	76	196	197	270

SOURCE: Authors' tabulations from the Urban Institute telephone survey.

of African American owners were even higher (56 percent graduated from college) and reached near parity with white male owners.

The levels of education among owners of small firms far exceed the educational attainment of the adult population for all demographic groups. Of all African Americans in their mid-40s (about the median age of business owners), only 19 percent had graduated from college as of 2002. The college graduate rate for the African American owners in this sample is three times higher (61 percent); for all African American business owners, the college graduation rate is still more than twice as high (44 percent) than that of the general African American population. Even among white males, college graduation rates are much higher among business owners (60 percent) than among the population as a whole (32 percent).

TABLE 2. Owner Characteristics in 2003, by Race and Gender

Owner characteristic	African American female	African American male	Hispanic female	Hispanic male	White female	White male
	Mean	Mean	Mean	Mean	Mean	Mean
Share of all sample firms[a]	11.6%	19.7%	6.8%	17.5%	17.5%	24.0%
Age (Years)	43.5	47.2	40.3	41.7	46.7	47.4
Educational attainment						
Less than high school diploma	0.8%	0.5%	5.3%	4.1%	0.0%	1.1%
High school diploma	5.4	10.5	13.2	15.3	12.3	10.7
Some college	29.5	29.2	32.9	35.7	32.8	25.6
College degree	40.3	37.0	32.9	28.6	34.9	40.0
Graduate degree	24.0	22.4	15.8	15.8	18.5	20.0
Years of ownership	11.7	12.0	11.2	11.8	12.5	17.0
Computer use						
Years of computer use	15.0	15.2	12.4	13.1	14.6	13.9
Comfort level with computers						
Very comfortable	70.3%	66.8%	60.0%	62.9%	53.1%	51.9%
Somewhat comfortable	22.7	26.8	30.7	32.5	33.7	36.5
Somewhat uncomfortable	6.3	5.5	6.7	3.6	9.2	7.1
Very uncomfortable	0.8	0.9	2.7	1.0	4.1	4.5
Cell phone ownership (%)	83.8	81.0	75.0	81.1	76.1	76.7
PDA ownership (%)	27.7	31.2	23.7	21.9	13.2	24.4
Number of firms	130	221	76	196	197	270

SOURCE: Authors' tabulations from the Urban Institute telephone survey.
a. The percentages will not add up to 100 because the 33 Asian firms in the sample are not included in this table.

A firm's computer use might reflect the owner's experience with computers and other new technologies. The survey results indicate a high level of comfort and experience with computers across all demographic groups. About 60 percent of owners said they are very comfortable with computers. As table 2 shows, African American owners reported the highest level of comfort—two out of three said they were very comfortable—while white male owners reported the lowest comfort levels. Data on the years of experience with computers show a similar but not identical pattern. African American owners averaged 15 years of prior experience with computers, a level higher than the 13.9 years averaged by white male owners. Other indicators also show owners use modern technologies at high rates. Nearly 80 percent own cell phones and nearly 25 percent own PDAs. In both cases, the rates are higher among African American than among white male business owners. Women and Hispanic owners, however, are somewhat less likely to own a PDA than are white male owners.

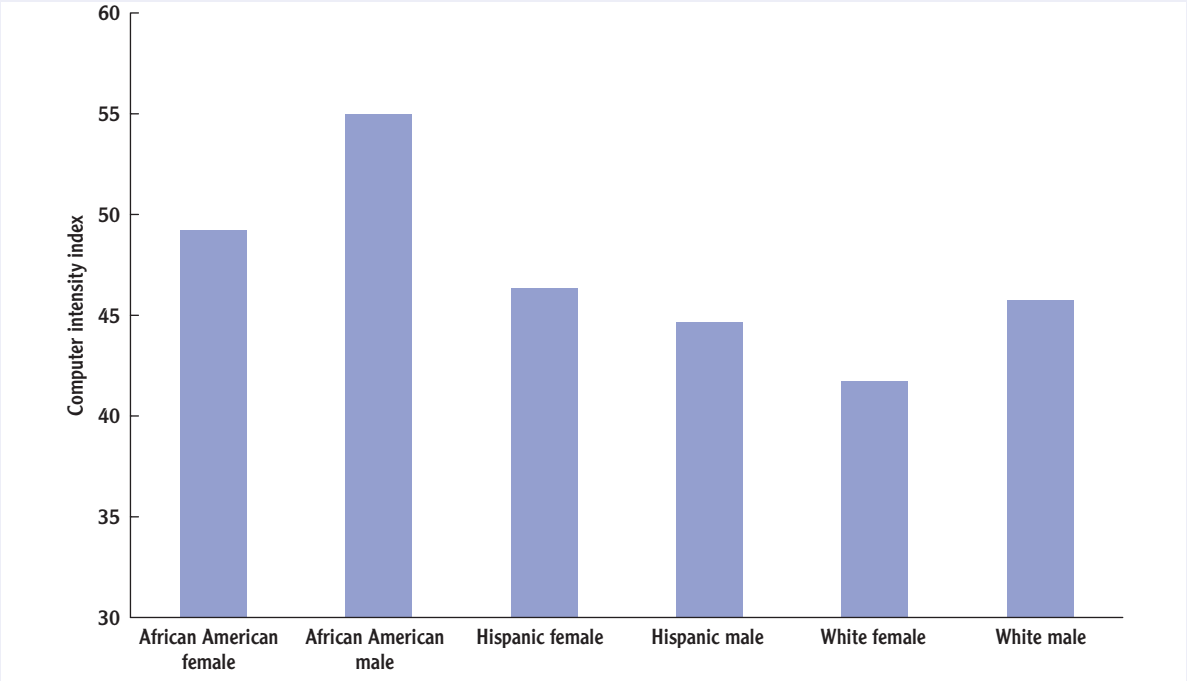
Overall, the survey results suggest that this group of small business owners is highly educated, experienced, and technology oriented. Moreover, the findings clearly indicate that African American and women owners are not disadvantaged relative to white owners in terms of observed characteristics. While Hispanic owners do exhibit a lower level of educational attainment than do white male owners, Hispanic–white male gaps are modest.

The Patterns of Computer Use among Small Businesses

One type of business gap involves shortfalls in computer use by minority- and women-owned enterprises relative to those owned by white males. Surprisingly, however, the data show no serious and consistent differences of this type. As figure 2 illustrates, computer use in 2003 was highest among firms owned by African Americans, next highest among Hispanic women–owned firms, similar among white and Hispanic male–owned firms, and lowest among white female–owned firms. In two-way comparisons between white males and other groups, both the advantage of African American owners and the disadvantage of white women were statistically significant. Thus, with the exception of slightly lower computer use among white women, the gaps in computer use by race, ethnicity, and gender did not materialize.

Turning to computer uses for specific business activities, we again find no evidence of a gap by race or gender. As table 3 shows, white-male-owned enterprises typically show no greater systematic tendency for using computers for specific business activities than do firms owned by minorities and women. Again, African American owners demonstrate significantly higher computer use than do white males. Hispanic and women-owned enterprises sometimes average higher computer use and sometimes average lower computer use when compared with white males, but the dominant indication is one of no significant difference. Other specific indicators of computer intensity, such as computer spending per employee and percentage of employees using computers, confirm the same basic pattern of computer use.

FIGURE 2. Computer Intensity of Small Enterprises Varies by the Race, Hispanic Origin, and Sex of the Majority Owner



SOURCE: Telephone survey designed by the Urban Institute and implemented by NuStats.

TABLE 3. Firms' Computer-Related Characteristics in 2003, by Race and Gender of the Majority Owner

Computer-related characteristics	African American female	African American male	Hispanic female	Hispanic male	White female	White male
	Mean	Mean	Mean	Mean	Mean	Mean
Computer intensity index[a]	49.2	55.0	46.3	44.7	41.7	45.7
Share of firms that use computers for						
Interacting with customers	62.0%	65.2%	47.4%	46.7%	56.9%	53.0%
Accounting functions	84.5	82.8	77.6	74.5	82.2	83.0
Paying suppliers	57.8	66.1	67.1	59.5	49.7	60.6
Payroll	59.1	68.8	50.0	53.8	47.4	57.6
Managing inventory	50.8	50.7	51.3	43.9	31.5	35.7
Scheduling	59.7	63.8	52.6	50.3	39.6	47.4
Core work activities	75.2	73.8	63.2	62.1	55.8	63.2
Number of firms	130	221	76	196	197	270

SOURCE: Authors' tabulations from the Urban Institute telephone survey.
a. This computer intensity index uses seven business functions and takes on a value of 0 to 100, where a higher value implies higher computer use.

While few gaps emerge by race, ethnicity, and gender, limited use of computers is common among small firms in general and small MWEs in particular. For example, over 40 percent of MWEs reported minimal or no reliance on computer technologies for their core work activities. This group of firms is also less likely to apply computer technologies to scheduling, inventory, payroll, and accounting functions.

Information from the one-on-one interviews suggests that small businesses sometimes overstated and sometimes understated their use of computers in the telephone survey. Consider the use of e-mail to attract or interact with customers. Although 43 percent of firms reported this use of computers, the in-depth interviews revealed that far fewer reported using e-mail on a daily basis, and even then, most reported only one or two business e-mails per day. Typically, businesses used e-mail with suppliers more than with customers (retail) or with patients (health care), and for submitting bids more than for interacting with clients (construction). The one expection is that contractors involved in design regularly used e-mail to discuss design details.

A similar story emerges for Web sites. In response to the telephone survey, 42 percent of firms reported having a Web site. Yet, in the in-depth interviews, it became clear that few were using high-functioning Web sites. Most Web sites were informational only and did not allow for other functions, such as ordering products, scheduling services, or filling out necessary forms. Not much customer acquisition took place through Web sites.

The accounting function exhibited the most extensive computer use, with 68 percent of owners reporting in the telephone survey that they used computers for various accounting functions (payroll, receivables/payables, taxes). Owners identified the benefits they perceived in using computers for these functions. In one health care business, the interviewee indicated that technology helped her manage business income and set goals for maintaining the flow: "Tracking patient billing and payments by computer allows me to run reports and see where incoming money is delayed. I can keep on target with my 'one-month run' goal (not letting patient and insurance company payments go beyond one month)."

Although computer use was widespread in performing accounting-related functions, many owners were not utilizing available functions. Sometimes this occurred in businesses that otherwise demonstrated high computer usage. One reason was that owners like to "stay with what has always worked" and many want to "touch and feel" their money, which, in their perception, they can do if they have accounts written in pencil on paper rather than accounts accessible only through a computer keyboard.

The case of computer use for core business activities is complicated by the fact that the relevant computer application varies across industries. In retail, a core function includes point-of-sale and business-specific systems, such as a computer-controlled drink dispenser for a bar. Core functions for health care systems involve patient record management and other processes used in providing treatment (e.g., a system for recording skeletal alignment in a chiropractor's office). Process technology for construction consists of estimation, design, and project management systems.

The field visits and interviews revealed that small business owners sometimes used computers for core business activities without knowing it. Many interviewees did not immediately identify core processes and technology use and/or did not identify the technology as a computer technology. Although the field interviews identified more use of computer-based technology for core functions than firms reported by telephone, the telephone survey responses indicated a common perception that business owners believe that technology is peripheral to their core business functions, to how they conduct their primary work functions.

Throughout the interviews, we heard about the tension between an emphasis on technology to control processes and attention to service that improves the customer relationship. These issues obviously are not always in conflict, but the interviewees often identified them as a trade-off—not just in terms of how increased computer use changed the process but also in terms of where owners focused their attention and time. In some firms, there were clear productivity gains through computerization. For example, one car dealer explained,

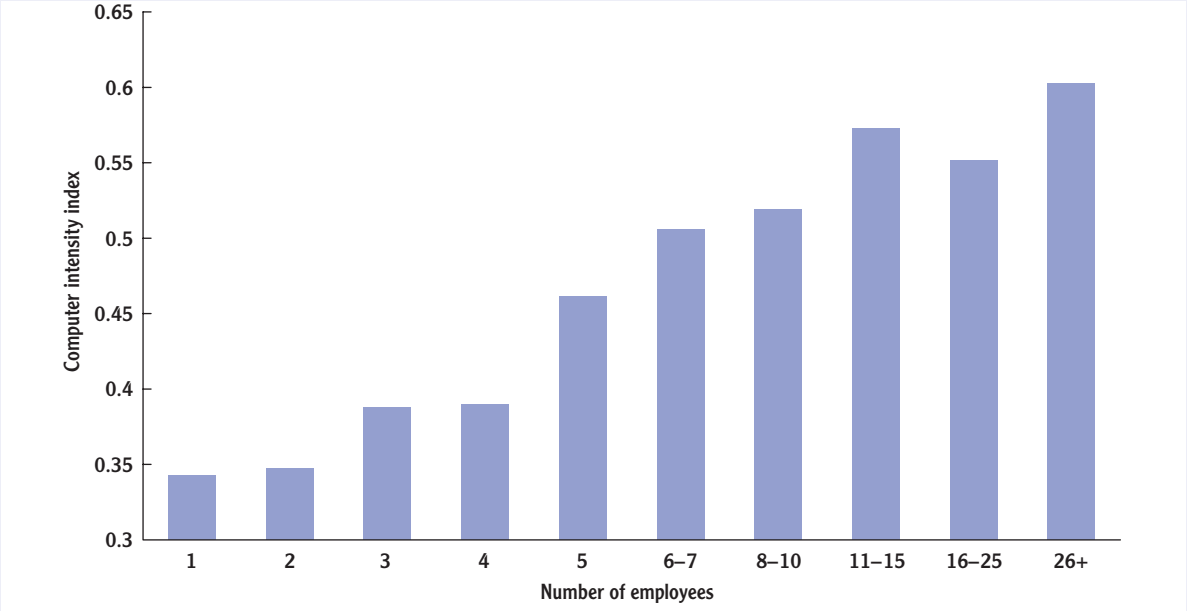
> Computer forms and submissions save time—it now takes only 5 to 10 minutes instead of the normal 20 to 25 minutes . . . but we only sell 30 to 40 cars per month. Even though the savings are significant, it does not add up to much over the course of a tracking period. But, it does translate into an easier, more pleasant experience for the customer.

Many of these businesses employ staff at a level to keep the business open; they may be hardly affected by small to moderate productivity gains. For example, for a small store, the number of sales people required to keep the store open and assist customers will not be greatly reduced by greater efficiency in processing orders; most employee time is still devoted to the human interaction in the sales process. Moreover, field evidence indicates there is a clear distinction between extensive computer use and strategic computer use. Firms may use computers for several functions without strategically applying computers to improve performance.

What Determines Computer Use by Small Firms? What Limits Expansion?

Computer use varies substantially among small businesses because of differences in firm and owner characteristics. Firm size is a major determinant. As figure 3 shows, the computer

FIGURE 3. Computer Intensity Increases with Number of Employees



SOURCE: Telephone survey designed by the Urban Institute and implemented by NuStats.

intensity index increases sharply and steadily as the number of employees rises from 1 to the 11–15 range and then peaks for firms with more than 25 workers. Multivariate statistical analyses can incorporate at one time how the firm and owner characteristics influence the firm's computer use.

The results shown in table 4 confirm expectations on several indicators. The owner's personal involvement with technology exerts a significant impact on his or her firm's use of computers. For example, firms with owners who own PDAs raise their score on the computer intensity index by about 9 percentage points, or about 18 percent of the mean value. A similar increase occurs with a 10 percent increase in years of owners' computer experience. Computer intensity is higher among more educated owners; mainly, educated owners have more experience and comfort with computers than less educated owners. Among owners with the same computer experience, owners' education exerts no additional effect on firms' computer use. Firms with more workers, companies in computer-intensive industries, and businesses with national or regional markets (instead of local markets) are more likely to use computers. Washington, D.C., and Seattle are the two metropolitan areas with the highest computer use, though firms in Chicago and Los Angeles also have higher computer use than firms in the New York City metropolitan area.

Some factors either exert impacts in unexpected directions or exercise no significant influence on computer use. Older firms, which might have well-developed business structures, tend to use computers less intensively than do younger firms. However, this effect is minimal in size, as is the effect of the age of the business owner.

Firms reported surprisingly few constraints limiting their computer use. Only about 20 percent of MWEs agreed that they could not afford computers or that they lacked the capital

TABLE 4. Determinants of Firms' Computer Intensity

	All small enterprises	Minority- and women-owned enterprises
Owner characteristics		
Race and sex[a]		
African American male	0.045**	0.079***
African American female	0.017	0.050*
Hispanic male	–0.020	0.010
Hispanic female	0.011	0.040
White/Asian female	–0.031	
Age	–0.002***	–0.002***
Missing age	–0.118***	–0.126***
Educational attainment[a]		
Some college	0.015	0.030
College degree	0.039*	0.033
Graduate/professional degree	0.029	0.007
Firm characteristics		
Years with current ownership	–0.002**	–0.002**
Number of firm locations	0.001	0.003
Number of employees	0.004***	0.003***
Firm's legal status[a]		
Proprietorship	–0.062***	–0.069***
Marketplace for goods/services[a]		
Local	–0.100***	–0.109***
Regional	–0.049***	–0.039*
Geographic location[a]		
Chicago	0.041*	0.040
Los Angeles	0.050**	0.047
Miami	0.005	0.002
Seattle	0.063**	0.057*
Washington	0.060***	0.059**
Firm's industry[a]		
Construction	–0.030	–0.034
Finance	–0.035	–0.024
Manufacturing	0.007	0.025
Retail trade	–0.023	–0.025
Transportation	–0.014	–0.017
Wholesale trade	0.032	0.031
Engineering, accounting, and management	0.028	0.031
Health	0.011	0.009
Legal	–0.039	0.005
Other	–0.041	–0.037
Experience with computers[a]		
Log of industry-level computer index	0.048	0.023
Owner's years of computer use	0.084***	0.091***
Comfort level with computers	0.075***	0.072***
Cell phone user	0.037**	0.033*
PDA user	0.090***	0.092***
Constant	0.237***	0.246***
Observations	1,024	776
Adjusted R-Squared	0.356	0.343

SOURCE: Ordinary Least Squares estimates by authors based on the Urban Institute telephone survey.
NOTE: The sample includes only firms with at least $5,000 in labor costs.
a. Omitted variables include white male, high school education or less, corporation/partnership, national/international marketplace, New York.
*p < .10. **p < .05. ***p < .01.

to purchase computers. Even among low computer users, less than one-quarter expressed these problems. One barrier that modestly limits computer use is "having the skills to use computers a great deal in the business." More than 25 percent of low users reported this problem and another 21 percent were uncertain about their skill level. Moreover, controlling for other owner and firm characteristics, being uncertain about or lacking skills exerts a small but statistically significant negative impact on computer use.

Given the substantial role of owners' computer skills, experience, and comfort in determining computer use by small firms, it is not surprising that the technology resources available in owners' social networks are important in determining the extent and effectiveness of computer use. In-depth interviews revealed that often the owner's primary resource for computer installation, networking, and/or software development is a family member or a friend. For example, a 74-year-old camera shop owner reported buying the region's first digital processing equipment because his daughter, who worked in the IT industry, insisted that he do so. He had a Web site because his granddaughter, who worked as a Web designer, insisted upon it and developed it for him. An occupational therapist practice had a sophisticated database that the owner's son-in-law, a programmer, had developed.

While unexpected, the strong dependence on social networks for computerization is consistent with the overall business approach of many firms. Owners often mentioned that they began their business without much professional advice or guidance and that their friends and family provided advice, staffing, and financial assistance. Social networks can be a source of low-cost technology support. However, they can cause firms to become dependent on the availability of largely unpaid and not always available family and friends.

Level of technology expertise varies by owners' socioeconomic status, and this is cause for concern. Those with higher incomes (generally not in the urban inner city) reported that they had access to family and friends who worked in the IT industry. Those owners reporting very limited technology use and more problems often had little access to quality computer support. The barrier in these businesses appears to be less the owners' level of computer skills and more their limited access to high-quality, reliable technology support in their social network. Paid consultants were reported as expensive and the quality of support they offered varied.

Organizations with which a business interacts sometimes help drive computer use. The experiences of health and construction firms offer good examples. Health care offices reported that computer-generated reimbursement submissions to insurance companies experienced lower rejection rates than those filled out manually. Respondents reported that while the computer-generated submissions were not necessarily more accurate, their appearance indicated a more systematic process and therefore insurance companies were more likely to accept them as submitted. However, because the entire insurance reimbursement process is a large burden, many health care practices have begun to outsource the entire insurance reimbursement submission process.

In the construction industry, building loans are released on a rolling basis as a given project is at different stages of completion. To receive the loan, the company must submit a progress report for the project. Most businesses reported that they find it easier (and that lenders find it more "legitimate") to track progress on a spreadsheet that provides a breakdown of job components and shows the percentage of the job completed.[10] Minority contractors working on projects that were specifically geared to minorities stated that the additional reporting requirements and job tracking were easier on a computer.

Industry associations and minority and women business organizations are important resources for improved computer use. These organizations can provide the advantages of scale and offer professional support at a low cost. For example, a chiropractor purchased a semi-custom Web site for $400 from a chiropractic association. This site provided in-depth information and, though somewhat generic, was higher in quality than a business of that size could purchase alone. The FTD retail flower company provides to individual stores a semi-custom Web site with flower information and ordering capability. Wider involvement by business associations in providing customizable software and/or support could expand the technology capabilities of small firms.

Computer Use, Productivity, and Firm Performance

Many small firms saw business development and competitiveness driven by acquiring customers and by establishing higher profitability with higher-volume customers. Gains in productivity and operating efficiencies were less central to these businesses than to moderately larger businesses. These smaller businesses were often most interested in something to help them first to provide better service and, second, to improve efficiency. Technology was often successful in meeting both objectives. Moreover, small firms reported that administrative efficiencies helped them better service and potentially free up time for activities more closely related to productivity and competitiveness. Productivity gains might not be reflected in overall business outcomes, however, if the opportunities for productivity savings are in peripheral areas of the business (e.g., administrative functions) and if these small businesses are not large enough to realize such gains. The indications are that strong economic gains are realized only in the presence of some scale.

We take these considerations into account when analyzing computer impacts on the productivity of small firms. The question here is, did differences in computer use lead to differences in the performance of firms, as measured by two indicators—sales less computer costs per worker and profits per firm? Although these sales measures do not incorporate the costs of intermediate goods and services purchased by the firm, the industry variables should control for some of the variation in the relationship between sales and the costs of intermediate goods. To reduce the role of outlier firms and to capture percentage impacts, we conducted the regression analyses using the natural log of the variables [(sales minus computer costs)/workers] and the natural log of profits. For the models presented in this report, we excluded the smallest firms—those with no more than $5,000 in annual labor costs.

Correlations show that computer use and firm performance go together. The higher the computer intensity index is, the higher the sales per worker, profits, profits per worker, and sales net of computer costs per worker are. The tabulated correlations between these variables and computer use are all statistically significant. Yet while these relationships are of interest, they do not tell us whether computer use contributes to firm performance. It might be that other factors that improve performance generally influence businesses to use computers more intensively and for more functions. The first step in examining this possibility is to control for firm and firm owner attributes that might raise both computer use and measures of firm performance. For example, more educated owners may achieve higher levels of firm performance and also be more likely to use computers extensively. Similarly, firms operating in national

markets might achieve higher sales and choose to use computers more intensively than might firms in local markets.

Linear regression analysis can help isolate the association between computer use and firm performance, independently of these and other firm characteristics. One set of linear regressions take account of the firm's industry, number of workers, market coverage, metropolitan area, number of locations, years of operation under current ownership, and corporate form as well as the owner's age, education, race, sex, and Hispanic origin. The results show that, even after controlling for these characteristics, computer use is closely linked with indicators of firm performance. All of these associations are large and statistically significant. They indicate that a change in the computer index from 0 (zero) to 1 is associated with a 94 to 98 percent increase in sales per workers. Of course, firms are very unlikely to have indices near 0 (zero) or 1. A more plausible change involves moving a firm from the 33rd to the 67th percentile of computer use. Doing so would increase the firm's score on the computer index by 0.28, which is equivalent to increasing the use of computers for all seven functions by one "notch" (from "a little use" to "moderate use," for example). This change of 0.28 would be associated with about a 26 to 27 percent increase in sales per worker.

Other notable results emerged from the regressions. Controlling for firm size, industry, and other firm and owner characteristics, businesses owned by African Americans experience significantly lower sales per worker than do businesses owned by white males. The lower sales translate into lower profits for African American women owners but not for African American male owners. Surprisingly, age, education, and metropolitan area make little difference in terms of sales or profits. As expected, industries differ markedly in terms of sales per worker and profits. Construction and finance firms show consistently high sales per worker and profits; to a lesser extent, firms in wholesale trade and transportation also do better than most other industries. The effects of scale are mixed. Added workers are associated with lower sales per worker. However, the sales-per-worker number is higher for firms featuring more locations and covering a national or international market.

These results are informative, but they are unlikely to measure the *causal* effect of computer use on firm performance. Instead, these estimates might have come about because firms that do well for reasons unrelated to computer use end up utilizing computers intensively. As a result, it might well be that higher sales per worker cause more computer use instead of the other way around. For this reason, we turn to the two-stage model discussed above. This model should not be subject to the reverse causation problem because its estimates of the computer use impact rely on the interaction between predicted computer use and firm performance. It should answer a key question: Is the positive relationship between computer use and firm performance a causal impact in which higher computer use leads to higher sales per worker?

The findings in table 5 suggest that the answer is yes. As part of the two-stage model, we first predict the firm's score on the computer intensity index based on firm characteristics, owner characteristics, and the special instrumental variables (natural log of years of computer use, owner's comfort level with computers, owner's PDA usage, and the computer intensity of the firm's two-digit industry). The first three of these instruments are statistically significant (at the 1 percent level) predictors of computer use; the industry computer index is not statistically significant (even at the 10 percent level).

The effects of computer use are statistically significant and surprisingly large. The gains in sales per worker linked to computer use are quite dramatic for all small firms of at least

TABLE 5. Impacts of Computer Intensity on Productivity and Profits

	Productivity—Log of sales (net of computer costs) per worker		Log of profits per firm	
	All small enterprises	Minority- and women-owned enterprises	All small enterprises	Minority- and women-owned enterprises
Computer intensity (predicted)	1.154**	1.472**	1.648*	1.743*
Owner characteristics				
Race and sex[a]				
African American male	–0.417***	–0.184	–0.040	0.091
African American female	–0.644***	–0.409**	–0.471**	–0.319
Hispanic male	0.020	0.289*	0.046	0.231
Hispanic female	–0.077	0.225	–0.164	–0.007
White/Asian female	–0.254*		–0.147	
Age	–0.006	–0.005	–0.005	–0.006
Missing age	–0.374	–0.308	0.004	–0.052
Educational attainment[a]				
Some college	0.035	–0.066	–0.114	–0.268
College degree	–0.047	–0.170	–0.127	–0.207
Graduate/professional degree	0.048	0.009	–0.089	–0.052
Firm characteristics				
Geographic location[a]				
Chicago	0.260	0.194	–0.163	–0.113
Los Angeles	0.311*	0.193	–0.089	–0.151
Miami	0.109	0.006	–0.173	–0.289
Seattle	–0.060	–0.127	–0.417*	–0.560**
Washington	0.114	–0.012	–0.321	–0.460*
Firm's industry[a]				
Construction	0.545***	0.694***	0.656***	0.743***
Finance	1.232***	1.395***	1.495***	1.555***
Manufacturing	0.249	0.112	0.287	0.141
Retail trade	0.194	0.355	0.199	0.155
Transportation	0.596***	0.659**	0.508*	0.670**
Wholesale trade	0.744***	0.693***	0.404	0.348
Engineering, accounting, and management	–0.014	–0.047	–0.213	–0.292
Health	–0.058	–0.328	0.219	–0.125
Legal	0.356	0.241	0.002	–0.001
Other	–0.075	0.031	0.141	0.099
Years with current ownership	0.014**	0.019**	0.014*	0.024**
Firm's legal status[a]				
Proprietorship	–0.307**	–0.311**	–0.320**	–0.304
Marketplace for goods/services[a]				
Local	–0.416***	–0.527***	–0.335*	–0.389*
Regional	–0.314**	–0.355**	–0.172	–0.193
Number of firm locations	0.047**	0.041*	0.075***	0.072**
Number of employees	–0.044***	–0.050***	0.031***	0.029***
Constant	11.252***	11.002***	11.116***	11.038***
Observations	711	547	511	401
Adjusted R-Squared	0.192	0.183	0.212	0.226

SOURCE: Two-Stage Least Squares estimates by authors based on the Urban Institute telephone survey.
NOTE: The sample includes only firms with at least $5,000 in labor costs.
a. Omitted variables include white male, high school education or less, corporation/partnership, national/international marketplace, New York.
*p < .10. **p < .05. ***p < .01.

$5,000 in labor costs and for MWEs at this scale. If these results are accurate, there are major payoffs from increasing the intensity of computer use, possibly through the computerization of more accounting and customer support functions and/or the automation of accounts payable, payroll, inventory management, scheduling, and core work activities. A rise of 0.28 on the computer intensity index is linked to nearly a 41 percent increase in sales per worker ($0.28 \times 1.47 = .41$) and an even higher increase in profits. Although these impacts are strikingly large, one should use caution in drawing conclusions. For one thing, not all specifications yield statistically significant impacts. In particular, the impact of computer use is not significant in several specifications that include all firms (even those with extremely low revenues and labor costs).

The productivity (sales per worker) effects of variables other than computer use are similar to those observed in the simple linear regressions. The industries with the highest productivity levels are finance, wholesale trade, and transportation. Firms organized as proprietorships have lower sales per worker, as do firms with few locations, only a local or regional market, and fewer numbers of employees. Those businesses in operation for more years demonstrate higher productivity; in fact, each additional year raises productivity by about 1.5 percent. The owner's age and education and the firm's metropolitan location are generally not statistically significant explanations of productivity or profit.

Again, most striking are the large negative and statistically significant effects on productivity associated with firms owned by African Americans. This finding is consistent with the analysis conducted by Fairlie and Robb (2003). They contend that a lack of experience in a family business accounts for some of the lower success rates among African American–owned firms. While 23.3 percent of white business owners had prior experience in a family member's business, only 12.6 percent of African Americans did so. Fairlie and Robb's results differ somewhat from ours with respect to profits. While they project lower profits for African American firms, we find that businesses owned by African American men achieve profits as high as otherwise comparable firms owned by white males but firms owned by African American women experience lower profits.

Given the high computer intensity demonstrated among businesses owned by African American men, it is surprising that their sales-per-worker figure is relatively low. Although differences in broad management practices or employee skills may be at work, another possible explanation is differences in the *cost-effectiveness* of computer use manifested in ways not captured by our computer intensity measure. Perhaps there are differentials in the ability to achieve higher productivity and/or profits from the customer service, accounting, payroll, inventory, and core business uses. Capturing in detail the ways different firms adopt and capitalize on computer technology for raising productivity and/or profits is beyond the reach of this study.

Effects of Improving MWEs' Computer Use on the National Economy

Projecting the results observed for MWEs to impacts on the national economy required several steps and assumptions, with the ultimate goal of translating the increase in computer use for each MWE into a meaningful economic gain. The first step was to determine the measure of

primary interest. The approach used here was to focus on gains in the amount of value produced per worker less the added computer costs. Such gains (summed over all firms) would represent the increase in the nation's potential to produce goods counted as adding to the nation's gross domestic product (GDP). For these gains to materialize, the demand for the goods and services produced by these firms would have to increase an equivalent amount.

The second step was to calculate an average gain figure for each MWE in the sample. To do this, we used two-stage models to derive impacts on value produced per worker (hereafter called value added). The dependent variable for these estimates was the natural log of sales minus costs other than labor costs per worker.[11] For each firm, we calculated two predicted values of value added per worker—the first using the firm's actual computer index and a second assuming each firm raised its computer use by +0.28 to a maximum of 1.0 (i.e., those with levels at about 0.72 would see a gain in computer use of less than +0.28).[12] The difference between the second measure and the first represents the gain in value added per worker. We then multiplied this gain per worker by the number of workers to obtain the total gain for each firm. To recognize that raising one's computer use might require additional computer spending, we subtracted an estimate of the added computer spending costs associated with raising the firm's level on the computer intensity index.[13]

The final step was to calculate the aggregate gains for all MWEs. The key assumptions were that the composition of firms and gains in value added in our sample would be the same for all MWEs in the country. We calculated mean and median gains separately for each demographic group of minorities and women. We then multiplied these average gains per firm by the number of MWEs with 1 to 50 workers in the nation as a whole as of 1998.

The procedure ultimately yielded estimates in potential GDP of between $100 billion and $200 billion per year. The lower number reflects a median gain of about $100,000 per firm and the second reflects a mean gain of about $196,000 per firm. These figures represent the extra value that could be generated by the firm with the same number of workers. The added efficiency would make these firms more competitive in prices and thus increase their likelihood of survival and expansion. These are unexpectedly large numbers on a per-firm basis and should be understood as average estimates subject to substantial variations up or down. However, even if the true impacts were only one-quarter as large as the average estimates in this study, they would still imply very substantial gains for small firms and for the economy.

Conclusions and Next Steps

This study focused on how small businesses use computers and the impact of such use on productivity. The evidence from our telephone survey of over 1,100 small firms suggests at most a modest gap in use between white males and white females and Hispanic males. However, the results also show that firms owned by African American men are the most intensive computer users. Even where we do see a shortfall among white women and Hispanic men, the gap is only about 6 to 10 percent of the average use. In part, this is because these minority and women business owners—having been in business at least two years and having at least one employee—are a highly select group. About 60 percent of them are college

graduates or have a graduate degree, a rate comparable with the levels observed for white male businesses owners.

Several changes over the past three to five years might explain why we see few gaps today, despite past studies indicating different levels of computer use across demographic groups. First, prices of business-level-performance personal computers have dropped dramatically—to under $600. Such a price reduction has affected all groups but might conceivably have most influenced those firms with the lowest level of capitalization. Second, business owners have demonstrated an increased awareness of and attention to the importance of the Web. Just these two factors would increase the adoption of computers without significant capital barriers.

While no gaps in computer use based on owners' race, ethnicity, and gender materialized in our study, utilization of computers still varies widely among all small firms and among minority- and women-owned enterprises. Many businesses in all demographic groups use computers only in a limited way. Moreover, when we closely examine actual computer use, we find significant gaps between nominal, extensive, and strategic use. E-mail and Web sites are good examples. They are widely used but are mostly peripheral to the main communication channels of the businesses. In part, this is a function of customer demand and in part it is the relative utility of that communications channel for business activities.

The study's findings provide empirical evidence that intensive computer use promotes productivity and profitability among firms of more than minimal size.[14] In addition to finding significant associations between computer use and firm performance, our results suggest that the positive association likely represents causations—that more intensive computer use improves firm performance. These causal effects show up among all firms and among firms owned by minorities and women. Furthermore, these effects are substantial.

Despite the clear benefits to small firms in using and investing in computers, the policy implications of this study are not quite so clear. The ways in which firms already incorporate computers into their businesses yield real benefits. However, this fact does not prove the efficacy of outside interventions to promote more intensive computer use. For example, if computer-intensive firms are also more organized, simply increasing the computer use of low users may not lead to large increases in productivity. To demonstrate the effectiveness of interventions that encourage more computer use requires answering two questions: (1) Would the intervention actually cause small businesses to increase their computer use? and (2) Would the additional computer use induced among participating firms prove as effective as computerization of firms already undertaking these activities on their own?

What this study offers is empirical evidence that more intensive computer use allows MWEs to achieve higher levels of performance, particularly when computerization involves more efficient business practices. The in-depth interviews found a number of specific areas of underutilization where investment might prove productive and thus help guide any actual intervention. Such investments may also play an important role in improving the performance and longevity of minority- and women-owned enterprises. The payoff for the nation's economy would be not only increased productivity but also increased economic progress for groups formerly outside the mainstream of business ownership.

Notes

1. Tabulations by the authors from the 1 percent sample of the 2000 Census yielded the following shares of employed workers working in businesses they owned: white males—13.4 percent, white females—7.9 percent, black males—5.5 percent, black females—3.4 percent, Hispanic males—8.2 percent, and Hispanic females—6.6 percent.

2. See, for example, Bitler (2001), Greenan and Mairesse (1996), and Black and Lynch (2000, 2001).

3. Interviewers asked all telephone survey respondents in the construction, health care, or retail industries if they were willing to participate in the follow-up personal interviews in exchange for a payment of $100. Interviewees consisted of those who agreed to the personal interview and were able to schedule the interview on days the researchers were in the metropolitan area.

4. A detailed description of the computer intensity index is available on request.

5. The statistical controls for the firm's industry should capture some of the differences across firms in the relationship between labor and other costs and thus take some account of the costs of intermediate goods.

6. Using actual years of computer use is inappropriate because it would imply that having 20 instead of 19 years of computer experience (a gap of one year) should have the same effect on an owner's decision to computerize as having 2 years instead of 1 year of experience. The results obtained using the log specification are similar to those obtained using a series of dummy variables indicating years of experience.

7. The 38 percent of firms that did not report sales were excluded from the analysis.

8. Excluding firms with $5,000 or less in computer costs reduced the sample by about 7 percent.

9. A large sample of other specifications is available on request.

10. As in insurance, the appearance of legitimacy seemed to be an important factor. One construction company stated, and another implied, that using an itemized spreadsheet allowed them to indicate progress in ways that allowed release of loan amounts at a rate in advance of actual stage completion, enabling them to get more of their funds sooner.

11. The tabulation involved subtracting total costs from sales, adding labor costs, dividing by the number of workers, and then taking the natural log of the result. The two-stage models, which excluded cases with value added per worker higher than $1 million per year, are available on request.

12. As noted above, this is equivalent to moving from the 33rd to the 67th percentile. To illustrate the meaning of this increase, note that it would be equivalent to increasing the computer use for all seven functions by one "notch" (from "a little use" to "moderate use," for example).

13. This adjustment no doubt understates the full costs of raising one's level of computer use. Firms would generally bear additional costs for training and for implementation.

14. The main results of the study are for firms with more than $5,000 in labor costs, or any amount more than the cost of a half-time, full-year worker at the minimum wage.

References

Bitler, Marianne P. 2001. "Small Businesses and Computers: Adoption and Performance." Working Paper 2001–15. San Francisco, CA: Federal Reserve Bank of San Francisco. October.

Black, Sandra E., and Lisa M. Lynch. 2000. "What's Driving the New Economy: The Benefits of Workplace Innovation." NBER Working Paper w7479. Cambridge, MA: National Bureau of Economic Research. January.

———. 2001. "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity." *Review of Economics and Statistics* 83 (3): 434–45.

Fairlie, Robert W., and Alicia Robb. 2003. "Why Are Black-Owned Businesses Less Successful than White-Owned Businesses? The Role of Families, Inheritances, and Business Human Capital." Unpublished manuscript, University of California at Santa Cruz, October.

Greenan, Nathalie, and Jacques Mairesse. 1996. "Computers and Productivity in France: Some Evidence." NBER Working Paper w5836. Cambridge, MA: National Bureau of Economic Research. November.

The Urban Institute

2100 M Street, NW
Washington, DC 20037

Phone: 202.833.7200
Fax: 202.429.0687
E-mail: paffairs@ui.urban.org
http://www.urban.org

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