The Personal Computer and Entrepreneurship

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Abstract: In contrast to the large and rapidly growing literature on IT investments and firm productivity, we know very little about the role of personal computers in business creation. Using matched data from the 1997-2001 Computer and Internet Usage Supplements to subsequent Outgoing Rotation Group files from the Current Population Survey, I explore the relationship between computer ownership and entrepreneurship. Trends over the past two decades provide some evidence of a positive relationship between home computers and entrepreneurship rates, but the evidence is not clear. In contrast, an analysis of the relationship between computer ownership and entrepreneurship at the individual level provides evidence that individuals who had access to a home computer are substantially more likely to become an entrepreneur over the following 12-15 months. Probit and bivariate probit regressions also provide evidence of a strong positive relationship between computer ownership and entrepreneurship among women, but only limited evidence for men. Further, estimates from the CPS indicate that entrepreneurs who had prior access to home computers create a large variety of types of businesses and not only those in the IT industry.

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1. Introduction

The personal computer is one of the most important technological innovations in the second half of the twentieth century. The potential economic importance of computers and information technologies (IT), in general, has not been lost in the literature. A plethora of research in the past two decades has focused on the relationship between IT investment and productivity. Although earlier studies generally found no relationship, the consensus among more recent studies is that IT investment has a positive and significant effect on labor productivity and economic growth.[1] It is now well known that the sectors of the economy that have invested the most in information technology experienced some of the largest productivity gains during the 1990s and that the application of information technologies has stimulated remarkable improvements in production processes in many sectors of the economy.

In contrast to the literature on IT investments and firm productivity, we know very little about the role of personal computers in business creation.[2] At some level, personal computers are useful for most small businesses. Estimates from the 1998 Survey of Small Business Finances indicate that more than 75 percent of small businesses used computers (Bitler, Robb and Wolken 2001, and Bitler 2002), and estimates from the 2000 Computer and Internet Usage Supplement (CIUS) to the Current Population Survey (CPS) indicate high rates of computer ownership among self-employed business owners (U.S. Small Business Administration 2003). We also know that small- and medium-sized businesses make relatively large investments in computers and communication equipment (Buckley and Montes 2002) and that 25 to 45 percent of total capital expenditures are for computers among relatively young employer firms (Haltiwanger 2004).[3] Although these patterns suggest that personal computers are useful for small

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[1] See McGuckin, Streitwieser and Doms (1997), Doms, et al. (1997), Lehr and Lichentenberg (1998), Basu, Oliner and Sichel (2000), Brynjolfsson and Hitt (2000), Gordon (2000), Greenan and Mairesse (2000), Jorgenson and Stiroh (2000), Whelan (2000), and Fernald and Shapiro (2001).

[2] Earlier research using aggregate data finds that changes in technology contributed to the rise in non-agricultural self-employment rates from 1973 to 1982, which ended at least a century-long decline in self-employment (Blau 1987).

[3] Large investments in computer equipment, however, may only occur after the initial stages of business formation. Investments in computers per employee increase rapidly with firm size (Buckley and Montes

businesses, an unanswered question in the literature is whether the personal computer has an effect on the earliest possible stage of business creation -- the individual's decision to become an entrepreneur.

One approach to exploring this hypothesis is to analyze whether having access to a personal computer, particularly a home computer, increases the likelihood that an individual chooses to become an entrepreneur. Theoretically, we might expect that exposure to a home computer may make it substantially easier for a potential entrepreneur to create an experimental business plan, obtain information about tax codes and legal regulations, learn about specific industries, and research competition. Further, the skills acquired from owning a home computer, such as familiarity with using spreadsheets, word processing and database programs, may be valuable for creating and managing a business, and specific computer skills, such as programming, graphics design, and hardware knowledge, may be especially valuable for creating firms in hi-tech industries. In fact, estimates from the Survey of Small Business Finances indicate that the four most common uses of computers in small businesses are for administrative purposes, bookkeeping, email and managing inventory (Bitler 2002). Finally, the personal computer, especially through use of the Internet, may substantially lower marketing, investment and operating costs.

On the other hand, access to personal computers and the skills acquired in using them may decrease entrepreneurship by increasing earnings in the wage and salary sector and improving job search. Workers who use computers on the job earn more than their non-computer-using counterparts, although there is some debate over why, and there is evidence suggesting high levels of use of the Internet for job search (see Autor, Katz and Krueger 1998, DiNardo and Pischke 1997, Freeman 2003, Kuhn and Skuterud 2000, 2004 and Stevenson 2003 for example). As posited by the standard economic model of entrepreneurship, the individual chooses the work sector -- self-employment or wage/salary work -- that provides the highest expected net income (Evans and Jovanovic 1989). If computer ownership increases the returns to wage/salary work, all else equal, then entrepreneurship rates will be lower.

2002), and computer investment as a share of total capital expenditures increases rapidly with firm age, at least through the first five years (Haltiwanger 2004).

Theoretically, it is unclear as to which of the two opposing forces dominates, and therefore the question of whether access to personal computers increases entrepreneurship must be explored empirically. To test the hypothesis, I create a novel panel from the CPS that includes information on computer ownership and subsequent business creation over a 12-15 month period. In particular, I match microdata from the CIUS files to the CPS in one year to the CPS Outgoing Rotation Group (ORG) files in the following year for the same individuals. The CIUS files contain detailed information on computer and Internet use, and to my knowledge, have not been previously used to examine the relationship between computer ownership and entrepreneurship. Using these data, I examine the relationship between having access to a home computer and subsequent entrepreneurship. Probit regressions and instrumental variable techniques are used to test whether having access to a home computer increases the likelihood that an individual becomes an entrepreneur.

2. Data

The primary datasets that will be used in analysis are the matched CIUS and ORG files to the CPS. By linking the CPS files over time, longitudinal data can be created, which allows for the examination of business creations. These surveys, conducted regularly by the U.S. Bureau of the Census and the Bureau of Labor Statistics, are representative of the entire U.S. population and contain observations for more than 130,000 people.

Households in the CPS are interviewed each month over a 4-month period. Eight months later they are re-interviewed in each month of a second 4-month period. Thus, individuals who are interviewed in January, February, March and April of one year are interviewed again in January, February, March and April of the following year. The rotation pattern of the CPS makes it possible to match information on individuals in a CIUS who are in their first 4-month rotation period (e.g. September 2001) to information from the ORG for their second 4-month rotation period (e.g. September, October, November and December 2002). The rotation pattern of the CPS, thus allows for the creation of a 12-15 month panel for up to half of all respondents in the CIUS files. To match these data, I use the same criteria as Madrian

and Lefgren (2000) for matching the CPS March Annual Demographic Files over time, but the modified rotation months noted above. I match the October 1997, December 1998, August 2000 and September 2001 CIUS files to the appropriate ORG files 12-15 months later.

MEASURING ENTREPRENEURSHIP

Potential measures of the number of entrepreneurs are readily available from several nationally representative government datasets. For example, the Economic Census: Survey of Minority-Owned and Female-Owned Business Enterprises provides estimates of the number of small businesses every 5 years, and the CPS and Census of Population provide estimates of the number of self-employed business owners annually and every decade, respectively. Typical measures of business ownership based on these data, however, do not capture the dynamic nature that is generally implied when defining entrepreneurship. Therefore, a measure of flows into business ownership may be preferable for measuring entrepreneurship.[4]

One approach is to use matched CPS data over time to create a time series of entrepreneurship rates. All business owners are captured in the CPS microdata including those who own incorporated or unincorporated business, and those who are employers or non-employers. To create the measure of entrepreneurship, I first identify all individuals who do not own a business when they are first surveyed in the CPS. By matching CPS files, I then identify whether they report being a self-employed business owner for their primary occupation 12-15 months later when they are surveyed again in the CPS. For most analyses, self-employment is only counted in the second survey if the individual reports working 15 or more hours during the survey week. The hours restriction is imposed to rule out part-time business owners and very small business activities. Individuals who were not business owners at the time of the first survey and became business owners by the time of the second survey are defined as entrepreneurs.

[4] The Total Entrepreneurial Activity (TEA) index used in the Global Entrepreneurship Monitor captures individuals who are involved in either the startup phase or managing a business that is less than 42 months old (Reynolds, Bygrave and Autio 2003).

Individuals who owned a business with any hours at the time of the first survey are excluded from the sample. The CPS does not provide information on when these individuals started their businesses.

A firm-level approach can also be adopted by comparing firm births to the existing stock of businesses using data from the Statistics of U.S. Businesses (SUSB). The SUSB data files are created by the U.S. Bureau of the Census and are partially funded by the Office of Advocacy at the Small Business Administration. They include all employer firms. Although the exclusion of non-employer firms is likely to lead to a substantial undercount of the rate of entrepreneurship because non-employer firms represent 75 percent of all firms (U.S. Small Business Administration 2001), these estimates provide a useful comparison to the CPS estimates.

3. Results

TIME-SERIES EVIDENCE

Computer ownership has increased dramatically over the past two decades (see Figure 1). In 1984, the first year in which the CPS collected data on computer ownership, 8.2 percent of households had a personal computer (U.S. Department of Commerce 2002). By 2001, 56.5 percent of households had access to a computer. Computers are also common in the workplace. In 2001, 56.7 percent of employed adults reported using a computer at work (U.S. Department of Commerce 2002). A slightly smaller percentage of self-employed business owners report using a computer at work at 53.9 percent. This estimate may be understated, however, because some self-employed business owners may only use their home computers for work. Combining home computer use for work and work computer use, 59.0 percent of self-employed business owners use computers. Self-employed business owners also report growing levels of computer ownership. From 1998 to 2000, the number of self-employed computer owners grew by 1.35 million or 14.7 percent (U.S. Small Business Administration 2003).

To explore the relationship between home computers and entrepreneurship, Figure 1 also displays entrepreneurship rates calculated from matched CPS data. To provide a time series that covers the past two decades, I match consecutive ORG files over time. Using matched ORG files, I can identify

entrepreneurs by examining whether individuals start businesses over a one-year time interval between surveys. Entrepreneurship rates are displayed for men and women separately.[5] For both men and women, entrepreneurship rates increased in the early 1980s, hit lows in the early 1990s, and increased to higher levels in recent years. Over the entire time period, entrepreneurship rates appear to have increased for both men and women. The average rates of business formation from 1980 to 1982 were 2.2 and 1.2 percent for men and women, respectively. By 1999-01, these rates of entrepreneurship had increased to 2.7 and 1.5 percent.

These patterns are consistent with the hypothesis that personal computers increased entrepreneurship, however, some of the growth may be due to the CPS redesign in 1994. In a thorough analysis of the 1994 CPS redesign using a "parallel survey," Polivka and Miller (1998) conclude that self-employment rates increased by 0.44 percentage points for men and 1.58 for women.[6] On the other hand, Fairlie and Meyer (2000) find by comparing estimates from the CPS ORG to estimates from the CPS Annual Demographic Files that are for the same year, but were subject to the redesign in different years, that the redesign may have led to a fall in the reported white male self-employment rate of one percentage point. Using the same comparison, however, they find that the redesign led to an increase in the black male self-employment rate by almost a full percentage point. In addition to this uncertainty over the effects of the CPS redesign on self-employment rates, it is unclear how they would affect trends in the dynamic measure of entrepreneurship used here. The redesign may have led to an increase (decrease) in entrepreneurship rates if the probability of reporting self-employment is now higher (lower).[7] On the other hand, the effects of the redesign may have been partially "differenced out" over time when

[5] Estimates are not reported for 1984 and 1985, which require matching 1984-1985 and 1985-1986, respectively, because the identifying codes were randomized. The same is true for 1994 and 1995. The 1993 estimate is not reported because of the CPS redesign in 1994.

[6] Polivka and Miller (1998) note that the change in reporting of self-employment is likely due to the inclusion of a question about household businesses at the beginning of labor force questions, the reordering of class of worker and industry and occupation questions, and general changes in the measurement of employment.

[7] In the extreme case in which individuals randomly report self-employment in each period independent of the previous year's status, the entry rate would increase proportionately with the increase in self-employment rates.

calculating entrepreneurship rates if the increase in reported aggregate self-employment rates is driven by a subgroup of the labor force who now consistently report being self-employed because of the reordering of questions.

For comparison, Figure 2 displays trends in home computer rates and birth rates for employer firms from the Statistics of U.S. Businesses from 1989 to 1999. The firm creation or birth rate is calculated by comparing firm births to existing stocks. The estimates indicate that firm birth rates decreased slightly over the 1990s. These trends do not provide evidence consistent with the hypothesis that personal computers increased birth rates for larger, employer firms. Overall, the time series patterns for entrepreneurship rates and firm birth rates do not provide clear evidence on the relationship between personal computers and entrepreneurship.

THE EFFECTS OF COMPUTERS ON ENTREPRENEURSHIP

An analysis of the relationship between computer ownership and entrepreneurship at the individual level reveals a less ambiguous pattern. Entrepreneurship has a strong positive association with owning a home computer. Table 1 reports estimates of entrepreneurship rates by access to home computers. These entrepreneurship rates are created by matching the CPS CIUS files for 1997, 1998, 2000 and 2001 to subsequent CPS ORG files. For both men and women, a higher percentage of individuals who had access to home computers started businesses over the following 12-15 months than those who did not have access to a home computer. The differences in entrepreneurship rates are present for every year even in the presence of rapidly growing ownership rates of personal computers. Averaging the 4 years of matched CIUS files to ORG files, reveals that male computer owners are 0.6 percentage points more likely than non-computer owners to become an entrepreneur, and female computer owners are 0.7 percentage points more likely to become an entrepreneur than non-computer owners. Although this simple comparison of entrepreneurship rates does not control for factors, such as income, education, and age, it is suggestive of the direction and size of potential impacts.

To control for these factors and others, I first model the entrepreneurship decision. Assume that entrepreneurship is determined by an unobserved latent variable,

(4.1) $Y_i^* = X_i'\beta + C_i'\delta + u_i$,

for person i, $i=1,....,N$. Only Y_i is observed, which equals 1 if $Y_i^* \geq 0$, implying that person i chooses to start a business over the following 12-15 month time interval; Y_i^* equals zero if person i chooses not to start a business over the time interval. X_i is a vector of individual, family and geographical area characteristics measured at the beginning of the time interval, C_i is a dummy variable for the presence of a home computer at the beginning of the time interval, and u_i is the error term. Only individuals who do not own a business and are not retired or disabled at the beginning of the time interval are included in the sample.

Assuming that u_i is normally distributed, the data are described by the following probit model.

(4.2) $Prob(Y_i=1) = \Phi(X_i'\beta + C_i'\delta)$,

where Φ is the cumulative normal distribution function. Although the normality assumption should only be taken as an approximation, the probit model provides a useful descriptive model for the binary event that an individual starts a business.

Tables 2A and 2B report estimates from probit regressions for the probability of becoming an entrepreneur over a 12-15 month time period. All specifications include controls for race, immigrant status, age, marital status, number of children in the household, education level, family income, region of the country, central city status, home ownership, the year of the CIUS (1997, 1998, 2000 or 2001), and the length of the time interval (12-15 months). All controls are measured at the time of the first survey (i.e. in the CIUS). Sample means and standard deviations for most variables are reported in Appendix A. Estimates for men, which are reported in Table 2A, are discussed first.

Specification 1 of Table 2A reports estimates excluding the home computer variable. Blacks, Hispanics and Asians have lower entrepreneurship rates, and immigrants have higher rates, all else equal. Men who are older (through age 45), married and have at least 2 children have higher rates of

entrepreneurship. Higher levels of education are associated with larger probabilities of starting a business. In contrast, the relationship between family income and entrepreneurship is ambiguous. Most of the coefficients on the family income dummies are statistically insignificant. Another surprising result is that home ownership does not have a positive and statistically significant effect on entrepreneurship. One might expect that home ownership represents a proxy for wealth, and there is substantial evidence suggesting that assets are an important determinant of entry into self-employment (see Holtz-Eakin, Joulfaian, and Rosen 1994, Dunn and Holtz-Eakin 2000 and Fairlie 1999 for a few recent examples).

Specification 2 includes the dummy variable indicating whether the individual had access to a home computer measured at the time of the first survey. Having access to a home computer is associated with a higher probability of becoming an entrepreneur over the following 12-15 months, however, the coefficient estimate is not statistically significant at the conventional α=0.05 level, although the t-statistic is 1.75 and the p-value is 0.081. The point estimate implies a large effect. The marginal effect evaluated at the mean characteristics of the sample, which is reported below the coefficient estimate, implies that ownership of a home computer is associated with a 0.0034 higher probability of entrepreneurship.[8] This effect represents 11.4 percent of the sample entrepreneurship rate of 0.0299.

The coefficient estimates on the controls are not sensitive to the inclusion of home computers. The main exception is that the coefficients on higher levels of education decline somewhat after the inclusion of home computers. The change, however, is small.

Specification 3 of Table 2A reports estimates for an alternative measure of entrepreneurship in which the hours restriction is relaxed. Thus, the dependent variable is equal to one if the individual reports starting a business irregardless of the number of hours worked in the survey week. Using this definition, the sample entrepreneurship rate increases to 0.0360. The coefficient estimate on home

[8] The marginal effect for access to a home computer equals $\Phi(X'\beta + \delta) - \Phi(X'\beta)$.

computers in this specification is large, positive and now statistically significant at the α=0.05 level.[9] Home computers are associated with a 0.0054 increase in the probability of becoming an entrepreneur.

As indicated in Figure 1, the prevalence of home computers has risen sharply over the past two decades raising concerns that the relationship between access to computers and entrepreneurship may have changed over the sample period (1997 to 2001). To investigate this possibility, Specification 4 includes interactions between home computer ownership and year dummies for 1998, 2000 and 2001 (the left out year is 1997). Although some of the coefficient estimates are large, none of them is statistically significant and the three interactions are not jointly significant.

Table 2B reports corresponding specifications for the probability of entrepreneurship among women. Many of the factors associated with entrepreneurship for men are the same for women. Blacks, Latinos, and Asians have lower rates of entrepreneurship, whereas immigrants have higher rates, all else equal. Female entrepreneurship also generally increases with age (through age 51), being married and education level, and decreases with the number of children. Several of these variables, however, have substantially different sized effects on entrepreneurship.[10] For example, the relationship between marriage and entrepreneurship is much strong among women, whereas the relationship between education and entrepreneurship is weaker. Another difference is that home ownership appears to increase female entrepreneurship although the coefficient estimate is only significant at the α=0.058 level. Finally, similar to the results for men, family income does not have a clear effect on entrepreneurship.

Among women, home computers are clearly associated with higher levels of entrepreneurship. The coefficient estimate is large, positive and statistically significant. It implies that having access to a home computer increases the probability of starting a business by 0.0055. This represents a large effect relative to the sample entrepreneurship rate of 0.0145.

[9] Imposing an hours restriction of 30 or more hours, the coefficient estimate on home computer is similar to the original estimate.

[10] The null hypothesis that the female and male slope coefficients are the same is easily rejected.

The coefficient is slightly smaller, but remains large, positive and statistically significant using the definition of entrepreneurship that relaxes the hours worked restriction (reported in Specification 3).[11] The coefficient estimate implies that access to a home computer increases the probability of entrepreneurship by 0.0078 percentage points. Estimates from Specification 4 indicate that none of the year / home computer interactions is statistically significant individually or jointly.

THE INTERNET

A potentially beneficial use of home computers among would-be-entrepreneurs may be to obtain information about tax codes and legal regulations, learn about specific industries, and research competition using the Internet. The Internet may also be useful for lowering marketing, investment and operating costs. On the other hand, job search using the Internet is prevalent and Internet skills were likely to have been valuable in the labor market during the sample time period (Freeman 2003, Kuhn and Skuterud 2000, 2004 and Stevenson 2003). Therefore, access to the Internet may have an independent effect on entrepreneurship.

To investigate this question, I first checked the relationship between having a home computer and access to the Internet. I find that 73.3 percent of my sample of men who have access to a home computer also have Internet access and 71.7 percent of my sample of female computer owners have access to the Internet at home. Next, I include Internet access as an additional regressor in the probit equations. Specification 5 of Tables 2A and 2B report the results. For both men and women, the coefficient estimate on Internet access is small, negative and statistically insignificant. In both cases, the main home computer effect becomes larger. Although not reported, I also estimate a probit regression for the less restrictive hours definition of entrepreneurship (Specification 3) that includes access to the Internet. For men, the coefficient on Internet access is close to zero, and for women the coefficient is 0.0508, but is statistically insignificant. These estimates do not provide evidence of a separate and independent effect of

[11] The coefficient estimate on home computer is similar imposing an hours restriction on entrepreneurship of 30 or more hours.

Internet access on entrepreneurship. The Internet, however, may have independent effects on business outcomes, such as survival and profits, after the initial startup phase.

ADDITIONAL ESTIMATES

I investigate the sensitivity of the results to two alternative samples. First, I am concerned about the timing of computer purchases and the entrepreneurial decision. Although individuals who report being a self-employed business owner in the first survey year are already excluded from the sample, some individuals may purchase computers in anticipation of starting a business. The CPS does not provide information on the timing of when all computer purchases were made, but it does provide information on when the newest computer was obtained. Therefore, as a check of these results I estimate a probit model that excludes all observations for which the newest computer was obtained in the first year surveyed. Thus, I exclude observations in which the newest computer was purchased in 1997 for the 1997 panel, 1998 for the 1998 panel, 2000 for the 2000 panel, and 2001 for the 2001 panel. This exclusion is likely to be overrestrictive, however, because a computer purchased in the survey year may represent a replacement for an older model or may have been purchased several months prior to the survey month. The results for men and women are reported in Specification 2 of Tables 3A and 3B, respectively. Specification 1 of both tables reports estimates from the main specification (i.e. Specifications 2 of Tables 2A and 2B) for comparison. Although the sample sizes decrease substantially for both men and women, the coefficient estimates on access to a home computer are only slightly smaller in magnitude.[12] Evidently, the previous results are not overly influenced by recent computer purchases among would-be entrepreneurs.

The CIUS files also provide information on whether the newest household computer is owned by a home business. Although only a small fraction of the newest home computers are owned by a home business (1.2 percent) and individuals who report being self-employed business owners in the CIUS are

[12] I also estimate a specification that excludes computers purchased in the year prior to the survey year. I find a coefficient estimate on home computer which is somewhat smaller, but still large, for men and slightly larger for women.

excluded from the sample, it may be useful to exclude these computers as a robustness check. Access to computers used for a home business by another household member may be limited and result in a different relationship with subsequent entrepreneurship. Specification 3 of Tables 3A and 3B report results. For both men and women, the coefficient estimate on access to home computers does not differ substantially from the original coefficients.

I also investigate whether the relationship between access to home computers and entrepreneurship is being driven primarily by college graduates. These individuals may benefit the most from exposure to home computers in terms of starting businesses. Estimates for a college graduate / home computer interaction are reported in Specification 4 of Tables 3A and 3B. For both men and women, the coefficient estimate on the interaction term is relatively small and statistically insignificant. These estimates suggest that college graduates are not driving the previous results, which is further evidenced by the negative point estimates on the interactions. Overall, the estimates of the relationship between access to home computers and entrepreneurship appear to be robust to alternative samples and interactions.

BIVARIATE PROBIT RESULTS

Although the findings presented above are based on regression models that include numerous controls for individual, parental, and family characteristics, estimates of the effects of home computers on entrepreneurship may be biased. For example, if unmeasurable entrepreneurial characteristics, such as less risk aversion, strong preferences for autonomy or high levels of entrepreneurial ability, are positively correlated with preferences for having a home computer, then the probit estimates may overstate the effect of access to home computers on entrepreneurship.[13] On the other hand, if these characteristics are negatively correlated with preferences for having home computers, then the probit estimates may understate the effect. In either case, the effects of unobserved determinants of entrepreneurship and computer ownership that are correlated may invalidate the causal interpretation of the previous results.

[13] See Fairlie (2002) for evidence on the importance of entrepreneurial characteristics.

A potential solution to this problem is to estimate a bivariate probit model in which equations for the probability of entrepreneurship and the probability of having a home computer are simultaneously estimated. This model is equivalent to an instrumental variables or two-stage least squares model and is preferred when both the dependent variable and endogenous variable are binary.

Similar to (4.1), assume that home computer ownership is determined by an unobserved latent variable,

(4.3) $C_i^* = X_i'\gamma + Z_i'\pi + \varepsilon_i$,

where only C_i equal to 0 or 1 is observed, Z_i is a vector of variables that are not included in (4.1), and ε_i is the error term. In this case, u_i and ε_i are distributed as bivariate normal with mean zero, unit variance, and $\rho=Corr(u_i, \varepsilon_i)$. The bivariate probit model is appropriate when $\rho \neq 0$ (see Greene 2003 for further discussion).

In practice, the choice of Z_i is difficult. In this application, however, there are two potential exclusion restrictions. First, I use information on the use of the Internet outside the home among all household members. In particular, I create a dummy variable that equals one if anyone else living in the individual's household uses the Internet at work. Internet use at work by another household member should satisfy the two necessary properties of a valid instrumental variable -- it affects the probability of purchasing a computer, but does not affect entrepreneurship (after controlling for other factors). There exists a strong correlation between using a computer at work by a household member and computer ownership by that household (U.S. Department of Commerce 2002). In addition, we do not expect the use of the Internet at work by another household member to have a strong direct effect on whether the individual becomes an entrepreneur after controlling for family income, education, and marital status. Internet use at work by another household member may be associated with higher family income, but this effect is already controlled for and, as indicated above, does not have a clear positive or negative effect on entrepreneurship.

It is useful to examine the correlation between these variables and the probability of entrepreneurship in my sample (see Appendix B). For men, the probability of entrepreneurship is essentially the same for those who live in households where someone else uses the Internet at work and for those who do not live in households where someone else uses the Internet at work. For women, however, the probability of entrepreneurship appears to be somewhat higher for individuals who have household Internet users compared to those who do not.

Another exclusion restriction used in the bivariate probit model is whether a teenager is present in the household. Teenagers have the highest probability of computer use for all age groups (U.S. Department of Commerce 2002). Estimates from all four CIUS files included in this analysis indicate that teenagers (ages 10-17) have a high probability of living in a household with a home computer (see Figure 3). As expected, the probability of having a home computer is much higher for this age group than for younger children. The probability also declines substantially after age 17 and is relatively low for young adults. On the other hand, the presence of a teenager is not expected to have a large independent effect (after controlling for the number of children and marital status) on the probability of entrepreneurship among adults in the household.

Estimates reported in Appendix B also indicate that the presence of teenagers is uncorrelated with the probability of entrepreneurship. Entrepreneurship rates are only slightly lower for men and women who have teenage children compared to those who do not have teenage children.

Estimates from the bivariate probit model for the probability of entrepreneurship and having a home computer are reported in Tables 4A and 4B. I first discuss the results for men (reported in Table 4A). The first column reports the coefficients for the probability of owning a computer. As expected, education is an important determinant of owning a home computer. The probability of owning a home computer increases substantially with the individual's education level. Education may be a proxy for wealth or permanent income and have an effect on the budget constraint or may have an effect on preferences for computers through pure tastes, exposure, perceived usefulness, or conspicuous consumption. Family income is also important in determining who owns a home computer. The

relationship between the home computer probability and income is almost monotonically increasing across the listed categories. It is likely to be primarily due to its effect on the budget constraint, however, it may also be due its effect on preferences. Related to these variables, home ownership increases the probability of having access to a home computer. The effect, however, is relatively small compared to the effects of education and family income.

Race and ethnicity are also important determinants of computer ownership. Blacks, Latinos, and Native Americans have lower probabilities of owning a home computer than do whites. In addition to these control variables, marital status, the number of children, region, central city status and the year of the survey also have statistically significant effects on the home computer probability.

Both instrumental variables have positive and statistically significant coefficients in the home computer equation. The coefficients on these variables imply large effects on the probability of having a home computer. The presence of another household member who uses the Internet at work increases the probability of having a home computer by 0.0956, which is roughly equal to the effect of increasing family income from less than $10,000 to the $30,000-$35,000 level.[14] The presence of a teenager has an even larger effect on the probability of owning a home computer. All else equal, if a teenager is present in the household, the probability of having a home computer is 0.1605 higher.

The second column reports coefficients for the probability of entrepreneurship. The coefficients on the control variables in the bivariate probit model are very similar to those for the probit model. The coefficient estimate on home computer is also similar, but is now slightly larger. The point estimate implies that the presence of a home computer increases the probability of entrepreneurship by 0.0039. The main difference between the bivariate probit and probit results is that the coefficient estimate is no longer close to being statistically significant at conventional levels.

[14] Unfortunately, work use of computers is not available in 1997 and 2001. Using a sample of children from the 2001 CPS, Fairlie (2004), however, finds that Internet use at work by parents has a larger effect on the probability of computer ownership than computer use at work among parents. Communication and information retrieval uses of computers at work may have a stronger association with purchasing home computers than other uses, such as appointment scheduling, database entry, and production.

The CPS CIUS files contain additional information on Internet use outside the home. In particular, information exists on Internet use anywhere outside the home for every survey except 2000. Using a smaller sample, I estimate a bivariate probit model that replaces the dummy variable for other household member's use of the Internet at work with a dummy variable for other household member's use of the Internet anywhere outside the home. Specification 2 reports estimates. The coefficient on the non-home use the Internet by another household member is large, positive and statistically significant. The coefficient on the home computer increases to 0.0754, but remains statistically insignificant. Overall, for men, the bivariate probit results do not provide conclusive evidence suggesting that home computers increase entrepreneurship because of the lack of statistical significance, but they do not overturn the findings from the probit regressions presented above.

I now turn to the results for women, which are reported in Table 4B. As expected, the determinants of computer ownership are generally similar between women and men. Computer ownership increases with education, family income and home ownership, but is lower among blacks, Latinos and Native Americans, all else equal. The coefficients on the instruments are also fairly similar. In both specifications, the included instruments have large, positive and statistically significant coefficients. In Specification 1, the coefficient estimate on home computer is somewhat larger than the coefficient estimate in the comparable probit specification. The coefficient increases from 0.1747 to 0.2523. The bivariate probit coefficient estimate, however, is no longer statistically significant at the α=0.05 level. Using the smaller time period in Specification 2, the coefficient on home computer is even larger. It is now statistically significant and implies that computer ownership increases the probability of entrepreneurship by 0.0115.

EXCLUSION RESTRICTION ISSUES

Estimates from the bivariate probit also allow one to test whether a correlation exists between the unobserved factors affecting home computer ownership and entrepreneurship. Formal tests of the hypothesis that ρ=0 reveal consistent results across the four specifications. For all specifications,

especially for men, the test statistics are substantially lower than the chi-squared critical value suggesting that the unobserved factors are uncorrelated. Although these results provide evidence that the original probit estimates are consistent and that estimation of the bivariate probit is unnecessary, it is useful to further explore the validity of the exclusion restrictions for completeness.

Although the estimates reported in Appendix B provide evidence on whether the excluded variables are uncorrelated with the probability of entrepreneurship, the true test is whether they are uncorrelated with unobserved factors affecting the probability of entrepreneurship *after* controlling for other factors (i.e. u_i). One method of exploring this issue is to estimate a probit model for entrepreneurship that includes the variables listed in Table 2 and the excluded variables. Although not reported, I generally find small and statistically insignificant coefficient estimates on the excluded variables for both men and women. The only exception is that I find a negative and statistically significant coefficient on the presence of teenagers using the shorter time period for men. Although this is not a formal test of the validity of the instruments, it suggests that Internet use at work or outside the home by other household family members and the presence of a teenager in the household generally do not have a large effect on the probability of entrepreneurship after controlling for other factors.

To address concerns that one of the excluded variables is problematic, I estimate bivariate probits that include the presence of teenagers and other household member uses the Internet at work separately. Estimates are reported in Tables 5A and 5B. For men, the coefficients on home computer increase, but remain statistically insignificant. For women, the coefficient on home computer is smaller than the bivariate probit estimate, but larger than the original probit estimate when the presence of teenagers is the only excluded variable. The home computer coefficient, however, becomes much larger using other household member uses the Internet at work as the only exclusion restriction. These results indicate that the bivariate probit estimates are somewhat sensitive to the exclusion restrictions, but do not overturn the original results.

To further check the sensitivity of my results, I add another exclusion restriction to the model. If network effects exist in the adoption of computers and the Internet then the rate of computer ownership in

the local area should affect the probability of owning a computer. At the same time, local levels of computer ownership should not have a large effect on entrepreneurship rates after controlling for education, family income, and home ownership. Therefore, I use computer ownership rates in the metropolitan area as an additional exclusion restriction in the bivariate probit. Estimates are reported in Specification 3 of Tables 5A and 5B. For men, the coefficient estimate on home computer becomes small and negative. In contrast, the estimated effect of home computers on entrepreneurship remains large and positive.

I also estimate bivariate probits that include metropolitan-area home Internet access rates instead of home computer rates as exclusion restrictions. These estimates are reported in Specification 4 of Tables 5A and 5B. The home computer ownership coefficient is essentially zero for men, and slightly larger than the estimate reported in Specification 3 for women. Overall, the use of the addition of these exclusion restrictions indicates that the estimated effect of home computers on entrepreneurship is somewhat sensitive to the chosen specification for men. For women, however, the magnitude of the estimated home computer effect appears to be robust, although it continues to be statistically insignificant in the bivariate probits.

INDUSTRY COMPOSITION OF BUSINESSES

What types of businesses are being created by entrepreneurs who had prior access to a home computer? To investigate this question, I compare industry distributions between entrepreneurs who had prior access to home computers and entrepreneurs who did not have prior access to home computers. Estimates are reported in Table 6. For men, entrepreneurs with prior access to home computers were much more likely to create businesses in Finance, Insurance and Real Estate (F.I.R.E.), Professional Services, and Business and Repair Services than entrepreneurs without prior access to home computers. Male entrepreneurs who had prior access to home computers were substantially less concentrated in Agriculture and Mining, Construction, and Transportation, Communication and Other Public Utilities. These patterns appear to be roughly consistent with the industries requiring the most and least amounts of

investment in technology, respectively. Estimates from the 1998 Annual Capital Expenditures Survey indicate, for example, that capital expenditures per employee were $2,639 in F.I.R.E., compared to only $151 in Construction (Buckley and Montes 2002).

Although industry differences exist between the two groups, the estimates reported in Table 6 indicate that entrepreneurs with prior access to home computers are starting many different types of businesses. Clearly, these entrepreneurs are not primarily starting businesses in hi-tech industries. In fact, an examination of more detailed industries reveals that only 5.9 percent of all male entrepreneurs who had prior access to home computers started businesses in the Computer and Data Processing industry.[15] This is a relatively small percentage compared to the nearly 17 percent who start businesses in the Construction industry.

Table 6 also reports industry compositions for female entrepreneurs. The estimates reveal a clear pattern -- female entrepreneurs with and without prior access to home computers create businesses in similar industries. The only major exceptions are that a higher percentage of female entrepreneurs with access to home computers create businesses in F.I.R.E. and a lower percentage of these entrepreneurs create businesses in personal services. Further, more detailed industry shares reveal that less than 2 percent of female entrepreneurs with prior access to home computers create businesses in the Computer and Data Processing industry.

The comparison of industry distributions reveals that entrepreneurs who had prior access to home computers create a large variety of types of businesses. This pattern is especially true for women as the industry distributions based on prior access to home computers are fairly similar. Overall, the results suggest that exposure to home computers may be useful for creating all types of businesses and not only for those in specific industries, such as IT. The skills acquired from owning a home computer, such as familiarity with using spreadsheets, word processing and database programs, may be valuable for creating and managing any type of business. Consistent with this idea, estimates from the 1998 SSBF indicate that

[15] A related point is that the relationship between home computers and entrepreneurship is not simply due to higher levels of job mobility, and thus possible movement into entrepreneurship, among hi-tech workers (i.e. Fallick, Fleishman and Rebitzer 2003).

the most common uses of computers in small businesses were for administrative purposes (63 percent), bookkeeping (68 percent), email (57 percent) and managing inventory (31 percent), and uses were generally the most common across all reported industries (Bitler 2002).

4. Conclusions

Using matched data from the 1997-2001 CIUS files to subsequent ORG files from the CPS, I explore the relationship between computer ownership and entrepreneurship. Trends over the past two decades provide some evidence of a positive relationship between home computers and entrepreneurship rates, but the evidence is not clear. In contrast, an analysis of the relationship between computer ownership and entrepreneurship at the individual level reveals a less ambiguous pattern. Male computer owners are 0.6 percentage points more likely than non-computer owners to become an entrepreneur, and female computer owners are 0.7 percentage points more likely to become an entrepreneur than non-computer owners.

Probit regressions are also used to test whether having access to a home computer increases the likelihood that an individual becomes an entrepreneur. For men, having access to a home computer is associated with a 0.0034 higher probability of becoming an entrepreneur, however, the coefficient estimate is only statistically significant at levels slightly above conventional levels of significance. The magnitude of the estimated effect, however, is robust to several alternative samples and interactions, and is statistically significant using an alternative definition of entrepreneurship. Estimates from bivariate probit models, which attempt to remove potential biases from the correlation between unobserved determinants of computer ownership and entrepreneurship, are also roughly similar in magnitude.

The estimated relationship between prior access to home computers and entrepreneurship is much stronger for women. Having access to a home computer increases the probability of starting a business among women by 0.0055, which represents 38 percent of the sample entrepreneurship rate of 0.0145. The coefficient estimate is statistically significant and very robust to alternative samples, definitions of

entrepreneurship and interactions. Further, bivariate probit models provide even larger estimates of the effects of access to home computers on female entrepreneurship.

To examine whether access to home computers potentially influences the types of businesses created by entrepreneurs, I compare industry distributions between entrepreneurs who had prior access to home computers and entrepreneurs who did not have prior access to home computers. Estimates from the CPS indicate that entrepreneurs who had prior access to home computers create a large variety of types of businesses and not only those in specific industries, such as IT. This pattern is especially true for women as the industry distributions based on prior access to home computers are fairly similar.

Overall, these findings are consistent with the hypothesis that exposure to a home computer may make it substantially easier for a potential entrepreneur, especially among women, to create an experimental business plan, obtain information about tax codes and legal regulations, learn about specific industries, research competition, and lower operating, investment and marketing costs. Further, familiarity with using spreadsheets, word processing and database programs, and other computer and software skills acquired from owning a home computer may be valuable for creating and managing a wide range of different types of businesses. Unfortunately, however, the exact causes of the estimated impacts of access to home computers on entrepreneurship are difficult to identify. Further research in this area is important because in contrast to the large and rapidly growing literature on IT investments and firm productivity in established businesses, the relationship between technology and entrepreneurship is not well understood.[16]

[16] More research on the impact of technology on entrepreneurship through consumer and bank use is also needed. An interesting finding in a recent study by Berger, Frame, and Millermay (2004) is that a rapidly spreading technology, small business credit scoring, has increased credit availability for small businesses.

References

Autor, David, Lawrence Katz, and Alan Krueger. 1998. "Computing Inequality: Have Computers Changed the Labor Market?" The Quarterly Journal of Economics. 113:4, 1169-214.

Basu, Susanto, John G. Fernald, and Matthew D. Shapiro. 2001. "Productivity Growth in the 1990s: Technology, Utilization, or Adjustment?" National Bureau of Economic Research Working Paper #8359.

Berger, Allen N., W. Scott Frame and Nathan H. Miller. 2004. "Credit Scoring and the Availability, Price, and Risk of Small Business Credit," Journal of Money, Credit, and Banking, forthcoming.

Bitler, Marianne P. 2002. "Does PC Use Pay? Computers and Small Business Performance," RAND Working Paper.

Bitler, Marianne, Alicia Robb, and John Wolken, 2001. "Financial Services Used by Small Businesses: Evidence from the 1998 Survey of Small Business Finances"
Federal Reserve Bulletin, Vol. 87, April 2001.

Blau, David M. 1987. "A Time-Series Analysis of Self-Employment in the United States," Journal of Political Economy, 95(3): 445-467.

Brynjolfsson, E. and Hitt, L. M. (2000), "Beyond Computation: Information Technology, Organizational Transformation and Business Performance," *The Journal of Economic Perspectives* 14(4), 23-48.

Buckley, Patricia, and Sabrina Montes. 2002. "Main Street in the Digital Divide Age: How Small and Medium-Sized Businesses are Using the Tools of the New Economy," U.S. Department of Commerce, Economics and Statistics Administration, Washington, D.C.: USGPO.

DiNardo, John, and Jorn-Steffen Pischke. 1997. "The Returns to Computer Use Revisited: Have Pencils Changed the Wage Structure Too?" The Quarterly Journal of Economics. 112:1, 291-304.

Doms, M. E., Dunne, T. and Troske, K.R. (1997), "Workers, Wages and Technology," *Quarterly Journal of Economics*, 112 (1), 253-90.

Dunn, Thomas A. and Douglas J. Holtz-Eakin. 2000. "Financial Capital, Human Capital, and the Transition to Self-Employment: Evidence from Intergenerational Links," Journal of Labor Economics 18 (2): 282-305.

Evans, David and Boyan Jovanovic. 1989. "An estimated model of entrepreneurial choice under liquidity constraints", Journal of Political Economy 97(4):808-27.

Fairlie, Robert W. 2004. "The Effects of Home Computers on School Enrollment," Economics of Education Review (forthcoming).

Fairlie, Robert W. 2002. "Drug Dealing and Legitimate Self-Employment," Journal of Labor Economics 20 (3): 538-567.

Fairlie, Robert W. 1999. "The Absence of the African-American Owned Business: An Analysis of the Dynamics of Self-Employment." Journal of Labor Economics, 17(1): 80-108.

Fairlie, Robert W., and Bruce D. Meyer. 2000. "Trends in Self-Employment among Black and White Men: 1910-1990." Journal of Human Resources, 35(4): 643-669.

Fallick, Bruce, Charles A. Fleischman, and James B. Rebitzer. 2003. "Job Hopping in Silicon Valey: The Micro-Foundations of a High Technology Center," Paper Presented at the NBER Workshop on Entrepreneurship.

Freeman, Richard B. 2002. "The Labour Market in the New Information Economy," National Bureau of Economic Research Working Paper No. 9254.

Gordon, R. J. (2000), "Does the 'New Economy' Measure up to the Great Inventions of the Past?", *The Journal of Economic Perspectives* 14(4), 49-74.

Greenan, N. and Mairesse, J. (2000),"Computers and Productivity in France: Some Evidence," *Economics of Innovation & New Technology* 9(3), 275-316.

Greene, William H. 2003. Econometric Analysis (Fifth Edition), Prentice Hall: Upper Saddle River, New Jersey.

Haltiwanger, John. 2004. "What do we know (and not know) about the contribution of young businesses to economic growth," Presentation at the Entrepreneurship in the 21st Century Conference, March 26, 2004, U.S. Small Business Administration, Office of Advocacy.

Holtz-Eakin, Douglas, Joulfaian, David, and Rosen, Harvey. 1994. "Entrepreneurial Decisions and Liquidity Constraints." Rand Journal of Economics 23: 334-347.

Jorgenson, D. W. and Stiroh, K. J. (2000), "Raising the Speed Limit: U.S. Economic Growth in the Information Age," *Brookings Papers on Economic Activity* (1), 125-211.

Kuhn, Peter, and Mikal Skuterud. 2004. "Internet Job Search and Unemployment Durations," American Economic Review (forthcoming).

Kuhn, Peter, and Mikal Skuterud. 2000. "Job Search Methods: Internet versus Traditional." Monthly Labor Review, October, pp. 3-11.

Lehr, W. and Lichtenberg, F. (1998), "Computer Use and Productivity Growth in U.S. Federal Government Agencies, 1987-92," *Journal of Industrial Economics* 46(2), 257-79.

Madrian, Brigette C., and Lars John Lefgren. 2000. "An Approach to Longitudinally Matching Current Population Survey (CPS) Respondents," Journal of Economic and Social Measurement, 26, 31-62.

McGuckin, R. H., Streitwieser, M. L. and Doms, M. E. (1998), "The Effect of Technology Use on Productivity Growth," *Economics of Innovation and New Technology* 7(1), 1-26.

Oliner, S. and Sichel, D. (2000), "The Resurgence of Growth in the late 1990s: Is Information Technology the Story?", *The Journal of Economic Perspectives* 14(4), 3-22.

Polivka, Anne E. and Stephen M. Miller (1998): "The CPS After the Redesign: Refocusing the Economic Lens." In Labor Statistics Measurement Issues. eds. John Haltiwanger, Marilyn E. Manser, and Robert Topel, 249-286. Chicago: University of Chicago Press.

Reynolds, Paul D., William D. Bygrave, and Erkko Autio. 2003. Global Entrepreneurship Monitor: 2003 Executive Report. Babson College, London Business School and the Kauffman Foundation.

Stevenson, Betsey. 2003. "The Internet, Job Search, and Worker Mobility." University of Pennsylvania, Working Paper.

U.S. Department of Commerce. 2002. A Nation Online: How Americans are Expanding Their Use of the Internet. Washington, D.C.: U.S.G.P.O.

U.S. Small Business Administration, Office of Advocacy. "Self-Employment and Computer Usage," April 2003.

U.S. Small Business Administration, Office of Advocacy. 2001. "Private Firms, Establishments, Employment, Annual Payroll and Receipts by Firm Size, 1998-2001" Table reported at http://www.sba.gov/advo/stats/us_tot.pdf.

Whelan, K. (2000), "Computers, Obsolescence, and Productivity," FEDS Working Paper 2000-6, Federal Reserve Board of Governors.

Figure 1
Entrepreneurship Rates for Men and Women and Percent of Households with a Home Computer
Current Population Surveys,1980-2001

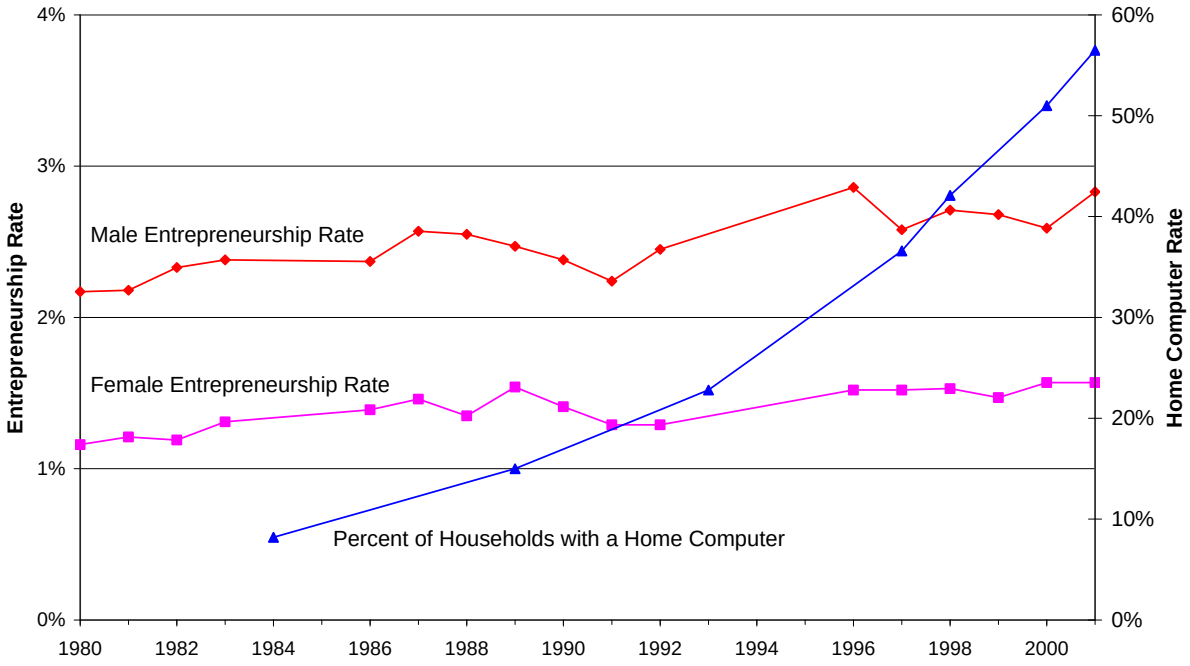

Figure 2
Firm Birth Rate (Employer Firms) and Percent of Households with a Home Computer
Statistics of U.S. Businesses (1989-1999) and Current Population Surveys (1984-2001)

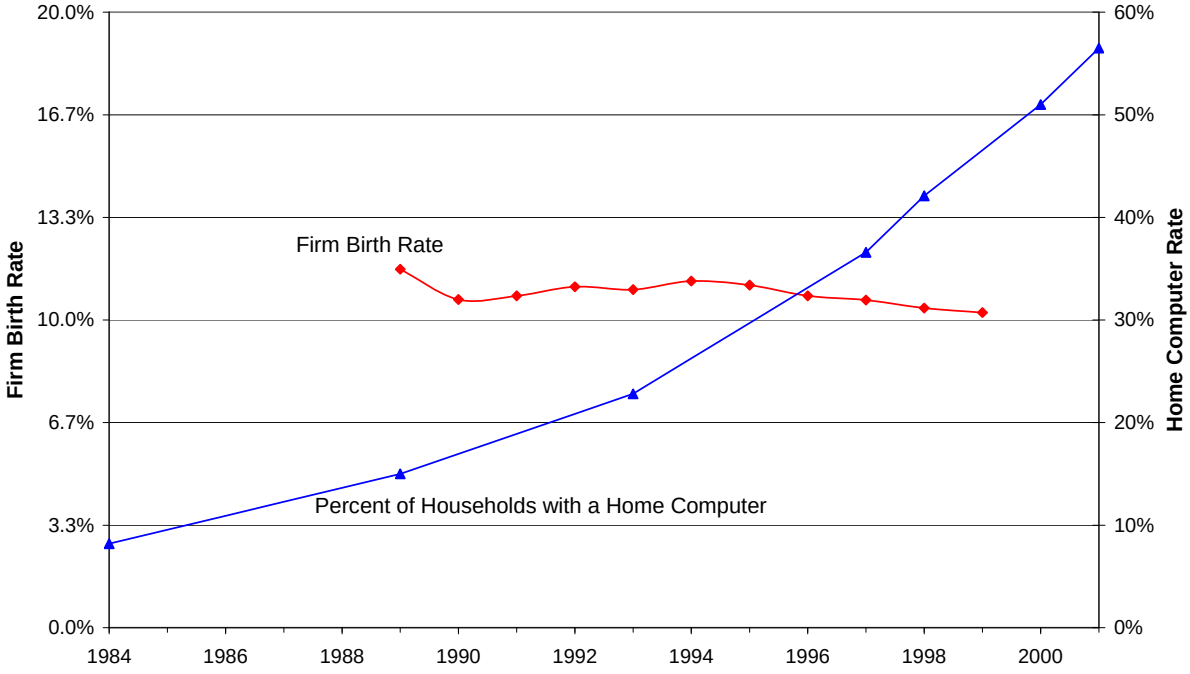

Table 1
Entrepreneurship Rates by Access to a Home Computer
Matched Current Population Surveys, 1997-2001

	1997	1998	2000	2001	4-Year Average
Male Entrepreneurship Rate					
Without access to a home computer	2.4%	2.9%	2.8%	2.1%	2.6%
Sample size	4,690	4,120	3,367	3,287	
With access to a home computer	2.9%	3.4%	3.1%	3.5%	3.2%
Sample size	4,842	5,517	6,230	8,444	
Female Entrepreneurship Rate					
Without access to a home computer	0.9%	0.7%	1.2%	1.1%	1.0%
Sample size	5,778	5,023	3,988	3,805	
With access to a home computer	1.8%	1.8%	1.5%	1.6%	1.7%
Sample size	5,658	6,507	7,285	9,814	

Notes: (1) The sample consists of individuals (ages 20-64) who did not own a business and were not retired or disabled in the first year surveyed. (2) The entrepreneurship rate is the percent of non-business owners in the first year surveyed who started and reported owning a business with at least 15 hours during the survey week in the second year surveyed, 12-15 months later. (3) Having access to a home computer is measured in the first year surveyed in the CPS. (4) All estimates are calculated using sample weights provided by the CPS.

Table 2A
Probit Regressions for Entrepreneurship - Men
Current Population Surveys (1997-2001)

	Specification				
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
Black	-0.2259	-0.2193	-0.1600	-0.2179	-0.2208
	(0.0562)	(0.0563)	(0.0501)	(0.0563)	(0.0563)
Latino	-0.2576	-0.2506	-0.2443	-0.2513	-0.2517
	(0.0608)	(0.0609)	(0.0562)	(0.0610)	(0.0610)
Asian	-0.2025	-0.2036	-0.2056	-0.2049	-0.2037
	(0.0773)	(0.0773)	(0.0723)	(0.0773)	(0.0773)
Immigrant	0.2129	0.2141	0.2035	0.2141	0.2141
	(0.0506)	(0.0506)	(0.0472)	(0.0506)	(0.0506)
Age	0.0155	0.0153	0.0158	0.0154	0.0153
	(0.0092)	(0.0092)	(0.0085)	(0.0092)	(0.0092)
Age squared	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
High School graduate	0.0727	0.0664	0.0642	0.0648	0.0669
	(0.0503)	(0.0504)	(0.0462)	(0.0505)	(0.0504)
Some college	0.0812	0.0681	0.0684	0.0673	0.0695
	(0.0521)	(0.0527)	(0.0484)	(0.0527)	(0.0527)
College graduate	0.0986	0.0822	0.0686	0.0813	0.0847
	(0.0554)	(0.0562)	(0.0521)	(0.0562)	(0.0563)
Graduate school	0.1363	0.1189	0.1016	0.1187	0.1219
	(0.0611)	(0.0619)	(0.0578)	(0.0619)	(0.0620)
Family income: $10,000 to $15,000	0.0359	0.0381	0.1351	0.0366	0.0383
	(0.0990)	(0.0991)	(0.0854)	(0.0991)	(0.0991)
Family income: $15,000 to $20,000	0.0559	0.0560	0.0905	0.0545	0.0552
	(0.0976)	(0.0977)	(0.0860)	(0.0977)	(0.0977)
Family income: $20,000 to $25,000	-0.0441	-0.0449	-0.1474	-0.0467	-0.0453
	(0.0924)	(0.0924)	(0.0846)	(0.0924)	(0.0924)
Family income: $25,000 to $30,000	-0.0579	-0.0597	-0.0990	-0.0617	-0.0598
	(0.0913)	(0.0914)	(0.0819)	(0.0914)	(0.0914)
Family income: $30,000 to $35,000	-0.1569	-0.1618	-0.2212	-0.1654	-0.1616
	(0.0923)	(0.0923)	(0.0832)	(0.0924)	(0.0924)
Family income: $35,000 to $40,000	-0.1582	-0.1641	-0.2433	-0.1663	-0.1639
	(0.0916)	(0.0917)	(0.0831)	(0.0917)	(0.0917)
Family income: $40,000 to $50,000	-0.1475	-0.1566	-0.2654	-0.1588	-0.1560
	(0.0841)	(0.0843)	(0.0763)	(0.0843)	(0.0843)
Family income: $50,000 to $60,000	-0.1562	-0.1685	-0.2665	-0.1708	-0.1678
	(0.0851)	(0.0854)	(0.0771)	(0.0854)	(0.0854)
Family income: $60,000 to $75,000	-0.2356	-0.2494	-0.3416	-0.2519	-0.2477
	(0.0863)	(0.0867)	(0.0782)	(0.0867)	(0.0867)
Family income: more than $75,000	0.0882	0.0720	-0.0513	0.0692	0.0747
	(0.0802)	(0.0808)	(0.0726)	(0.0807)	(0.0809)
Home owner	-0.0363	-0.0395	0.0053	-0.0397	-0.0398
	(0.0364)	(0.0365)	(0.0341)	(0.0365)	(0.0365)
Access to a home computer		0.0541	0.0732	0.0437	0.0716
		(0.0311)	(0.0291)	(0.0567)	(0.0394)
Marginal effect		0.0034	0.0054	0.0028	
Home computer in 1998				-0.0124	
				(0.0758)	
Home computer in 2000				-0.0464	
				(0.0777)	
Home computer in 2001				0.1056	
				(0.0787)	
Access to the Internet at home					-0.0272
					(0.0380)
Mean of dependent variable	0.0299	0.0299	0.0360	0.0299	0.0299
Log Likelihood value	-5,267.26	-5,265.73	-6,082.37	-5,263.64	-5,367.97
Sample size	39,972	39,972	39,972	39,972	39,972

Notes: (1) See notes to Table 1. (2) All independent variables are meausred in the first year surveyed. (3) All equations also include a constant, number of children, dummy variables for Native

Table 2B
Probit Regressions for Entrepreneurship - Women
Current Population Surveys (1997-2001)

	Specification				
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
Black	-0.1998	-0.1771	-0.1706	-0.1776	-0.1783
	(0.0673)	(0.0676)	(0.0542)	(0.0676)	(0.0676)
Latino	-0.3477	-0.3265	-0.3043	-0.3285	-0.3280
	(0.0811)	(0.0812)	(0.0627)	(0.0814)	(0.0813)
Asian	-0.3895	-0.3879	-0.3191	-0.3859	-0.3880
	(0.1061)	(0.1062)	(0.0826)	(0.1062)	(0.1062)
Immigrant	0.1519	0.1511	0.1003	0.1494	0.1513
	(0.0637)	(0.0638)	(0.0523)	(0.0639)	(0.0638)
Age	0.0156	0.0128	0.0005	0.0128	0.0127
	(0.0114)	(0.0115)	(0.0095)	(0.0115)	(0.0115)
Age squared	-0.0002	-0.0001	0.0000	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
High School graduate	0.0246	0.0015	-0.0106	0.0011	0.0017
	(0.0631)	(0.0635)	(0.0515)	(0.0636)	(0.0635)
Some college	-0.0149	-0.0583	-0.0211	-0.0584	-0.0577
	(0.0656)	(0.0663)	(0.0535)	(0.0664)	(0.0663)
College graduate	0.0298	-0.0222	0.0171	-0.0233	-0.0204
	(0.0699)	(0.0707)	(0.0574)	(0.0708)	(0.0708)
Graduate school	0.0843	0.0290	0.0585	0.0286	0.0307
	(0.0788)	(0.0796)	(0.0657)	(0.0797)	(0.0797)
Family income: $10,000 to $15,000	-0.0635	-0.0686	0.0083	-0.0666	-0.0692
	(0.1103)	(0.1105)	(0.0848)	(0.1106)	(0.1105)
Family income: $15,000 to $20,000	-0.0865	-0.0965	-0.1303	-0.0938	-0.0973
	(0.1118)	(0.1122)	(0.0904)	(0.1123)	(0.1122)
Family income: $20,000 to $25,000	0.0027	-0.0054	-0.0747	-0.0067	-0.0060
	(0.0995)	(0.0996)	(0.0816)	(0.0998)	(0.0996)
Family income: $25,000 to $30,000	-0.2333	-0.2486	-0.1922	-0.2454	-0.2491
	(0.1081)	(0.1084)	(0.0836)	(0.1084)	(0.1084)
Family income: $30,000 to $35,000	-0.0641	-0.0879	-0.1781	-0.0841	-0.0881
	(0.0995)	(0.0998)	(0.0819)	(0.0999)	(0.0998)
Family income: $35,000 to $40,000	-0.1633	-0.1945	-0.2079	-0.1936	-0.1946
	(0.1038)	(0.1042)	(0.0832)	(0.1043)	(0.1042)
Family income: $40,000 to $50,000	-0.1203	-0.1591	-0.2185	-0.1576	-0.1590
	(0.0937)	(0.0941)	(0.0760)	(0.0943)	(0.0941)
Family income: $50,000 to $60,000	-0.1217	-0.1645	-0.2439	-0.1650	-0.1639
	(0.0947)	(0.0952)	(0.0772)	(0.0954)	(0.0952)
Family income: $60,000 to $75,000	-0.2158	-0.2646	-0.3140	-0.2629	-0.2635
	(0.0973)	(0.0979)	(0.0786)	(0.0980)	(0.0979)
Family income: more than $75,000	-0.0147	-0.0722	-0.1404	-0.0696	-0.0700
	(0.0901)	(0.0909)	(0.0731)	(0.0910)	(0.0910)
Home owner	0.0904	0.0754	0.0231	0.0759	0.0756
	(0.0477)	(0.0478)	(0.0382)	(0.0478)	(0.0478)
Access to a home computer		0.1747	0.1554	0.1740	0.1877
		(0.0380)	(0.0312)	(0.0651)	(0.0458)
Marginal effect		0.0055	0.0078	0.0054	
Home computer in 1998				0.1327	
				(0.0934)	
Home computer in 2000				-0.1080	
				(0.0938)	
Home computer in 2001				-0.0357	
				(0.0931)	
Access to the Internet at home					-0.0216
					(0.0432)
Mean of dependent variable	0.0145	0.0145	0.0247	0.0145	0.0145
Log Likelihood value	-3,483.43	-3,472.56	-5,301.52	-3,469.35	-3,571.88
Sample size	47,261	47,261	47,261	47,261	47,261

Note: See notes to Table 2A.