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Do women lag behind men? A matched-sample analysis of the dynamics of gender gaps

Joseph Farhat[1] · **Naranchimeg Mijid**[2]

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Abstract Existing research suggests that female-owned firms are not as successful as those owned by men. However, there is a distinct possibility that the performance measures employed in these studies have failed to control for the level of heterogeneity that may be inherent in the firms that were assessed during these studies. This study employed a matched sample approach to determine whether gaps in success, such as survival rate, outcomes, growth, and financial capital injection, between male- and female-owned businesses are eradicated when heterogeneity is controlled for within the models employed. We matched 430 female-owned business with male-owned equivalents that had the same human capital profile in terms of age, level of education, experience, and race; the same working preferences in terms of factors such as number of hours worked per week and whether the business was run from home or an office; and the same industry in terms of high-tech, medium-tech and non-tech. We found that female-owned firms have the same rate of survival as their male-owned counterparts and that the growth rate exhibited by female-owned businesses in terms of factors such as total assets, employment, profit, and sales, is the equivalent of male-owned firms. We did not detect any gender gaps in terms of business performance. Furthermore, the results indicated that, while the firms that are started by women start smaller and stay smaller, they do not lag behind those started by males in terms of business performance. The findings of this research hold particular interest for scholars, researchers, policy makers, investors, and financiers. Above all else, they should offer women who are considering commencing their own venture some confidence that they have the same chance of succeeding as their male counterparts.

✉ Joseph Farhat
farhatjob@ccsu.edu

Naranchimeg Mijid
mijid@ccie-web.com

[1] Central Connecticut State University, 1615 Stanley St, New Britain, CT 06050, USA

[2] Connecticut Center for Innovative Entrepreneurs, 185 Main St., Room 4030200, New Britain, CT 06051, USA

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1 Introduction

The latest data from the U.S. Census indicates that female-owned firms, especially those operated by females of color, increased dramatically between 2007 and 2012. However, women are still underrepresented among the U.S. population of small business owners. Furthermore, female business owners tend to run non-employer firms, and their sales/revenues are 20–50 times smaller than the employer firms owned by men.

Over the past few decades, the number of studies that have explored female entrepreneurs and gender gaps in business performance have increased rapidly and will continue to grow as the role of women in the economy continues to evolve. Studies have consistently found that female-owned firms are typically smaller than male-owned firms, and are more likely to be organized as proprietorships or partnerships (Coleman and Robb 2012). In addition, women tend to choose highly competitive services and retail industries (Loscocco and Robinson 1991) and are more risk averse than men (Kepler and Shane 2007). These differences stem from the underlying gendered social construct in which women and men exhibit different motivations, preferences, and expectations when running their businesses. However, the question remains as to whether females lag behind men in terms of business performance. Researchers have mixed answers to this question.

According to social feminist theories, men and women are expected to act and behave differently. They take different roles within the household, workplace, society, and economy. They are also subject to different perceptions. Through a gendered lens, Loscocco and Bird's (2012) study investigated the direct and indirect relationship between the gender of a business owner and the success of the business. They argued that females typically start a home-based business as a means of balancing their work-family obligations because businesses of this nature allow them to have full control over the amount of effort and the hours they put into their businesses. Furthermore, home-based businesses allow women to stay closer to home. As a result, this gendered path could provide one explanation for why female-owned firms underperform in comparison to those of males in terms of sales.

However, Robb and Watson's (2012) study found that females do not lag behind men in terms of business performance even after controlling for risk-related factors, key demographic differences, and the firm size. The success of a business largely depends on both human capital and financial capital (Cooper et al. 1994). This is especially the case with family businesses (Fairlie and Robb 2007). Within the retail and services sector, where female-owned firms are heavily concentrated, human capital plays a more significant role in the success of female-owned firms whereas financial capital is more important for male-owned firms (Coleman 2007). Studies have also found that female entrepreneurs not only start their

business with smaller start-up capital, but that they also raise lower amounts of financial capital in subsequent years (Coleman and Robb 2009).

The purpose of this study is to investigate the relationship between human and financial capital and gender gaps in business outcomes and financing sources using matched sample estimates drawn from the Kauffman Firm Survey (KFS). The matched sample method allowed us to compare the business performance of two identical firms (owned by a woman vs. a man) that had the same human capital and the same preferences (measured by the number of hours worked) within the same industry and that were of a similar set-up (home-based or non-home-based). The data from the KFS also allowed us to explore the impact financial capital had on the business performance of two firms that were identical with the exception of the fact that one was owned by a man and one was owned by a woman. The main research question that underpinned this study was as follows: Are male-owned businesses more successful than female-owned businesses? The analysis assessed and compared male- and female-owned enterprises across three measurements: survival, business performance, and financing.

This study makes a contribution to existing research in this domain by building upon previous studies (Robb and Watson 2012; Coleman et al. 2013) that have investigated the survival rate and business performance of male- and female-owned firms. However, this study was the first of its kind to use the matched sample method with panel data to examine the dynamics of female-owned firms using the KFS full sample. Thus, in addition to the methodological contributions the paper makes to the existing body of literature on female entrepreneurs and the success of female-owned firms, it also presents a novel approach to conducting research in this area.

Our results revealed that a) female-owned firms have the same survival rate as male-owned firms across the industry (with the exception of the retail sector); b) the consistent gender gap in assets, sales, profits, and employment that can be observed between male- and female-owned firms can be attributed to the fact that female-owned businesses start smaller and stay smaller but grow at the same rate as male-owned firms; c) only half of the asset gaps could be explained by differences in industry and the remaining half were unexplained; and d) although female-owned firms start with a smaller capital and make lower capital injections in subsequent years, there are no significant differences in debt and equity capital injections in relative terms (percentage of total financing).

2 Literature review

The number of studies that have explored gender gaps and female entrepreneurs have grown exponentially over the past few decades. However, while many studies have attempted to determine whether females lag behind males in terms of business performance, the results have been inconsistent. Three interrelated streams of literature are closely tied to the question as to whether females lag behind men in terms of business performance:

1) studies on human capital investment as a key determinant that explains business performance,

2) studies on financial capital that predict the future growth of business and the success of business, and
3) literature that uses other factors to explain the success of business and gender gaps.

2.1 Literature on human capital as a determinant of business performance

Human capital investment is a fundamental factor that determines productivity growth, especially for high-tech industry and high-growth firms. For example, one year of schooling increases productivity by 8.5–12.7% (Black and Lynch 1996). Formal education and prior work experience are the most cited factors that affect entrepreneurial success. A business owner's additional year of schooling not only directly increases firm's earnings (Van der Sluis et al. 2008) but also indirectly affects business performance. Parker and van Praag (2006) estimated that an additional year of schooling (13.7%) both directly impacted the entrepreneurs' performance and indirectly reduced the capital constraints of the firm (1.18%) which, in turn, affected the firm's performance (by 3.9%). According to the Bureau of Labor Statistics, only 2% of all firms in the U.S. in 2009 were high-employment-growth[1] firms; however, this 2% generated 35% of job gains between 2009 and 2012 (Clayton et al. 2013).

Studies have also found that the education and experience of entrepreneurs are fundamental resources that not only directly impact businesses performance but also influence the firm's chances of survival. For example, Coleman et al. (2013) examined survival rates and exit routes (through closure or through mergers and acquisitions) of new ventures and found that an entrepreneur's human capital (education, work experience, and life experience) impacts not only the survival of the firm but also determines whether an exit via a merger and acquisition (M&A) will be successful. Delmar and Shane (2006) argued that the founding team's prior start-up and industry experience greatly enhanced a new firm's survival rate and sales. Gimeno et al. (1997) claimed that some low-performing firms continue to survive in situations in which others fail because of the entrepreneur's human capital characteristics (as measured by formal education and managerial/supervisory skills), among other factors, and that these characteristics increase the economic performance of the organization. Contrary to this argument, Unger et al. (2011) found that there was a stronger relationship between knowledge and skills and a firm's success than past education and experience because human capital is dynamic in the same way a firm's growth is dynamic.

Moreover, task-related knowledge and skills have also been identified as factors that can have a significant impact on the success of a firm (Unger et al. 2011); however, the relative lack of these essential skills in females in comparison to males (especially in terms of business and technical skills) could affect the performance of female owners (Heilbrunn 2004). Female business owners also lag behind men in terms of management and financial skills (Fairlie and Robb 2009; Loscocco and Robinson 1991). In addition, female entrepreneurs may have different skill sets than men; the former tend to be more skilled in professional, educational, or medical services sectors but less skilled in technology, construction or management. As a result, we would expect

[1] High-employment-growth firms are defined as firms that have 10 or more employees that have experienced 20% or more average annualized employment growth over a three-year period.

female-owned firms to have a lower survival rate or a higher exit rate than those owned by males.

2.2 Literature on financial capital as a predictor of business success

Financial capital is another important factor that determines the growth of startups. The relationship between the success of a business and access to credit is relatively explicit within start-ups and can have a direct impact on their survival in subsequent years (Bates et al. 2013; Fracassi et al. 2013). However, startups and small businesses have many disadvantages in comparison to large and established businesses (Berger and Udell 1998). More specifically, startups have fewer options for access to capital and the success of small businesses heavily depends on their access to credit. This is especially the case with traditional bank loans (Williams and Ou 2008). The U.S. Small Business Administration report that examined the financing patterns of small businesses found that over 80% of the firms had outstanding debt and 55% had traditional bank loans (Ou and Williams 2003). Using the Kauffman Firm Survey, which contains more recent data on startup firms, Robb and Robinson (2014) found that 40% of initial startup capital is funded by bank loans.

Traditional bank loans are an especially important source of finance for female-owned businesses (Fairlie and Robb 2009; Gatewood, Brush, Carter, Greene, & Hart, 2009) since women are more disadvantaged (Loscocco and Robinson 1991). Bates et al. (2013) have found that female-owned small startups have lower growth rates than their male-owned counterparts. As a result, they may encounter difficulties securing the loan required for growth and expansion (Coleman and Robb 2009). In addition, their growth may be restricted because female-owned firms are clustered into a few, highly competitive service industries and retail sectors (Wang 2013).

2.3 Literature on other factors that explain business performance

While both human capital and financial capital are key determinants of growth, it is possible that the owners of the firms (especially female-owned businesses) either don't want to grow their businesses or other barriers exist that impede their growth (Ahl 2006; Manolova et al. 2012; Robb and Coleman 2010). Regardless of their intention to grow or stay smaller, not all firms want to maximize their profits (Wiklund et al. 2003). Entrepreneurship is a dynamic process that continually evolves based on an owner's current assessment of market demand, internal and external conditions, and the outside environment (Bianchi and Winch 2008).

However, studies have found that female-owned firms are fundamentally different than male-owned firms. As a result, their performance and success are different. For example, when starting their businesses, female business owners have different motivations and expectations than men (Loscocco and Bird 2012; Manolova et al. 2012). Men are motivated, for example, by financial gains and self-realization, whereas females are more interested in status (Manolova et al. 2008). Female owners also want to be independent, and this is one reason as to why they do not seek outside equity and/or debt (Orser et al. 2006; Robb and Coleman 2010). Furthermore, women have different priorities when running their business; for example, some see it as a hobby as opposed to a primary income. They may also have different preferences; for

example, keeping their businesses small and manageable. Balancing work-family obligations is another factor that explains the comparative underperformance and/or small size of female-owned firms (Ferguson and Durup 1998). Furthermore, women typically cultivate more personal networks (Staber 1993) than professional networks (Weiler and Bernasek 2001), which could be another reason as to why female-owned firms are relatively smaller than that of males.

Based on the arguments discussed in these three streams of literature, the current research sought to test the following set of hypotheses:

- H1a: A female-owned and a male-owned firm with the same human capital (measured by age, education, and experience) and the same preferences (home-based vs. non-home-based, weekly hours worked) have the same survival rate.
- H1b: A female-owned and a male-owned firm with the same human capital (measured by age, education, and experience) and the same preferences (home-based vs. non-home-based, weekly hours worked) have the same growth rate.
- H1c: A female-owned and a male-owned firm with the same human capital (measured by age, education, and experience) and the same preferences (home-based vs. non-home-based, weekly hours worked) use the same capital structure.

The methods researchers most commonly use to examine gender gaps in performance are multivariate regression models, such as logistic regression or conditional logistic model. For example, to name a few recent studies, Robb and Watson (2012) explored gender differences in business performance using the KFS, Yang and Aldrich (2014) investigated gender inequalities in leadership, Coleman and Robb (2009) analyzed gender gaps in access to capital and Mijid (2015), and Mijid and Bernasek (2013) investigated whether credit rationing is a form of gender discrimination. However, one of the main limitations of multivariate modeling with control variables is that it does not account for group differences in distributions (Starks and Garrido 2004). In other words, in the context of the current study, if female-owned firms are inherently different to male-owned firms, multivariate modeling with control variables does not capture the heterogeneity of these firms. The current study differed from previous research in that it employed a multivariate model to examine gender differences in a controlled environment that consisted of a subset of a sample matched by key characteristics. By matching firms by the owner's age, education, experience, and race and the weekly hours worked, and location of the firms, we were able to create two comparable groups (Marlow 1997) that were identical with the exception of the gender of the owner.

3 Data and sampling method

3.1 About the Kauffman firm survey

This study uses the Kauffman Firm Survey (KFS), the largest and longest longitudinal data of its kind. The KFS involved 4928 firms that started operating in 2004. Although the KFS data is publically available, the confidential version of the data was used in the current study because it contains information about the firm's location, four-digit

industry codes, and imputed values of missing variables. In response to the Kauffman Foundation's interest in understanding the dynamics of high-technology, medium-technology, and female-owned businesses, the KFS is a stratified sample based on the industrial technology level and gender, which oversamples businesses in high- and medium-tech industries. As such, the sample of high-tech, medium-tech, or non-tech businesses standalone is equivalent to a stratified simple random sample (e.g., the high-tech sample is a stratified simple random sample based on gender). In the KFS sampling process, businesses within each technology and female-owned indicator sampling stratum were sorted by two control variables (implicit stratification): (1) D&B employee count categories, and (2) three-digit zip code; then, sampling selection was performed using Chromy's sequential random sampling method (Farhat and Robb 2014). Thus, we can think of the KFS as consisting of six random sub-samples. Since we matched female entrepreneurs with male entrepreneurs at the lowest level of the sampling path, we were not concerned about the oversampling and weights in our study. The imputed data was used to conduct the current research. Details of the data imputation procedures as well as data descriptions are available in Farhat and Robb (2014).

3.2 Matched sample estimation

To the best of our knowledge, this study was the first of its kind to use the matched sample method to study the dynamics of gender gaps in a panel data of start-up firms in the US. Riding and Swift (1990) used the matched sample method to investigate differences in loan terms, such as loan approval rates, interest rates, collateral, and cosigner requirements, between female- and male-owned firms. They argued that, because female-owned firms are smaller and younger on average than male-owned firms, and because women typically focus on certain retail and services industries, the loan terms are usually associated with these characteristics (firm size, age of a firm, and industry) but not necessarily on the gender of the owner. To properly measure the gender gap in lending terms between female and male-owned firms, they matched a female-owned firm with a male-owned firm using five criteria: age, size, industry, growth rate, and organizational structure.

The key differences between the approach taken by Riding and Swift (1990) and that of the current research is twofold: 1) They investigated loan terms and whether banks discriminate against female entrepreneurs, while the aim of our research was to investigate whether female lag behind men in terms of business performance and, if so, why? 2) They used firm size, age, industry, organizational structure, and sales growth rate as the matching criteria to investigate gender discrimination, while our approach was to use alternative objective criteria such as age, education, experience, and race of the owner, number of hours worked, and whether the firms were home-based.

The matched sample method was also used by Marlow (1997) to examine the motivations of female and male entrepreneurs. Her study was based on 28 matched samples and mainly focused on qualitative analysis. She suggested that further studies should assess a larger dataset.

In our study, a sample of female entrepreneurs was matched with male entrepreneurs based on industry, age, education, work experience, race, and location. This allowed us

to examine the performance gaps (earnings, growth, profitability, and survival) and financing gaps in a more controlled environment. Human capital, financial capital, and owner's characteristics have frequently been cited as the reasons for differences in performance between the gender gaps. Researchers have found evidence that human capital and financial capital may be substitutes for one another (Parker 2009). Thus, on the one hand, controlling for human capital will allow us to study if financial capital is the only driver of performance gaps, while, on the other, controlling for human capital will allow us to study the determinants of a start-up capital gap as well as the determinants of gaps in financing sources (internal vs. external).

Two main characteristics determine the measure of closeness to use in matching female entrepreneurs with male entrepreneurs. The first involves which factors to include in matching female entrepreneurs with male entrepreneurs. For the purpose of this study, we matched a female-owned firm with a male-owned firm based on industry, age, education, work experience, race, weekly hours worked, and location. The second characteristic involves combining those factors into one distance measure. In this study, the matched firm selected for a particular female-owned firm (case) (i) was the male-owned firm (j) closest to the female-owned firm in terms of Dij, where Dij was defined as the Euclidean distance between the case and the control matching factors.

Using the baseline year, within each industry we matched a female-owned firm with a male-owned firm based on the following characteristics:

1. Age of the owner
2. Education of the owner
3. Work experience of the owner
4. Race of the owner
5. Weekly hours worked
6. Location of the firm (Home-based vs. Other)

We imposed a one-to-one exact matching protocol to avoid the overmatching problems (Bland and Altman 1994, 1995). Thus, if two or more male-owned firms had the same distance from a female-owned firm, one of these male-owned firms was randomly selected. Meanwhile, if two or more female-owned firms had the same distance from one male-owned firm, one of these female-owned firms was randomly selected. Figure 1 illustrates the matching path and Table 1 presents the characteristics of the 430 matched firms. As shown in Fig. 1, out of 3140 firms that were still in operation as of the end of 2011, we identified 25 high-tech firms, 133 medium-tech firms, and 272 non-tech firms, and these were matched using the criteria outlined above. Table 1 Panel shows the variables used in the matching process. Panel B shows the characteristics of the matched firms.

3.3 Descriptive statistics

Panel A of Table 1 presents the summary statistics of matched firms as of 2004 by our six selected criteria. While continuous variables, such as age, experience, and weekly hours worked by the owners indicated an almost one-to-one match, categorical variables, such as education, or binary variables, such as race, demonstrated an exact

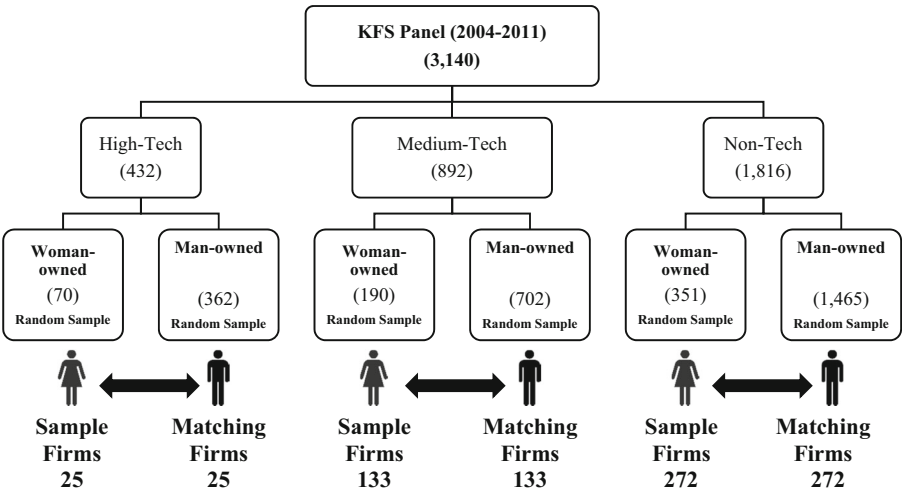

Fig. 1 Matching path of surviving firms

match. Panel B of Table 1 presents the additional characteristics of a female-owned and male-owned firm, such as total assets, sales, profits, numbers of employees, and industrial sectors.

On average, female-owned firms are half the size of male-owned firms in terms of total assets ($31 K vs. $61 K), sales ($45 K vs. $84 K), and number of employees (0.28 vs. 0.66). However, the female-owned firms included in our sample earned a higher profit in 2004 (although it was insignificant) than the male-owned counterparts ($3.7 K vs. $2.5 K) even though female-owned firms operated with significantly lower assets and fewer employees. A significantly higher percentage of females organized their firms as a sole proprietorship than men (69% vs. 53%). The percentage of female-owned firms with at least one person engaged in R&D activities was similar to that of the percentage of male-owned firms (0.18 vs. 0.16). Retail trade sector and arts, entertainment, and recreational services represented a higher percentage of females than men, whereas construction, professional, scientific, and technical services as well as administrative and support services had a higher representation of men than women. It is important to point out that, in 2004, although female-owned firms were smaller (in terms of traditional size measures) and tended to concentrate on certain industrial sectors that are different to the male-owned firms, they earned the same profit and engaged in similar R&D activities to the male-owned firms.

4 Empirical methodologies and findings

4.1 The gender gaps

Following Fairlie and Robb (2009), we used closure, profits, employment, and sales to measure performance gaps. In this study, we were specifically interested in business outcomes; as such, our independent variables included human capital, financial capital, owner characteristics, and industry characteristics as well as other control variables.

Table 1 Descriptive statistics of matched firms

Variables (in 2004)	Woman-owned Mean	Man-owned Mean	Difference Mean
Panel A Matched Variables			
Age	45.46	45.07	0.39
Work Experience	10.35	10.43	−0.08
Weekly Hours Worked	36.53	36.18	0.35
High School or less	8.60	8.60	0.00
College Degree	64.65	64.65	0.00
Graduate Degree	26.74	26.74	0.00
Race: White	88.37	88.37	0.00
Race: Other	11.63	11.63	0.00
High Tech Industry	5.81	5.81	0.00
Medium Tech Industry	30.93	30.93	0.00
Non-Tech Industry	63.26	63.26	0.00
Home Based	67.21	67.21	0.00
Panel B Unmatched Variables			
Total Assets	30,754.91	61,113.64	−30,358.72***
Sales	45,326.27	84,208.86	−38,882.58**
Profit	3767.45	2466.87	1300.58
Employees	0.28	0.66	−0.38**
Sole Proprietorship	0.69	0.53	0.16***
R&D activity	0.18	0.16	0.01
Construction	2.33	8.14	−5.81***
Manufacturing	8.14	5.35	2.79
Wholesale Trade	4.88	3.49	1.39
Retail Trade	15.58	11.63	3.95*
Information	3.95	3.02	0.93
Real Estate and Rental and Leasing	2.79	3.26	−0.47
Professional, Scientific, and Technical Services	27.21	32.56	−5.35*
Administrative and Support Services	6.05	9.77	−3.72**
Arts, Entertainment, and Recreation	5.12	1.40	3.72***
Other Services	23.95	21.40	2.55

two-sample t-test. ***, **, * indicate that the Man-owned mean is statistically different from Woman-owned mean at 0.01, 0.05 and 0.10 levels, respectively

The following subsections describe the methodologies we used to analyze gender gaps in survival, business outcomes, and financing, together with the results of this analysis.

4.2 Gender gaps in survival

First, among the nonparametric duration models that are available, we chose the life-table method to establish survival rates. The life-table method enables the calculation of

nonparametric estimates of the survival and hazard functions without assuming an underlying distribution or that independent variables change survival experiences. Thus, this approach avoids the potentially large errors that result from making incorrect assumptions about the distribution. The results of our analysis indicate (in Table 2) that female-owned firms have slightly lower survival rates in each year than male-owned firms. Using the Log-rank test for equality of survivor functions, we found no differences in the survival rates between female and male-owned firms between 2004 and 2011. As shown in Table 2, fewer and fewer females stayed in business each year; however, the same was true for the male entrepreneurs included in our sample. At the end of 2011, less than half of both female- and male-owned firms were still in operation (207 vs. 211 firms accordingly).

Table 3 presents the survival rates across industries, while Table 2 shows the survival rates in an aggregate number. We found that there were no differences in survival rates between women and men across different industries, with the exception of the retail sector. In fact, female-owned firms had a better survival rate in most industries; however, the differences were insignificant. The retail industry was the only sector that exhibited a significantly lower survival rate for females. This was somewhat interesting given that it is one of the sectors in which female entrepreneurs tend to cluster.

Next, as in Coleman et al. (2013), we used the Cox regression (proportional hazards) model to examine the factors that impact closure among female-owned and male-owned firms. Table 4 presents the results of the regression by estimating the Cox model for the hazard function of 860 firms in our sample. We considered four different specifications, as shown in Table 4. Models 1–4 included either start-up capital or start-up total assets or capital injection during year, *t*, or total assets during year, *t*, since these variables are highly correlated to each other. In addition, we controlled for industry effects as well as key demographic variables, such as owner's gender, education, and experience, number of hours worked, R&D activities, and organizational type.

Table 2 Survival rate

Panel A	Woman-owned			Man-owned		
Year	Beg. Total	Closure	Survivor	Beg. Total	Closure	Survivor
2004	430			430		
2005	382	48	0.888	392	38	0.912
2006	342	40	0.795	358	34	0.833
2007	316	26	0.735	322	36	0.749
2008	280	36	0.651	288	34	0.670
2009	255	25	0.593	256	32	0.595
2010	230	25	0.535	235	21	0.547
2011	207	23	0.488	211	24	0.491
Test for equality of survival curves: *P*-Value					0.786	

Log-rank test for equality of survivor functions. ***, **, * indicate that the Man-owned survivor rate is statistically different from Woman-owned survivor rate at 0.01, 0.05 and 0.10 levels, respectively

Table 3 Survival rates by industry

Survival Rates 2004–2011 by Industry	Woman-owned Survivor	Man-owned Survivor	Test for equality P-Value
Construction	0.600	0.600	0.941
Manufacturing	0.457	0.478	0.926
Wholesale Trade	0.476	0.400	0.698
Retail Trade	0.313	0.480	0.046**
Information	0.529	0.462	0.600
Real Estate and Rental and Leasing	0.667	0.643	0.984
Professional, Scientific, and Technical Services	0.530	0.500	0.679
Administrative and Support Services	0.577	0.452	0.419
Arts, Entertainment, and Recreation	0.636	0.500	0.639
Other Services	0.476	0.457	0.961

Log-rank test for equality of survivor functions. ***, **, * indicate that the Man-owned survivor rate is statistically different from Woman-owned survivor rate at 0.01, 0.05 and 0.10 levels, respectively

Prior research reveals that human capital is a significant factor in business survival (Cressy 1996). Our regression analysis confirmed the theoretical predictions that higher levels of human capital reduce the hazard rate. Weekly hours worked, owner's education, and experience are negatively correlated with the likelihood of closure. Whether a business was a sole proprietorship or conducted R&D activities significantly reduced the rate of hazard. More interestingly, after controlling for human capital, financial capital did not seem to be a major predictor of the likelihood of closure. Inconsistent with prior studies, the firm size (as measured by total assets or capital at startup) or

Table 4 Cox-proportional hazard model

Variables	Model 1 Hazard Ratio	Model 2 Hazard Ratio	Model 3 Hazard Ratio	Model 4 Hazard Ratio
Start-up Capital	1.03			
Start-up Total assets		0.98		
Capital Injection t			1.02	
Total Assets t				0.97**
Sole Proprietorship	0.83*	0.81**	0.82*	0.80**
Female owner	0.97	0.99	0.97	0.99
Weekly Hours Worked	0.99***	0.99***	0.99***	0.99***
Owner's education	0.95**	0.95**	0.95*	0.95*
Owner's work experience	0.99**	0.99**	0.99**	0.99**
R&D activity	0.73*	0.73*	0.71**	0.73*
Industry fixed effects	Yes	Yes	Yes	Yes

***, ** and * indicate the coefficient is statistically different from zero at 0.001, 0.01 and 0.05 levels, respectively. Description of the independent variables is provided in Appendix Table 14. Hazard ratio is the ratio of incidence rates

gender did not have an impact on the hazard rate. Our results indicated that the chance of a firm surviving is purely driven by human capital.

4.3 Gender gaps in business outcomes

For performance measures, we used standard regression models to estimate the factors that impact these outcomes among female-owned and male-owned firms. The Blinder-Oaxaca decomposition technique was used to explore the gender differences in business (if such differences exist). In addition, we used the random coefficients model to examine the growth paths of profits, employment, assets, and sales over time.

Simple comparisons of the growth paths of total assets, sales, profits, and number of employees are shown in Table 5. These variables follow the same growth path among female-owned and male-owned firms, but with a constant gap. In Fig. 2, for example, we show the growth path of total assets between female and male-owned firms. This data indicates that female-owned firms start smaller and stay smaller.

In Fig. 3, we can observe a similar growth pattern in sales since female-owned firms operated with significantly lower assets than male-owned firms. However, as Fig. 4 shows, the number of employees of male-owned firms grew at a much higher rate than female-owned firms between 2004 and 2007. However, the employment rate fell sharply in 2008 due to the recession and remained flat thereafter, at about 1.1 Female-owned firms' employment leveled off with 0.6 employees.

Table 5 Growth of mean values of business performance

Year	Total Assets	Sales	Profit	Employees
Woman-owned				
2004	30,755	45,326	3767	0.28
2005	41,756	72,338	12,199	0.59
2006	45,452	94,517	16,690	0.72
2007	49,755	172,384	18,749	0.65
2008	56,866	182,260	15,466	0.59
2009	50,231	202,486	11,843	0.59
2010	59,187	157,278	17,516	0.73
2011	70,164	161,492	24,500	0.60
2004–2011	48,039	125,385	14,071	0.57
Man-owned				
2004	61,114	84,209	2467	0.66
2005	91,792	180,654	15,220	1.22
2006	106,592	205,907	24,233	1.48
2007	104,118	216,982	17,821	1.51
2008	111,509	261,844	17,433	1.11
2009	94,070	295,218	21,783	1.06
2010	107,634	221,387	18,438	1.06
2011	125,155	259,041	31,006	1.08
2004–2011	97,049	203,964	17,220	1.14

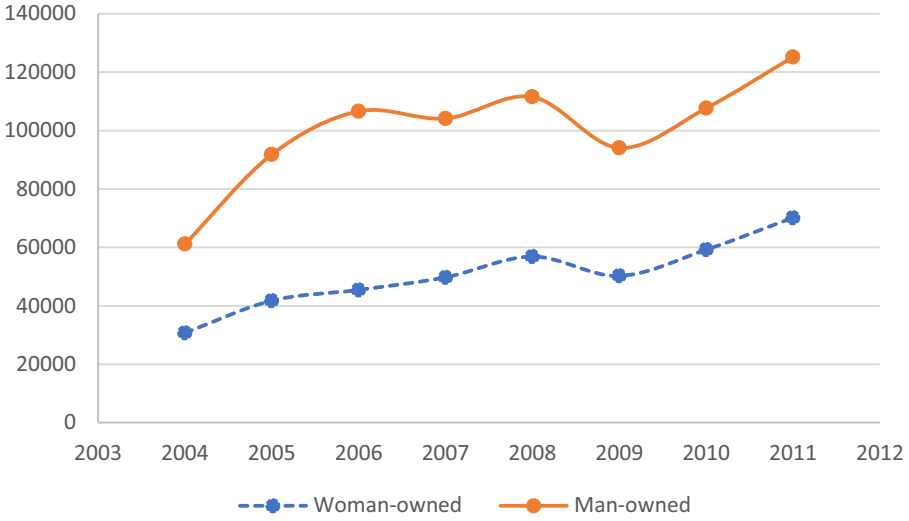

Fig. 2 Total assets

Profit is a highly volatile measure, especially within the first few years of a firm's inception. Figure 5 indicates that the profits of the businesses examined in this study were severely affected by the recession but that male-owned firms were hit by the recession earlier than the female-owned firms due to the fact that they were segregated in certain industrial sectors such as construction. As a result, the gender gap in profits

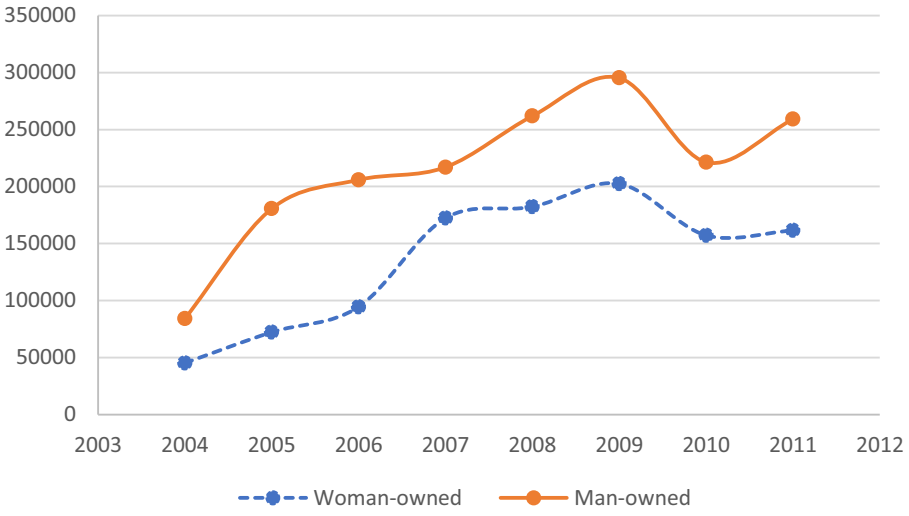

Fig. 3 Total sales

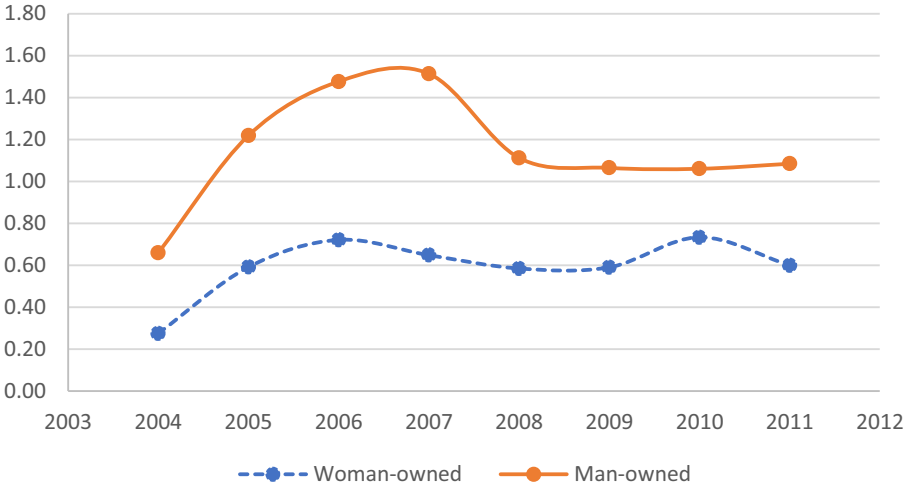

Fig. 4 Number of employees

closed in 2007, 2008, and 2010 but oscillated in 2006, 2009, and 2011, displaying a cyclical movement.

To explore these growth paths in more detail, we used a latent growth model. Latent growth modeling is a statistical technique that uses the structural equation model (SEM) framework to estimate growth trajectories. One main advantage of using latent growth models is that they facilitate the investigation of systematic change, inter-

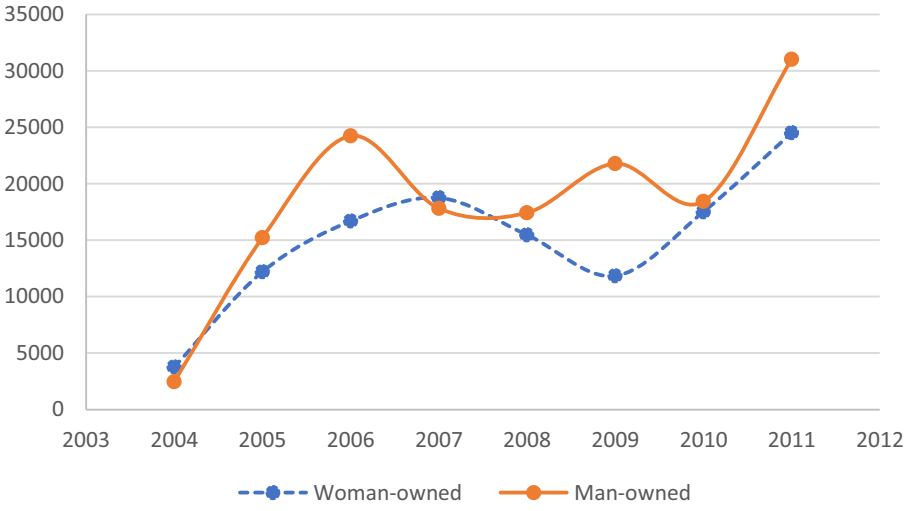

Fig. 5 Profit

individual variability in this change, and the correlation of the growth parameters (endowments "initial status" and growth rate) with time-varying and non-time-varying covariates.

The latent growth curve model is represented by the following set of formulas:

Level-1 equation (measurement model):

$$y_{it} = \pi_{0i} + \pi_{1i} Time_t + \in_{it}, \text{for } i = 1, 2, .. \ n \ \text{ and } t = 1, 2, ..T. \tag{1}$$

where y_{it} is the response variable for firm i at time t. π_{0i} is a latent variable that represents the level-1 intercept (endowments "initial status"), and π_{1i} is a latent variable that represents the growth trajectory (growth rate).

More traditionally, the structural model would be represented by:

$$\Upsilon = \tau_y + \Lambda_y \eta + \varepsilon \tag{2}$$

$$\begin{bmatrix} y_{i1} \\ . \\ . \\ . \\ y_{iT} \end{bmatrix} = \begin{bmatrix} 0 \\ . \\ . \\ . \\ 0 \end{bmatrix} + \begin{bmatrix} 1 & t_1 \\ . & . \\ . & . \\ . & . \\ 1 & t_T \end{bmatrix} \begin{bmatrix} \pi_{0i} \\ \pi_{1i} \end{bmatrix} + \begin{bmatrix} \epsilon_{i1} \\ . \\ . \\ . \\ \epsilon_{iT} \end{bmatrix} \tag{2.a}$$

Level-2 equations (structural model):

$$\pi_{0i} = \gamma_{00} + \gamma_{01} x_i + \zeta_{0i} \tag{3.a}$$

$$\pi_{1i} = \gamma_{10} + \gamma_{11} x_i + \zeta_{1i} \tag{3.b}$$

x_i is/are time-varying (or non-time-varying) predictor(s) of the intercept and (or) slope variables. In the level-2 equations, γ_{00} and γ_{10} are the intercepts or average value of π_{0i} and π_{1i} respectively, and ζ_{0i} and $\zeta_{1i}$are error terms.

$$y_{it} = \pi_{0i} + \pi_{1i} Time_t + \in_{it}, \text{for } i = 1, 2, .. \ n \ \text{ and } t = 1, 2, ..T. \tag{4.a}$$

$$\pi_{0i} = \gamma_{00} + \gamma_{01} Female + \zeta_{0i} \tag{4.b}$$

$$\pi_{1i} = \gamma_{10} + \gamma_{11} Female + \zeta_{1i} \tag{4.c}$$

The results from the latent growth model are presented in Table 6 and support the results presented in Table 5. The first column of Table 6 contains the total assets of male-owned and female-owned firms. The intercept that represented the initial endowments of assets for male-owned firms was $79,708; however, for female-owned firms, this was $45,179 lower than that of the male-owned firms, and this difference was significant. The slope indicates that male-owned firms grew by $3733 a year, whereas female-owned firms grew by $320 less than the male-owned firms, which was not significant. The data related to employment is presented in the second column and sales in the third column. As a result, our findings suggested that female-owned startups have lower initial assets, sales, and employment but the same growth rate as male-owned startups.

Table 6 Growth modeling

	Assets	Total Employees	Sales	Profit
Intercept				
γ_{00}	79,708.6 ***	1.43***	136,781.7***	9991.62***
γ_{01}	−45,179.24***	−0.55**	−71,133.17**	−1368.41
Slope				
γ_{10}	3732.92**	0.06*	20,083.47***	1778.63**
γ_{11}	−320.24	−0.01	−2386.98	−453.71

***, ** and * indicate the coefficient is statistically different from zero at 0.001, 0.01 and 0.05 levels, respectively. Description of the independent variables is provided in Appendix Table 14

In terms of profits (last column of Table 6), we observed a slightly different result. Male-owned firms earned about $9992 profit in their initial year of operation, as indicated by the coefficient of the intercept, but female-owned firms earned $1368 less profit, which is statistically insignificant. Furthermore, the slopes indicated that the male-owned and female-owned firms earned about the same profit each year thereafter. This suggests that female-owned startups also have the same initial profits and the same growth rate as male-owned firms.

Previous empirical studies (Fairlie and Robb 2009; Loscocco et al. 1991; Jennings and Brush 2013) repeatedly reported that female-owned firms have fewer assets than male-owned firms. Many reasons have been put forward to explain this discrepancy. First, most of the time, female entrepreneurs have different motivations for starting a business than male owners. In order to be more present and engaged with their families, many female entrepreneurs view themselves as self-employed as opposed to being a business owner. While the KFS data doesn't provide us with the reasons as to why the entrepreneurs started the business, it did ask the question in the final survey of 2011. Thus, we examined the reasons for starting the business that were provided by the surviving firms at this point.

As shown in Table 7, the female entrepreneurs in our sample had different motivations than the male entrepreneurs for starting their businesses. Approximately 22% of the female-owned firms reported that their reason for starting a business was to have a primary source of income, whereas this number was 32% for the male-owned firms. This gap was statistically significant at the 5% level. Conversely, a significantly higher percentage of female owners started their business to have more freedom to meet family responsibilities than male owners (15% vs. 8%). This result was not surprising given that previous studies have concluded that men are motivated by financial gains and self-realization, whereas females are motivated by status (Manolova et al. 2008). Nevertheless, the findings presented in Table 7 suggest that, if the KFS data had included these variables or other variables that measured the motivations of entrepreneurs across all years of the panel study, they might have explained some of the unexplained gender gaps in assets.

Second, due to the lack of savings (net worth), female entrepreneurs had a smaller amount of equity capital available to them. Starting from the 2008 survey, the KFS collected data about the net worth of the primary owner. As shown in Table 8, the percentage of female-owned firms with a negative or zero net worth was significantly

Table 7 Motivations of Start-ups

Reasons for Starting the Business (%)	Woman-owned	Man-owned
To have a primary source of income	22.06	31.90**
To have a secondary source of income	17.65	21.43
To be my own boss	27.45	28.57
To have more freedom to meet family responsibilities	15.20	8.10**
To create a job not available elsewhere in the job market	11.27	7.14
Other	6.37	2.86*
Number of Observations	207	211

***, **, * indicate that the Man-owned percentage is statistically different from Woman-owned percentage at 0.01, 0.05 and 0.10 levels, respectively

lower than that of male-owned firms in 2008–2011. This finding was contrary to what we expected. On the other hand, the percentage of woman entrepreneurs with less than $50,000 (positive net worth) or with $50,000–$100,000 net worth was higher than their male counterparts, although this was insignificant. The percentage of female-owned firms with more than $100,000 net worth was the same as the percentage of male-owned firms. This indicates that net worth was not an issue in our sample.

Third, female entrepreneurs tend to start their businesses in low capital requirement industries. This could be due to the fact that they are more risk averse than men and, therefore, start businesses of a smaller size. Since our sample was matched based on industry (high-tech, medium-tech, and low-tech), examining this claim using our sample

Table 8 Net worth of primary owners

Net Worth (%)	2008	2009	2010	2011
Woman-owned				
Negative or zero net worth	3.42	3.33	4.23	3.57
Between $1 and $50,000	18.63	19.58	18.31	17.86
$50,001 to $100,000	17.87	18.33	19.25	19.39
$100,001 to $250,000	20.15	20.83	20.66	20.92
More than $250,000	39.92	37.92	37.56	38.27
Number of Observations	280	255	230	207
Man-owned				
Negative or zero net worth	10.14***	9.68***	8.77**	8.33**
Between $1 and $50,000	16.30	14.52	14.04	14.71
$50,001 to $100,000	14.49	14.52	15.35	15.20
$100,001 to $250,000	20.00	20.97	21.05	20.10
More than $250,000	39.06	40.32	40.79	41.67
Number of Observations	288	256	235	211

***, **, * indicate that the Man-owned percentage is statistically different from Woman-owned percentage at 0.01, 0.05 and 0.10 levels, respectively

was not possible. However, using our sample and the full KFS data, we were able to examine the relative size of the businesses started by female and male entrepreneurs.

We calculated the average start-up size in each industry based on all businesses started in 2004 (Table 9 Column 2). We also calculated the average business size (Column 1) and the relative size (Column 3) by gender in our sample. Table 9 indicates that the size of businesses started by the female entrepreneurs of our sample was, on average, below the industry average within each industry. Although the same can be said for the male entrepreneurs in our sample (except the construction industry, which exhibited 108% relative size), female-owned firms were much smaller than the male-owned enterprises within each industry. For example, female-owned firms in the construction sector had an average of $80 K assets, but male-owned firms had $126.7 K (with a relative size of 69% and 108% accordingly). The only sector in which the size of assets was relatively equal between female-owned businesses and male-owned businesses was that of the wholesale trade industry, with both types of

Table 9 Firm size measured by total assets

Woman-owned	Woman-owned Business Size	Industry Average Size[a]	Relative Size[b] %
Construction	$80,440.00	$116,360.00	69.13
Manufacturing	$13,270.00	$112,660.00	11.79
Wholesale Trade	$45,396.00	$142,129.00	31.94
Retail Trade	$38,816.00	$87,920.00	44.19
Information	$15,672.00	$119,873.00	13.10
Real Estate and Rental and Leasing	$29,660.00	$217,235.00	13.66
Professional, Scientific, and Technical Services	$16,975.00	$59,147.00	28.73
Administrative and Support Services	$24,756.00	$66,483.00	37.29
Arts, Entertainment, and Recreation	$12,992.00	$37,856.00	34.30
Other Services	$36,753.00	$118,488.00	31.02
Man-owned	Man-owned Business Size	Industry Average Size[a]	Relative Size[c]%
Construction	$126,691.00	$116,360.00	108.33
Manufacturing	$98,563.00	$112,660.00	87.51
Wholesale Trade	$44,876.00	$142,129.00	31.58
Retail Trade	$53,186.00	$87,920.00	60.52
Information	$65,462.00	$119,873.00	54.71
Real Estate and Rental and Leasing	$123,683.00	$217,235.00	56.96
Professional, Scientific, and Technical Services	$30,924.00	$59,147.00	52.32
Administrative and Support Services	$44,076.00	$66,483.00	66.29
Arts, Entertainment, and Recreation	$22,312.00	$37,856.00	58.97
Other Services	$76,570.00	$118,488.00	64.65

[a] Based on all firms established in 2004, using the KFS data population

[b] Relative Size = Woman-own Business Size / Industry Average Size, based on 2004 data

[c] Relative Size = Man-owned Business Size / Industry Average Size, based on 2004 data

businesses holding an average of $45 K assets. Besides the construction and wholesale trade, the size of female-owned firms ranged between $12 K and $39 K, whereas the size of male-owned businesses ranged from $22 K to $123 K. These results supported the hypothesis that female entrepreneurs are more risk averse than men.

To explain the gap in the start-up size (means of assets) between the male-owned and female-owned businesses, we utilized the widely used Blinder–Oaxaca decomposition method (Blinder 1973; Oaxaca 1973). The decomposition is based on the linear model:

$$Y_\mu = \alpha_\mu + X_\mu^{'}\beta_\mu + \epsilon_\mu \tag{5.a}$$

$$E(\epsilon_\mu) = 0, \mu \in (F, M) \tag{5.b}$$

where Y_μ is the outcome variable (asset size, in our case), $X_\mu^{'}$ is a vector of predictors, β_μ contains the slope parameters, α_μ is the intercept, ϵ_μ is the error term, M represents men, and F represents women.

To investigate the sources of gender differentials in detail, using the coefficients estimated from the male and female equations presented above, the observed gender gap in Y could be decomposed into several effects:

$$E(Y_M) - E(Y_F) = [E(X_M^{'}) - E(X_F^{'})]\beta_M + [\alpha_M - \alpha_F] + E(X_F^{'})(\beta_M - \beta_F) \tag{6.a}$$

$$E = E(X_M^{'}) - E(X_F^{'})\Big]\beta_M \tag{6.b}$$

$$U = [\alpha_M - \alpha_F] + E(X_F^{'})(\beta_M - \beta_F) \tag{6.c}$$

The first term (E) of the right-hand side of the equation amounts to the part of the differential that is due to group differences in the predictors. The first term is occasionally called "explained," the "observed gender gap in characteristics" or the "endowments effect." The second term (U) measures the unexplained outcome gap due to differences in coefficients or returns. The literature cited two major problems with the Blinder-Oaxaca decomposition. First, the index number problem, which results from the fact that the results will vary along with the choice of the reference group. This problem has been addressed by some studies such as those by Oaxaca and Ransom (1994), Neumark (1988), and Cotton (1988). Second, in the case of having categorical variables, the decomposition results for the categorical predictors depend on the choice of the omitted base category. Gardeazabal and Ugidos (2004) and Yun (2005) proposed a solution to this issue by restricting the coefficients for the single categories to sum to zero. In our analysis, we used the modified Blinder-Oaxaca decomposition to overcome the problems with the traditional Blinder-Oaxaca decomposition.

The top panel of Table 10 shows the estimated values of the total assets of female-owned and male-owned firms in 2004, which indicate that female-owned firms are half the size of male-owned firms ($30,755 vs. $61,114). In 2004, the gender gap in assets was $30,359. The gap increased to $48,507 between 2004 and 2011, as female-owned assets grew ($48,214) as well as those of male-owned firms ($96,721). To analyze this gap using the Blinder-Oaxaca decomposition method, we first used the six criteria as predictors. Given that our sample was matched based on age, work experience, weekly hours

Table 10 Blinder-Oaxaca decomposition of assets

Year	2004		2004–2011	
Assets	Coef.	%	Coef.	%
Panel A Differential				
$E(Y_M)$	61,113.64	100.00	96,721.51	100.00
$E(Y_F)$	30,754.91	50.32	48,213.96	49.85
Difference: $E(Y_M) - E(Y_F)$	30,358.72	49.68	48,507.55	50.15
Panel B Model 1: Base Model				
Predictors: Age, Work Experience, Weekly Hours Worked, Education, Race, High, Medium, Non-Tech Industry and Home Based				
Decomposition				
Explained	−161.28	−0.53	1507.40	3.11
Unexplained	30,520.00	100.53	47,000.14	96.89
Panel C Model 2: Expanded Model				
Predictors: Model 1's Predictors plus industry dummies at 3-digits level NAICS				
Decomposition				
Explained	13,224.40	43.56	21,162.23	43.63
Unexplained	17,134.32	56.44	27,345.31	56.37

worked, education, race, high-tech, medium-tech, non-tech industry, and home-based, we anticipated that using only these variables as predictors would have a zero endowment effect and that most of the gap in the start-up size between the male-owned and female-owned businesses must be the result of omitted variables. As expected, the predictors that were used to match the sample were largely unable to explain the gap (see Panel B, the Base Model) in 2004, and only 3% of the gap in the 2004–2011 panel regression.

Next, we included the industry controls (at the three-digit level NAICS) to the predictors since industry classification is the only variable that was available across all years of the survey. Panel C of Table 10 presents the results of the Blinder-Oaxaca decomposition of start-up size with industry variables as predictors. By adding the industry controls, we were able to explain 43.6% of the gap. The remaining 56% of the gap was explained by omitted variables.

4.4 Gender gaps in the financing sources

It is well documented that female-owned start-ups use similar sources of finance to male-owned businesses, but they tend to use lower amounts of external finance (Jennings and Brush 2013); however, on average, female-owned start-ups have smaller businesses. Controlling for human capital, we examined what factors influenced the gaps in start-up capital. In addition, we examined the determinants of financing choice and the amount of internal and external financing among female-owned and male-owned firms as well as within each group.

We classified debt and equity into insider and outsider capital based on the fact that insiders have more access to information about the business than outsiders. Insiders'

personal debt consists of personal debt from family and others. Outsiders' personal debt consists of personal credit cards and personal bank loans. Insiders' business debt consists of business debt from family, employees, and other individuals. Outsiders' business debt consists of business credit cards, bank loans, government loans, and loans from other businesses. Owners' equity consists of equity provided by the owner. In Table 11, we report the mean differences in capital balances and capital injections between female-owned and male-owned firms. The men and women that were included in our sample started their businesses (2004) with similar debt structures with the exception of the outsider personal debt and equity. We found no significant differences in insider personal debt, business debt, (both insider and outsider). However, we did find that females used significantly less outsider personal debt ($7.5 K vs. $11.5 K for men) and equity capital ($10 K vs. $16.5 K) than men. This could be due to differences in the personal preferences of female and men toward equity and debt capital (perhaps females' desires to be independent prevent them from giving up as much equity or perhaps they have difficulty raising debt and equity capital under their business name?).

Table 11 Mean differences in capital balance and capital injections between woman-owned and man-owned firms

Year	2004		2011		2004–2011	
	Woman-owned	Man-owned	Woman-owned	Man-owned	Woman-owned	Man-owned
Capital Balance	$	$	$	$	$	$
Personal Debt: Insiders	1048	1065	229	501	780	854
Personal Debt: Outsiders	7537	11558*	1758	5132	4846	9848***
Personal Debt: Total	8585	12623*	1988	5633*	5626	10702***
Business Debt: Insiders	146	183	41	46	142	122
Business Debt: Outsiders	4123	5624	4484	7948	4939	7404*
Business Debt: Total	4269	5806	4525	7994	5081	7526*
Debt: Total	12,854	18429*	6512	13627**	10,707	18228***
Equity: Owner	10,782	16477**	34,429	54990*	19,250	33452***
Liability	6224	9180	9219	17,768	8081	13251*
Capital Injections						
Personal Debt: Insiders	1041	1066	245	358	820	948
Personal Debt: Outsiders	7081	11015**	1746	2922	4892	8995***
Personal Debt: Total	8122	12081**	1991	3280	5712	9943***
Business Debt: Insiders	167	207	48	55	168	163
Business Debt: Outsiders	4009	5544	5680	7870	5057	7390*
Business Debt: Total	4176	5751	5728	7925	5225	7552*
Debt: Total	12,298	17832*	7719	11,205	10,936	17496***
Equity: Owner	10,657	17758***	2574	3174	5786	8574**
Trade Finance	7602	15,510	7221	33993**	11,694	46240**
N	430	430	207	211	2442	2492

***, **, * indicate that the Man-owned mean is statistically different from woman-owned mean at 0.01, 0.05 and 0.10 levels, respectively

Our results also indicated that females raised significantly less outsider personal debt and equity capital in 2004. We found similar results for 2011. Female-owned firms had significantly lower total personal debt ($2 K vs. $5.6 K) and equity capital ($34 K vs. $54 K) even though there were no significant differences in the components of the debt. We also found that females used significantly less (4–5 times less than men) trade finance ($7 K vs. 34 K). Compared to the end-of-year snapshots; however, the 2004–2011 averages exhibited completely different results. On average, female-owned firms used and raised significantly lower debt and equity capital than their male-owned counterparts in almost all classifications except personal and business insider debt capital balances and capital injections.

In Table 12, we show the same variables in percentage terms (as a percent of total financing). With the exception of those in equity and trade finance, the gender gaps disappeared between 2004 and 2011. In other words, female owners had the same capital structure as men in percentage terms even though the dollar values were much

Table 12 Mean differences in capital balance and capital injections in percentage terms

Year	2004		2011		2004–2011	
	Woman-owned %	Man-owned %	Woman-owned %	Man-owned %	Woman-owned %	Man-owned %
Capital Balance						
Personal Debt: Insiders	3.1	3.4	0.5	0.5	1.8	1.5
Personal Debt: Outsiders	17.9	18.1	4.0	4.1	10.2	11.6
Personal Debt: Total	21.0	21.5	4.5	4.5	11.9	13.1
Business Debt: Insiders	0.6	0.9	0.1	0.0	0.6	0.4
Business Debt: Outsiders	6.7	7.7	7.2	8.1	8.2	9.0
Business Debt: Total	7.3	8.6	7.3	8.2	8.8	9.4
Debt: Total	28.3	30.1	11.8	12.7	20.7	22.4
Equity: Owner	57.8	56.2	69.6	69.8	63.5	61.7
Liability	13.9	13.8	18.6	17.5	15.8	15.9
Capital Injections						
Personal Debt: Insiders	3.7	4.0	3.5	2.7	4.0	3.3
Personal Debt: Outsiders	20.1	19.4	17.1	16.2	19.0	20.2
Personal Debt: Total	23.8	23.4	20.7	18.8	23.0	23.5
Business Debt: Insiders	0.9	1.1	0.0	0.8	1.1	1.0
Business Debt: Outsiders	7.1	8.0	31.2	27.9	16.2	18.3
Business Debt: Total	8.0	9.1	31.2	28.7	17.2	19.2
Debt: Total	31.7	32.4	51.9	47.6	40.2	42.7
Equity: Owner	63.2	60.3	30.3	31.5	50.4	45.1**
Trade Finance	5.1	7.3	17.8	21.0	9.4	12.2*
N	430	430	207	211	2442	2492

***, **, * indicate that the Man-owned percentage is statistically different from Woman-owned percentage at 0.01, 0.05 and 0.10 levels, respectively

Table 13 Determinants of capital injections ratios

	Personal Debt: Insiders	Personal Debt: Outsiders	Personal Debt: Total	Business Debt: Insiders	Business Debt: Outsiders	Business Debt: Total	Debt: Total	Trade Finance	Equity: Owner
	1	2	3	4	5	6	7	8	9
R&D activity	0.051	0.037	0.028	−0.018	−0.04	−0.04	−0.042	−0.078	0.102**
Intellectual property	0.052	−0.005	−0.012	0.059	0.029	0.027	−0.065	0.013	0.108**
Credit risk	0.002	−0.038*	−0.028	0.056	−0.161***	−0.147***	−0.147***	−0.046	0.211***
Tangible Assets	0.107*	0.081*	0.099**	0.071	−0.011	0.003	0.082	−0.091	−0.016
Sales (Ln)	−0.004	0.003	0.002	−0.013	0.024***	0.019***	0.016***	0.071***	−0.047***
Profitability	−0.250***	−0.145***	−0.18***	−0.085	0.171***	0.158***	0.040	0.207***	−0.224***
Home-based	−0.173***	0.037	−0.005	−0.021	−0.040	−0.042	0.003	−0.35***	0.164***
Age	−0.012***	−0.002	−0.004**	−0.001	0.003	0.003	−0.002	−0.004	0.004*
White	0.036	0.029	0.042	−0.019	−0.038	−0.035	0.047	−0.037	−0.037
Sole Proprietorship	0.058	0.115***	0.111***	−0.125	−0.308***	−0.301***	−0.103***	−0.032	0.127***
Female	−0.056	−0.041	−0.043	−0.052	−0.025	−0.028	−0.048	−0.041	0.094**
Commitment	0.005***	0.002*	0.002**	0.003*	0.004***	0.004***	0.003***	0.004***	−0.004***
Education	0.001	0.006	0.009	−0.022	0.001	−0.003	0.010	−0.103***	0.045***
Work experience	0.001	−0.005**	−0.004**	−0.004	−0.001	−0.001	−0.004*	0.005*	0.001
Medium Tech Industry	−0.084	0.027	0.026	0.221	0.043	0.064	0.128	−0.637***	0.140
Non-Tech Industry	−0.041	0.033	0.032	0.144	0.093	0.089	0.110	−0.097	−0.032
Intercept	−0.468**	−0.155	0.009	−1.58***	−0.218	−0.117	0.543***	−0.259	−0.388*
N	4934								

***, **, * indicate at 0.01, 0.05 and 0.10 levels, respectively

smaller. We found that female-owned firms raised 50% equity capital as a percentage of their total financing, which was significantly higher than that of men (45.1%). This could be due to the fact that the female-owned firms were smaller than the male-owned firms (the scale issue).

Next, we used the Tobit Model to estimate the determinants of debt and equity financing, following Coleman et al. (2014) and Cotei and Farhat (2011). The key difference between these studies and ours was that we used a sample of female-owned and male-owned firms matched by six criteria. Appendix (Table 14) describes the variables that were used in the model and Table 13 shows the results of the determinants of capital injection ratios. We found that the coefficients for "females" were negative but insignificant[2] (with the exception of equity injection ratio), which means that being a woman did not affect the debt capital injections ratios (whether it is personal or business and insider or outsider). The gender of the owner also did not affect trade finance as a percentage of total financing. However, the coefficient for the equity capital ratio was positive and significant at the 5% level. The female-owned firms raised more equity in percentage terms than the male-owned firms, which confirms the results shown in Table 12.

5 Conclusion

Previous studies have published different findings with regards to the question of whether female-owned firms are less successful than male-owned enterprises. Some research suggests that female entrepreneurs lag behind men because they tend to have less human capital, exhibit different personal preferences toward their businesses, and have a tendency to choose highly competitive services and retail sectors.

We used a matched sample of 430 pairs of female-owned and male-owned firms with the same human capital (measured by age, education, experience, and race), preferences (measured by weekly hours worked and whether the businesses were home-based or otherwise), and industrial focus (high-tech, medium-tech, and non-tech).

Unlike previous studies, we found no gender gaps in terms of business performance. We found that female-owned firms have the same survival rate as male-owned firms. Females start their firms with smaller assets and fewer employees and generate lower sales than males; however, they earn the same profit. Furthermore, the growth rates of the total assets, sales, profits, and employment of female-owned businesses are the same as their male-owned counterparts. However, we did find that females use more equity capital and less trade finance as a percentage of total financing than men. Our findings suggest that females do not lag behind men but manage smaller firms. Our analysis indicated that approximately half of the size gap could be explained by differences in the industry, while the remaining half was unexplained.

In addition, we highlighted how female entrepreneurs' motivations and risk-aversion are, indeed, different to those of male entrepreneurs. However, due to data limitations,

[2] Since our study is to explore the gender gaps, we explain here coefficients for "female" only for the interest of brevity.

we were unable to include the motivations and relative risk risk-aversion in our regression analysis.

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Appendix

Table 14 Table variables used in the determinants of capital injections ratios

Variable	Description
Dependent Variables	
Total Financing	Sum of Owner equity, Personal credit card balance, Personal bank loan, Personal other loan, Business credit card balance, Business credit line, and Business bank loan
Owner equity (%)	Total Owner equity to Total Financing
Total personal debt (%)	Total personal debt to Total Financing
Total business debt (%)	Total business debt to Total Financing
Total debt (%)	Total debt to Total Financing
Independent Variables	
R&D activity	Equals 1 if business has at least one employee responsible for R&D, =0 otherwise
Intellectual property	Equals 1 if business has patent or copyright or trademark, =0 otherwise
Credit risk	D&B Commercial Credit Score (1 very low risk,…….., 5 very high risk)
Tangible Assets	Tangible assets to total assets
Sales(ln)	The logarithm of (total sales($) + 1) at year t
Profitability	Equals 1 if the firm report profit, =0 otherwise
Home-based	Equals 1 if the firm is home based, =0 otherwise
Age (in years)	Age of the owner
White	Equals 1 if owner is White, =0 otherwise
Sole Proprietorship	Equals 1 if the firm is organized as a sole proprietorship, =0 otherwise
Female	Equals1 if owner is female, =0 otherwise
Commitment	The sum of number of hours worked weekly by the owner
Education (in years)	Owner Education level
Work experience (in years)	Work experience of the owner
High-tech	Equals 1 if business is in a high-tech industry, =0 otherwise
Medium-tech	Equals 1 if business is in a medium-tech industry, =0 otherwise
Non-tech	Equals 1 if business is in a non-tech industry, =0 otherwise

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