A Tale of Two Datasets: Business Survival in Administrative versus Survey Data

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Abstract

Entrepreneurs, particularly those who start and operate new businesses, are thought to be key drivers of economic innovation and growth. A large and growing literature examines small business survival and the factors associated with business growth. Researchers use a variety of datasets including administrative records and survey data, but little is known about the implications of each data source for reported estimates and the broader understanding of small business outcomes. We address two fundamental data differences and assess the implications for understanding the existing literature. First, we examine business survival using exits from a matched administrative and survey dataset. This analysis suggests that results differ meaningfully across data sources and analysis method suggesting caution in data selection and project design. Second, we use additional information available in the survey data to assess whether results differ when one considers actual business closure, not just exit from the data for any reason. We find that owner characteristics such as age and education are more strongly related to exits from survey data, but not exits from tax data or measures of firm closure available in the survey data. These results might suggest a closer relationship between owner characteristics and survey attrition and not necessarily firm longevity.

JEL: H25, L26

Keywords: small business survival, tax data, survey data, entrepreneurship

Introduction

Studies of business survival and growth provide key information for tax administration and tax policy including estimates of behavioral responses to tax policies used to inform revenue estimates. Research on the factors associated with business survival informs policies such as accelerated depreciation, tax treatment of employee benefits including health insurance, and rules for deducting other business expenses. Policies such as accelerated depreciation or immediate expensing are generally expected to enhance business activity, but the usefulness of the existing research for predicting the effects of policy changes hinges critically on whether research results are consistent across data sources and if not, which data provide useful information in a tax administration/policy context.

Studies of business performance and survival have commonly used administrative data including tax returns (Holtz-Eakin, Joulfaian, and Rosen, 1994; Carroll et al., 2001; Bruce and Mohsin, 2006; Gurley-Calvez and Bruce, 2008; Heim and Lurie, 2010, Heim, 2010) and survey data including the discontinued Characteristics of Business Owners Survey (Bates, 1990; Bates, 2005; Fairlie and Robb, 2007a; Fairlie and Robb, 2009; Headd, 2003) the Panel Study of Income Dynamics (Bruce, 2002), and the recent panel of firms included in the Kauffman Firm Survey (Robb and Watson, 2012). We follow the literature in examining the importance of owner demographics and firm characteristics and expand the literature by assessing consistency across data source and survival measure.

In order to better understand the disparate results in the literature, this analysis uses a matched data file of administrative and survey data to assess the importance of both the choice of dataset and how survival is measured on research results and policy conclusions. Administrative data such as tax return data and workforce data collected through the State-Federal Unemployment Insurance

Program (UI) are collected for the purposes of administering a policy or program, but also serve as a valuable source of secondary data information for researchers. Surveys such as the Characteristics of Business Owners Survey (CBO) the Panel Study of Income Dynamics (PSID), and the Kauffman Firm Survey (KFS) are often collected for research purposes, but rely on voluntary responses and self-reported information.

Each data source has potential strengths and limitations that might affect research conclusions and the appropriateness for certain types of questions. For example, if one was interested in the tax revenue implications of business closure, the tax data likely provides a more accurate estimate of business activity reported to the government. However, if one wanted to assess the prevalence of entrepreneurial activity, survey datasets might be more likely to capture a broader range of activities regardless of whether they are reported on tax returns.

Both types of data have played a prominent role in studies of business survival, but the implications of the relative strengths of each dataset or measure of survival are not well understood. This analysis uses the KFS, a panel survey of new businesses that began operations in 2004 and were followed annually through 2011. We then pull tax return data for all available years for each individual or business firm in the KFS. Importantly, our analysis includes businesses of all legal forms, while much of the prior literature has been limited to Schedule C sole proprietorships or self-employed workers. Following most of the literature, we first examine firm survival based on exit from the relevant data source. We then consider survival using the measure of firm closure reported in the KFS to distinguish between firms that specifically report closing, versus those that do not respond to the survey for any number of reasons.

Our results suggest important differences across data sources, methods, and measures of survival. Survey regression results that do not account for unobservable firm characteristics through

a firm fixed effect are more likely to indicate significant differences by ethnicity and gender, but the significance of specific owner characteristics differs by whether one measures firm closure or simple exit from the data source. These results also suggest a strong positive association between reliance on direct-to-consumer sales or lower credit scores and business closure/exit. A similar analysis for tax filing exits indicates little significance for owner characteristics, but stronger significance for firm characteristics.

Accounting for unobservable owner and firm characteristics through a panel fixed effects model enhances the consistency across estimates of survey-based closure and exit. Firms with older, more educated owners are more likely to close or exit while firms with lower credit scores are less likely to close or exit. Fixed effects results for tax filing exits (i.e. not filing an income tax return in the next year) are dramatically different and suggest that firms with older owners are less likely to exit while firms with lower credit scores are more likely to exit.

Finally, survival models of the duration of business operations on start-up characteristics echo the OLS regression results. Owner characteristics are more important for survey duration measured by exit and are not significantly associated with tax filing duration. Firm characteristics are key explanatory variables for tax filing duration with Schedule C filers associated with longer business spells and firms with a patent or trademark, more employees, and more owners associated with shorter spells.

Background: Research on Small Business Survival

There is a long history of research on small business entry and exit[1] but more recent work has taken advantage of identification strategies based on panel data or more rigorous statistical

[1] For example, see Schuetze and Bruce (2004) for an overview of the literature on tax policy and entrepreneurship.

techniques. Studies that examine firm survival examine owner characteristics and experiences as well as financial factors. Just as the literature contains a variety of measures of small business or entrepreneurship, there is an ongoing debate in the literature on how to measure business survival and failure. Many studies use measures of attrition from the data source (e.g. no survey response or tax return in the next period) as a measure of exit.[2] Others account for the possibility that business exit from the data source could result from a variety of circumstances such as sale of the business, new ownership structure, reduced interest in participating in a survey, or business closure.[3] In particular, the KFS made a concentrated effort to ascertain the reason for non-response in the follow-up years and from this information, one can identify the firms that were confirmed to be closed. It should also be noted that exit and closure do not necessarily imply that the business failed to survive for financial reasons. Bates (2005) notes that many owners of closed businesses describe their firms as successful at closure and that closure decisions are based on other available opportunities.[4] Our analysis explores the implications of using measures of survival based on exit from the data source (KFS and tax data) or a confirmed measure of business closure (KFS).

Much attention has focused on firm survival across education, gender, and race/ethnicity groups. An early study of business survival found a strong positive relationship between firm survival and owner education (Bates, 1990). This was largely substantiated by a meta-analysis of 70 studies that suggests a small positive relationship between a broader measure of human capital and business success (Unger et al., 2011). We include education of the primary business owner in all of our specifications to test the robustness of the relationship.

[2] E.g. Bates (1990) Holtz-Eakin, Joulfaian, and Rosen (1994), Bruce (2002), Fairlie and Robb (2007a), Gurley-Calvez and Bruce (2008), Heim and Lurie, 2010.

[3] E.g. Taylor (1999), Bates (2005), Robb and Watson (2012).

[4] See Headd (2003) for additional discussion of this issue.

Although individuals with prior experience in a family business are more likely to start a business, the relationship is not generally strong when it comes to predicting business survival (Fairlie and Robb, 2007). However, a more nuanced investigation reveals that well-documented lower survival rates among female and black-owned businesses are partially explained by lack of work experience in a family business (Fairlie and Robb, 2007a; 2009; Robb and Watson, 2012). Other analysis also suggests a weaker link between race, gender and firm performance. Headd (2003) finds that race and gender play negligible role in the financial status, or expected survivability, of a firm at closure. We include measures of primary owner race and gender in all specifications and although we cannot address family business experience specifically, we use a comparison of OLS results and a fixed effects specification to assess the importance of fixed unobservable characteristics such as prior experience in a family business.

In addition to owner demographics, the literature points to possible liquidity constraints as a determinant of firm survival as owners with larger inheritances are more likely to remain in business (Holtz-Eakin, Joulfaian, and Rosen, 1994). Although there a number of studies, the picture is less clear with regard to the effects of tax policy on firm behavior. Some find that increasing taxes generally or on small business income specifically discourages survival and growth (Carroll et al., 2001; Gurley-Calvez and Bruce 2008). Others find that lower taxes might actually increase exit from small business (Bruce, 2002) or at a minimum, that taxes are likely not the most effective tool for encouraging entrepreneurship (Bruce and Mohsin, 2006; Bruce and Deskins, 2012; Bruce, Liu, and Murray, 2015).

To indirectly account for liquidity constraints and tax impacts, we include firm-level characteristics that previous studies have found to be related to firm performance. These controls include credit scores and firm size, which have been shown to account for much of the estimated

differences in performance by gender (Robb and Watson, 2012). To get at tax effects without including estimates of marginal tax rates, we include controls for both gross and net revenue as well as indicators for the legal form of the enterprise. We control for industry groups in order to account for general economic conditions that disproportionately affect certain sectors. Finally, we include measures of the firm's reliance on direct-to-consumer sales, which might have responded in different magnitude and timeliness to economic conditions, particularly around the Great Recession.

Data Sources

The matched KFS-tax return data file is unique in terms of including both administrative and survey data, but is also a substantial shift in tax data typically available in the literature. Previous tax data studies of entrepreneurship have focused on sole proprietors as indicated by the presence of a Schedule C on an individual's Form 1040 (e.g. Bruce and Gurley, 2008; Heim, 2010; Heim and Lurie, 2010). Our matched file includes businesses regardless of form filed (1065, 1120, 1120s), providing a much more comprehensive view of small business activity. Of the 4,928 businesses included in the baseline wave of the KFS, 33 percent reported being sole proprietors, 32 percent were LLCs, 21 percent were Subchapter S-Corporations, and 9 percent were C-Corporations with the remainder reporting some form of partnership or other organization structure.[5] The matched file contains similar breakdowns, but differs slightly due to higher match rates to the tax data for S-Corporations and lower match rates for sole proprietors. In the matched data 29 percent reported being a sole proprietor, 33 percent an LLC, 25 percent a Subchapter S-Corporation and 9 percent a C-Corporation. This section provides more information on the each dataset and matched file.

Kauffman Firm Survey

[5] Note that these are unweighted statistics as it is unclear whether the weights are appropriate for the matched file. Weighted statistics indicated 36 percent were sole proprietors, 31 percent LLCs, 20 percent Subchapter S-Corporations, and 8 percent C-Corporations.

The KFS is a recent longitudinal survey of nearly 5,000 new firms that began operations in 2004.[6] The initial survey was administered in 2005 and 2006, and four follow-up surveys were administered through 2011. Response rates exceeded 80 percent at each of the follow-ups and concerted efforts were made to determine whether non-response was a result of business closure or for some other reason. As a result, the KFS provides researchers with a unique opportunity to study a panel of new businesses from start-up to sustainability. Data are collected on a variety of topics including how businesses are financed, products, services, innovations, revenue, and characteristics of business owners.

Tax Return Data

Tax return data were pulled from the Business Returns Transaction File (BRTF) and the Individual Returns Transaction File (IRTF) for tax years 2004-2013. The BRTF and IRTF are population level files. Tax return data include information on industry,[7] business income and expenses, and tax related forms and computations.

One concern for linking the KFS with tax data is the possibility that firms might change legal status and file different tax forms. These changes might be particularly difficult to track in the tax data if filers change taxpayer identification numbers (TINs). For this project, firms were linked across datasets using name and address for tax years 2004 through 2008 to capture the business regardless of TIN. Additionally, we estimate that only between 2.3 and 3.9 percent of KFS

[6] The panel was created using a random sample from the list of new businesses started in 2004 that were included in the Dun & Bradstreet (D&B) database, which totaled roughly 250,000 such businesses. The KFS oversampled businesses based on the intensity of research and development employment in the businesses' primary industries. See http://www.kauffman.org/what-we-do/research/kauffman-firm-survey-series

[7] NAICs codes are self-reported in the tax data and not necessarily consistent with information reported across years and tax forms.

respondents report a different legal status (e.g. sole proprietorship, S-corp, corporation) from one Wave to the next, thereby mitigating these concerns.[8]

Matched File

The matched data file includes 3,940 firms and 22,444 firm-year observations. Match rates differed by baseline (2004) KFS legal status as noted below, with the highest match rates for S corporations (88 percent) and lowest match rates for sole proprietorships (71 percent). For our analysis, we limit our sample to the firms that were matched to at least one year of tax return data. Table 1 details matches by KFS reported legal form (e.g. sole proprietorship, LLC) and tax form (e.g. 1040 Schedule C, 1065 partnership return). Firms were matched to entity-level records by name and address and not by tax form, such that firms switching between forms (and the individual and business tax divisions) are captured over time.[9] One notable exception is that some firms/owners were matched by name and address to the business return entity file, but never filed a firm-level income tax return (included in the table as "Other" form). These firms were successfully matched, but are not included in the data analysis as they do not have any form-specific data.

Table 1: KFS-Tax Return Match Rates by Legal Status and Form[10]

[8] This echoes the general findings of Bruce and Holtz-Eakin (2001), who explore transitions across legal business forms within a twelve-year panel of individual tax return data.

[9] Note that business tax returns might include a headquarters address and not necessarily reflect the physical location of the business. This is also true for Schedule C filers who report their home address on their tax form. About 80 percent of individual tax returns and 90 percent of business return filers matched on name and address.

[10] These statistics include about 240 cases from the BRTF where we have located a match in the taxpayer information file but not to one of the three main forms. We conducted more data searches for these firms and determined that most were in BRTF Entity file because they submitted payroll tax withholding reports. However, these firms did not file income tax returns. In some cases, it does not appear that an income tax return was required and in others, the firms were required to file but did not.

KFS Legal	Match Rate	Sched. C	F1065	F1120	1120S	Other	N
1 - Sole Proprietorship	0.710	0.607	0.013	0.017	0.037	0.036	1,635
2 – LLC	0.842	0.331	0.306	0.028	0.071	0.106	1,557
3 - Subchapter S	0.880	0.122	0.014	0.117	0.598	0.028	1,040
4 - C-Corporation	0.816	0.129	0.018	0.465	0.125	0.079	441
5 - Partnership and Other	0.757	0.311	0.487	0.036	0.083	0.083	255
Overall	0.8	0.355	0.125	0.082	0.175	0.062	4,928

Methods and Descriptive Statistics

We use this unique match of administrative and survey data to address fundamental questions in entrepreneurship/small business research. Do different datasets yield similar conclusions on the factors associated with firm survival and are these conclusions affected by whether survival is measured as exit from the data source or firm closure? We also explore robustness of results across several estimation possibilities often driven by data availability. First, we estimate linear probability models with fixed effects so that time-invariant factors are differenced out of the estimation so we identify the effects of changes over time in owner and firm characteristics. Next, we estimate proportional hazard models using baseline characteristics (Wave 0, 2004) to predict firm survival.

We include a basic set of primary owner characteristics in each specification. For firms with more than one owner, primary owner is selected first by firm equity holdings then number of hours worked. Owner characteristics from the KFS include an indicator for female owner, indicators for

race/ethnicity, owner age in years, level of educational attainment, and an indicator for whether the primary owner is a US citizen.

Table 2: Owner Characteristics for Matched KFS-Tax Return Data File

Variable	Mean	Standard Deviation
Female Primary Owner	0.253	0.435
Age		
<30	0.034	0.182
30-40	0.205	0.404
40-55	0.487	0.500
55-65	0.210	0.407
65+	0.063	0.244
Race		
American Indian/Native Hawaiian	0.011	0.104
Asian	0.035	0.185
Black	0.050	0.218
White	0.871	0.335
Other Race	0.033	0.179
Education		
High School or Less	0.112	0.316
Some College	0.254	0.435
Associate's Degree	0.081	0.273
Bachelor's Degree	0.259	0.438
Graduate Study	0.294	0.455
US Citizen	0.944	0.231

Source: authors' calculations based on the KFS-Tax Return matched data file. Entries represent percent in each category unless otherwise noted. Sample sizes range from 13,150 firm-years to 15,745 firm years depending on missing information.

Table 2 includes basic owner characteristics for the matched file. About one quarter of primary owners in the matched file are female. Most owners are aged 40 to 55 (49 percent) and the majority identify as white (87 percent). About 30 percent of owners report education beyond a

bachelor's degree, one quarter have some college but no degree and another quarter have a bachelor's degree. Most owners report being a US citizen (94 percent).

Table 3: Firm Characteristics for Matched KFS-Tax Return Data File

Variable	Mean	Standard Deviation
Legal Status		
Sole Proprietorship	0.283	0.451
LLC	0.333	0.471
Subchapter S-Corporation	0.268	0.443
C-Corporation	0.078	0.268
Partnership and other	0.038	0.192
Tax Form		
1040 - Schedule C	0.492	0.500
1065 - Partnership	0.153	0.360
1120S - Subchapter S-Corporation	0.279	0.449
1120 - C-Corporation	0.076	0.266
Credit Risk		
Highest Credit Score	0.042	0.202
High Credit Score	0.222	0.415
Middle Credit Score	0.504	0.500
Low Credit Score	0.168	0.373
Lowest Credit Score	0.064	0.245
Patent or Trademark	0.120	0.325
Number of Employees (KFS)		
Zero	0.346	0.476
1 to 4	0.255	0.436
5+	0.399	0.490
Salary Expense (Tax Data $10,000)	6.796	49.512
Net Receipts (Tax Data $10,000)	64.192	704.615
Direct to Consumer Sales		
Zero	0.402	0.490

1-40%	0.191	0.393
41-90%	0.159	0.366
>90%	0.247	0.431
Number of Owners		
Zero	0.446	0.497
2-4 owners	0.268	0.443
5+ owners	0.286	0.452
KFS Closed in Next Wave	0.086	0.280
KFS Exit in Next Wave	0.266	0.442
Tax Data Exit in Next Wave	0.167	0.373
KFS Duration in Years	6.042	2.382
Tax Data Duration in Years	6.813	2.517

Source: authors' calculations based on the KFS-Tax Return matched data file. Entries represent percent in each category unless otherwise noted. Sample sizes range from 13,150 firm-years to 15,745 firm years depending on missing information.

Table 3 includes basic firm characteristics including organizational form over the course of the panel. About one-third of the observations are from firms identifying as LLCs while more than a quarter report that they are sole proprietorships or Subchapter S-Corporations. In terms of tax filings, 44 percent of firms filed a Schedule C over the course of the panel, 22 percent of firm-year observations were for form 1120S for Subchapter S-Corporations, 16 percent filed 1065 partnership returns, and 10 percent filed 1120 C-Corporation forms. About half of firms have mid-level credit scores as captured by Dun and Bradstreet and about 12 percent of matched firms reported a patent or trademark. About 35 percent of firms reported zero employees in the KFS. Nearly 40 percent of firms do not sell directly to consumers and about one quarter make more than 90 percent of sales directly to consumers. Just under half of firms (45 percent) had reported one owner and about 30 percent had five or more owners.

In terms of firm survival, about 9 percent of firms were confirmed closed (not sold or unable to contact) in the following KFS wave and about 27 percent exited the KFS data source in

the next wave (i.e. do not have data in the next wave for any reason). Tax filing exit rates for the following wave are lower at 16.7 percent, possibly indicating that some firms just stop responding to the KFS. Average duration in the KFS for matched firms is about 6 years (from 2004-2011) and almost 7 years in the tax data (from 2004-2013).

Methods in the literature for assessing firm survival include binary models of firm exit using cross-sectional data, panel data models with firm fixed effects, and analysis of duration using survival models. Choice of estimation method is often driven by data availability and we include results for each estimation strategy to assess the variability in results across dataset and method choice.

Results

Table 4 includes results from linear probability OLS regressions of close and exit in the following wave based on KFS responses. Columns 1 and 4 include only owner characteristics, columns 2 and 5 add firm characteristics and columns 3 and 6 also include measures of firm revenue and net profit with the caveat that these variables include a number of missing values. Interestingly, conclusions about the importance of owner demographics differ markedly based on whether one considers confirmed firm closure or exit from the data source. Two of three regressions for closure indicate that female owners are more likely to close in the next wave, but the same does not hold for exit. Older and more educated owners are less likely to exit, but we generally do not reject the null of no effect of age and education on firm closure. Hispanic owners are more likely to exit, but the relationship is weaker and not statistically significant for closure. Results are more consistent across firm characteristics with C-Corporations generally more likely to close and exit as are firms with high levels of reliance on direct-to-consumer sales. Unsurprisingly, firms with middle to low credit scores are more likely to close and exit.

Table 5 contains results for tax filing exit (not filing a business income tax return in the following year. The results are generally similar with a couple of notable differences. We fail to reject the null of zero effect for female owners, owner education, and percent of sales to individuals. Consistent with the KFS close and exit results, firms with lower credit scores are more likely to exit and sole proprietors/Schedule C filers are less likely to exit the tax data.

Several previous studies of business survival using tax return data have included only sole proprietors/Schedule C filers due to limited access to other business tax information (e.g. Holtz-Eakin, Joulfaian, and Rosen, 1994; Carroll et al., 2001; and Gurley-Calvez and Bruce, 2008). Interestingly, when we limit our analysis to businesses filing a Schedule C (not shown), there is suggestive evidence that firms with higher credit scores are more likely to exit, but consistent findings that firms filing Schedule C's that report being an S Corporation, C-Corporation, or partnership in the KFS are more likely to exit. Although not conclusive, these results seem to suggest that some exits from sole proprietorship are merely changes in organizational form.

Table 4: OLS Estimates of KFS Closed and Exit for Matched Data File

	(1) Closed in Next Wave	(2) Closed in Next Wave	(3) Closed in Next Wave	(4) Exit in Next Wave	(5) Exit in Next Wave	(6) Exit in Next Wave
Female	0.0156**	0.00995	0.0173**	0.0117	0.00275	0.00406
	(0.00501)	(0.00536)	(0.00613)	(0.00707)	(0.00763)	(0.00856)
Owner Age 30-40	-0.0216	-0.0199	-0.0196	-0.0267	-0.0283	-0.0263
	(0.0145)	(0.0157)	(0.0174)	(0.0200)	(0.0219)	(0.0244)
Owner Age 40-55	-0.0268	-0.0217	-0.0166	-0.0451*	-0.0413*	-0.0325
	(0.0141)	(0.0152)	(0.0169)	(0.0192)	(0.0211)	(0.0236)
Owner Age 55-65	-0.0269	-0.0203	-0.0132	-0.0745***	-0.0670**	-0.0582*
	(0.0145)	(0.0157)	(0.0174)	(0.0197)	(0.0217)	(0.0242)
Owner Age 65+	-0.0126	-0.00465	-0.0133	-0.0519*	-0.0529*	-0.0581*
	(0.0164)	(0.0177)	(0.0194)	(0.0222)	(0.0241)	(0.0268)
Some College	-0.0107	-0.00640	-0.0118	-0.0270*	-0.0289*	-0.0287*
	(0.00811)	(0.00859)	(0.0101)	(0.0118)	(0.0126)	(0.0146)
Associate's Degree	-0.0153	-0.0134	-0.0155	-0.0553***	-0.0598***	-0.0622***
	(0.0100)	(0.0107)	(0.0123)	(0.0144)	(0.0155)	(0.0174)
Bachelor's Degree	-0.00789	-0.000988	-0.00420	-0.0456***	-0.0436***	-0.0395**
	(0.00814)	(0.00879)	(0.0103)	(0.0116)	(0.0126)	(0.0145)
Graduate Study	-0.0206**	-0.0125	-0.0179	-0.0559***	-0.0537***	-0.0437**
	(0.00782)	(0.00858)	(0.00996)	(0.0114)	(0.0126)	(0.0144)
Asian	-0.0277	-0.0321	-0.0521	0.0187	0.0143	-0.00494
	(0.0244)	(0.0247)	(0.0315)	(0.0353)	(0.0371)	(0.0423)
Black	0.00360	-0.0154	-0.0602	0.0483	0.0296	-0.000635
	(0.0248)	(0.0252)	(0.0315)	(0.0342)	(0.0362)	(0.0419)
White	-0.0122	-0.00941	-0.0334	0.00312	0.00540	-0.00371
	(0.0225)	(0.0229)	(0.0297)	(0.0309)	(0.0323)	(0.0373)
Other Race	-0.00910	0.00572	-0.0450	0.0449	0.0538	0.0318
	(0.0260)	(0.0277)	(0.0338)	(0.0365)	(0.0389)	(0.0456)
Hispanic	0.0122	0.0108	0.00950	0.0562**	0.0579**	0.0604*
	(0.0132)	(0.0143)	(0.0149)	(0.0193)	(0.0208)	(0.0236)
Citizen	0.00476	0.00635	0.0173	-0.0359	-0.0186	-0.0193
	(0.0119)	(0.0120)	(0.0112)	(0.0200)	(0.0205)	(0.0230)
LLC		0.00912	0.00772		0.0153	0.0167
		(0.00659)	(0.00737)		(0.00951)	(0.0105)
Subchapter		0.0147*	0.00699		0.0102	0.00905

S-Corp		(0.00700)	(0.00769)		(0.0101)	(0.0111)
C-Corp		0.0244*	0.0137		0.0458**	0.0420*
		(0.0108)	(0.0117)		(0.0156)	(0.0176)
Partnership/ Other		0.0173	0.00330		0.0375	0.0254
		(0.0140)	(0.0147)		(0.0203)	(0.0225)
Patent or Trademark		0.000216	-0.00183		0.00327	0.000870
		(0.00605)	(0.00639)		(0.00911)	(0.00992)
1-4 Employees		-0.0110*	-0.00907		-0.00671	-0.00542
		(0.00512)	(0.00565)		(0.00742)	(0.00822)
5+ Employees		-0.0196**	-0.0164*		-0.00122	-0.00473
		(0.00641)	(0.00696)		(0.00997)	(0.0109)
1-40% Sales to Ind		-0.0133*	-0.00119		-0.0129	0.0105
		(0.00560)	(0.00620)		(0.00894)	(0.00971)
41-90% Sales to Ind		0.00326	0.0125		0.00132	0.0249*
		(0.00678)	(0.00758)		(0.00999)	(0.0111)
>90% Sales to Ind		0.0237***	0.0272***		0.0337***	0.0510***
		(0.00648)	(0.00710)		(0.00900)	(0.0100)
2-4 Owners		-0.00633	-0.00481		0.00197	0.00858
		(0.00541)	(0.00584)		(0.00803)	(0.00882)
5+ Owners		-0.000333	0.0205		0.0301	0.0566
		(0.0166)	(0.0196)		(0.0266)	(0.0297)
High Credit Score		0.00721	0.00670		0.0303*	0.0258
		(0.00892)	(0.00902)		(0.0148)	(0.0154)
Mid Credit Score		0.0165	0.0188*		0.0498***	0.0497***
		(0.00860)	(0.00879)		(0.0142)	(0.0149)
Low Credit Score		0.0297**	0.0336**		0.0676***	0.0670***
		(0.0103)	(0.0110)		(0.0160)	(0.0173)
Lowest Credit Score		0.0591***	0.0602***		0.125***	0.127***
		(0.0141)	(0.0152)		(0.0204)	(0.0222)
Revenue ($10,000)			-0.00558			-0.000776
			(0.00932)			(0.0335)
Net Profit ($10,000)			-0.0127			-0.0154
			(0.0246)			(0.0977)
Constant	0.0965***	0.0612	0.0662	0.263***	0.173***	0.148**
	(0.0289)	(0.0321)	(0.0389)	(0.0410)	(0.0466)	(0.0532)
N	12566	10882	8347	14016	12119	9187

Table 5: OLS Estimates of Tax Filing Exit for Matched Data File

	(1) Exit With Owner Controls	(2) Exit With Owner & Firm Controls	(3) Exit With Owner, Firm & Revenue	(4) Exit With KFS & Tax Controls	(5) Exit with Tax Controls
Female	-0.0033	0.0021	-0.0015	-0.0009	
	(0.0047)	(0.0051)	(0.0257)	(0.0058)	
Owner Age	-0.0124	-0.0535***	-0.0370*	-0.0356*	
30-40	(0.0079)	(0.0124)	(0.0145)	(0.0145)	
Owner Age	-0.0187**	-0.0556***	-0.0368**	-0.0339*	
40-55	(0.0071)	(0.0119)	(0.0140)	(0.0139)	
Owner Age	-0.0191*	-0.0531***	-0.0362*	-0.0321*	
55-65	(0.0079)	(0.0125)	(0.0147)	(0.0146)	
Owner Age		-0.0470**	-0.0329	-0.0294	
65+		(0.0145)	(0.0171)	(0.0170)	
Some	0.0014	-0.0078	-0.0140	-0.0138	
College	0.0074	(0.0078)	(0.0092)	(0.0092)	
Associate's	0.0032	-0.0011	-0.0031	-0.0021	
Degree	(0.0095)	(0.0101)	(0.0117)	(0.0117)	
Bachelor's	-0.0077	-0.0116	-0.0130	-0.0130	
Degree	(0.0074)	(0.0079)	(0.0093)	(0.0092)	
Graduate	-0.0047	-0.0134	-0.0150	-0.0132	
Study	(0.0073)	(0.0080)	(0.0094)	(0.0092)	
Native	-0.0101	-0.0033	-0.0082	-0.0016	
American	(0.0198)	(0.0207)	(0.0249)	(0.0249)	
Asian	0.0301**	0.0172	0.0214	0.0190	
	(0.0115)	(0.0122)	(0.0142)	(0.0141)	
Black	0.0154	0.0150	0.0086	0.0123	
	(0.0095)	(0.0106)	(0.0131)	(0.0131)	
Other Race	-0.0020	-0.0061	-0.0077	-0.0044	
	(0.0125)	(0.0136)	(0.0162)	(0.0162)	
Hispanic	0.0203	0.0102	0.0110	0.0093	
	(0.0112)	(0.0118)	(0.0139)	(0.0139)	
Citizen	0.0004	0.0050	0.0034	0.0062	
	(0.0122)	(0.0127)	(0.0148)	(0.0148)	
LLC		0.0162**	0.0255***		
		(0.0064)	(0.0073)		

Subchapter S-Corp	0.0554***	0.0705***		
	(0.0067)	(0.0077)		
C-Corp	0.0626***	0.0684***		
	(0.0099)	(0.0116)		
Partnership/ Other	0.0507***	0.0615***		
	(0.0127)	(0.0149)		
Patent or Trademark	-0.0026	-0.0033	-0.0019	
	(0.0061)	(0.0069)	(0.0069)	
1-4 Employees	0.0108*	0.0136*	0.0102	
	(0.0050)	(0.0057)	(0.0057)	
5+ Employees	0.0220***	0.0278***	0.0203**	
	(0.0066)	(0.0075)	(0.0076)	
1-40% Sales to Ind	0.0041	0.0088	0.0100	
	(0.0062)	(0.0069)	(0.0069)	
41-90% Sales to Ind	0.0053	0.0071	0.0093	
	(0.0066)	(0.0076)	(0.0076)	
>90% Sales Individuals	0.0005	0.0027	0.0047	
	(0.0058)	(0.0068)	(0.0067)	
2-4 Owners	0.0243***	0.0235***	0.0098	
	(0.0054)	(0.0062)	(0.0064)	
5+ Owners	0.0115	0.0048	-0.0120	
	(0.0168)	(0.0188)	(0.0189)	
High Credit Score	0.0006	-0.0018	-0.0016	
	(0.0117)	(0.0127)	(0.0126)	
Mid Credit Score	0.0083	0.0066	0.0079	
	(0.0114)	(0.0124)	(0.0123)	
Low Credit Score	0.0295*	0.0336*	0.0380**	
	(0.0126)	(0.0139)	(0.0139)	
Lowest Credit Score	0.0395**	0.0493**	0.0529***	
	(0.0139)	(0.0153)	(0.0152)	
Revenue ($10,000)		0.0215	0.0221	
		(0.0226)	(0.0226)	
Net Profit ($10,000)		0.0719	0.0810	
		(0.0853)	(0.0851)	
Form 1040			-0.0761***	-0.0766***
			(0.0067)	(0.0066)
Form 1065			-0.0015	0.0044***

				(0.0082)	(0.0067)
Form 1120				0.0098	0.0135
				(0.0106)	(0.0086)
Salary					0.0000
					(0.0000)
Net Receipts					0.0000
					(0.0000)
N	14,694	12,661	9,649	9,649	20,653

Panel Fixed Effects

Next, we estimate linear probability panel models with firm fixed effects. The main advantage of these models is that the firm fixed effect will capture time-invariant firm characteristics that are unmeasurable or not included in the data. As indicated in Table 6, the signs and significance of results are remarkably consistent across KFS close and exit measures after including the firm fixed effects. Magnitudes of effects are generally greater for firm closure, which has a lower overall mean of about 9 percent (versus exit, which has an overall mean of about 27 percent).

Holding time in-variant characteristics constant, these results show the effects of changes in characteristics rather than levels. Firms with owners who move into older age categories and higher education categories are more likely to close or exit. Compared to those who switch to the highest credit category, firms with middle credit scores are less likely to exit and there is suggestive evidence that firms who move to the lowest credit category are more likely to exit the data. The panel data analysis might suggest an opportunity cost story to the extent that older owners have more experience and owners with graduate degrees have good employment options outside of business ownership. Conversely, firms that have low credit scores might have limited options for divesting firm assets and remain in business to improve their financial situation or, because credit scores are more closely linked to firm exit, owners whose businesses are under financial stress might be reluctant to answer survey questions about the business.

Contrary to the OLS results presented in Table 4, female owners are not significantly more likely to close or exit. This is, however, not entirely unexpected as the fixed effects model produces estimates for factors that change over time. As such, these results reflect only firms that switched between female and male ownership or where the primary owner changed to a different race category.

Results for tax return panel fixed effects models of exit are presented in Table 7. These results suggest that the choice of dataset is critical in obtaining useful information for a given research question. In contrast to the KFS closure and exit measures discussed above, firms with older owners are less likely to stop filing income tax returns and firms with lower credit scores are more likely to exit the tax return data.

Table 6: Fixed Effects Panel Models of KFS Closed and Exit for Matched Data File

	(1) Closed in Next Wave	(2) Closed in Next Wave	(3) Closed in Next Wave	(4) Exit in Next Wave	(5) Exit in Next Wave	(6) Exit in Next Wave
Female	0.00392	0.00900	0.00903	0.0230	0.0113	0.0402
	(0.0135)	(0.0165)	(0.01000)	(0.0293)	(0.0342)	(0.0358)
Owner Age 30-40	0.0448*	0.0301	0.0245	0.134***	0.113**	0.0900*
	(0.0220)	(0.0240)	(0.0250)	(0.0330)	(0.0369)	(0.0393)
Owner Age 40-55	0.0874***	0.0642*	0.0565*	0.224***	0.192***	0.169***
	(0.0232)	(0.0253)	(0.0269)	(0.0359)	(0.0403)	(0.0439)
Owner Age 55-65	0.109***	0.0747**	0.0642*	0.274***	0.219***	0.185***
	(0.0245)	(0.0268)	(0.0289)	(0.0384)	(0.0429)	(0.0469)
Owner Age 65+	0.137***	0.0971**	0.101**	0.332***	0.247***	0.222***
	(0.0287)	(0.0313)	(0.0343)	(0.0447)	(0.0496)	(0.0557)
Some College	0.0210	0.0351*	0.0303	0.0382	0.0695*	0.0705
	(0.0180)	(0.0175)	(0.0208)	(0.0280)	(0.0310)	(0.0360)
Associate's Degree	0.0457	0.0572*	0.0459	0.0339	0.0492	0.0479
	(0.0237)	(0.0247)	(0.0250)	(0.0390)	(0.0430)	(0.0485)
Bachelor's Degree	0.0590*	0.0784**	0.0964**	0.0720	0.127**	0.160**
	(0.0244)	(0.0267)	(0.0328)	(0.0389)	(0.0428)	(0.0512)
Graduate Study	0.0533*	0.0771**	0.0945**	0.0527	0.128**	0.138**
	(0.0252)	(0.0272)	(0.0330)	(0.0410)	(0.0444)	(0.0536)
Asian	0.0593*	0.0386	0.0617	0.0170	0.181	0.0215
	(0.0277)	(0.0372)	(0.0410)	(0.271)	(0.147)	(0.119)
Black	0.0527	0.0655	0.0732	-0.0761	0.156	0.294
	(0.0378)	(0.0547)	(0.0647)	(0.289)	(0.212)	(0.251)
White	0.0481	0.0310	0.0490	-0.259	0.0343	0.00266
	(0.0282)	(0.0402)	(0.0375)	(0.251)	(0.109)	(0.118)
Other Race	-0.0504	-0.0664	-0.0214	-0.307	-0.0429	0.0266
	(0.0809)	(0.0999)	(0.102)	(0.278)	(0.167)	(0.173)
Hispanic	0.0334	0.0614	-0.167	0.0640	0.0484	-0.348
	(0.146)	(0.182)	(0.142)	(0.177)	(0.203)	(0.203)
Citizen	0.000688	-0.00632	-0.0281	0.100	0.0921	0.113
	(0.00882)	(0.0140)	(0.0193)	(0.0625)	(0.0874)	(0.0964)
LLC		0.0235	0.0135		0.0528	0.0634*
		(0.0211)	(0.0203)		(0.0350)	(0.0316)
Subchapter		0.0175	0.00804		0.0438	0.0122

S-Corp		(0.0214)	(0.0286)		(0.0351)	(0.0420)
C-Corp		-0.0344	-0.0556		0.00434	-0.0601
		(0.0252)	(0.0326)		(0.0495)	(0.0515)
Partnership/		-0.0204	-0.0234		-0.0286	-0.0396
Other		(0.0342)	(0.0278)		(0.0516)	(0.0423)
Patent or		-0.00616	-0.000644		0.00611	0.0104
Trademark		(0.00971)	(0.0110)		(0.0145)	(0.0168)
1-4		-0.00447	-0.0139*		-0.000901	-0.0171
Employees		(0.00595)	(0.00665)		(0.00907)	(0.0101)
5+		-0.0136	-0.0265*		0.0132	-0.0289
Employees		(0.0105)	(0.0115)		(0.0169)	(0.0186)
1-40%		-0.0111	-0.0138		0.0130	0.00399
Sales to Ind		(0.00800)	(0.00930)		(0.0136)	(0.0155)
41-90%		-0.0165	-0.0192		0.00634	-0.0107
Sales to Ind		(0.0120)	(0.0138)		(0.0177)	(0.0212)
>90% Sales		0.00836	-0.0104		0.0340	0.00978
Individuals		(0.0122)	(0.0146)		(0.0179)	(0.0225)
2-4 Owners		-0.00324	-0.00256		-0.0164	-0.00458
		(0.00965)	(0.0103)		(0.0164)	(0.0189)
5+ Owners		0.00163	0.0298		-0.0401	-0.0179
		(0.0238)	(0.0227)		(0.0388)	(0.0408)
High Credit		-0.00488	-0.00264		-0.0121	-0.0125
Score		(0.00986)	(0.0112)		(0.0163)	(0.0182)
Mid Credit		-0.0253*	-0.0166		-0.0484**	-0.0374*
Score		(0.0102)	(0.0118)		(0.0167)	(0.0188)
Low Credit		-0.0550***	-0.0408**		-0.107***	-0.0882***
Score		(0.0125)	(0.0144)		(0.0195)	(0.0224)
Lowest		0.0227	0.0225		0.0427	0.0632*
Credit Score		(0.0166)	(0.0179)		(0.0253)	(0.0275)
Revenue			-0.00116			-0.00431
($10,000)			(0.00531)			(0.0444)
Net Profit			-0.00501			0.0406
($10,000)			(0.0138)			(0.127)
Constant	-0.115*	-0.0668	-0.0527	0.0261	-0.249*	-0.219*
	(0.0501)	(0.0604)	(0.0612)	(0.252)	(0.0996)	(0.106)
N	12566	10882	8347	14016	12119	9187

Table 7: Fixed Effects Panel Models of Tax Filing Exit for Matched Data File

	(1) Exit With Owner Controls	(2) Exit With Owner & Firm Controls	(3) Exit With Owner, Firm & Revenue	(4) Exit With KFS & Tax Controls	(5) Exit With Tax Controls
Female	-0.0440*	-0.0456	-0.0201	-0.0188	
	(0.0216)	(0.0240)	(0.0286)	(0.0286)	
Owner Age 30-40	-0.0434*	-0.0547*	-0.0330	-0.0326	
	(0.0197)	(0.0221)	(0.0262)	(0.0262)	
Owner Age 40-55	-0.0527*	-0.0703**	-0.0474	-0.0481	
	(0.0215)	(0.0242)	(0.0296)	(0.0296)	
Owner Age 55-65	-0.0454	-0.0629*	-0.0535	-0.0533	
	(0.0240)	(0.0268)	(0.0331)	(0.0331)	
Owner Age 65+	-0.0545	-0.0621	-0.0685	-0.0658	
	(0.0290)	(0.0318)	(0.0399)	(0.0399)	
Some College	-0.0123	-0.0046	0.0261	0.0291	
	(0.0181)	(0.0203)	(0.0250)	(0.0249)	
Associate's Degree	-0.0042	-0.0041	0.0248	0.0286	
	(0.0263)	(0.0288)	(0.0354)	(0.0353)	
Bachelor's Degree	-0.0175	-0.0079	0.0116	0.0144	
	(0.0254)	(0.0284)	(0.0347)	(0.0347)	
Graduate Study	-0.0201	-0.0184	0.0018	0.0056	
	(0.0277)	(0.0309)	(0.0380)	(0.0379)	
Native American	0.0743	-0.2639	-0.2205	-0.2396	
	(0.1499)	(0.2670)	(0.0275)	(0.2750)	
Asian	0.0360	0.0903	0.0570	0.0600	
	(0.0812)	(0.0926)	(0.1284)	(0.1284)	
Black	0.0507	0.1427	0.2564	0.2548	
	(0.0921)	(0.1138)	(0.1548)	(0.1548)	
Other Race	-0.0660	-0.0914	-0.1251	-0.1044	
	(0.0727)	(0.0847)	(0.0977)	(0.0979)	
Hispanic	0.0553	0.0929	0.1505	0.1358	
	(0.0825)	(0.0916)	(0.1140)	(0.1139)	
Citizen	0.1021	0.0867	0.1894*	0.1891*	
	(0.0576)	(0.0696)	(0.0838)	(0.0838)	
LLC		-0.0878***	-0.0882**		
		(0.0274)	(0.0298)		

Subchapter S-Corp	0.0289 (0.0273)	-0.0011 (0.0342)		
C-Corp	-0.0105 (0.0378)	-0.0676 (0.0464)		
Partnership/ Other	-0.0829 (0.0427)	-0.0328 (0.0489)		
Patent or Trademark	-0.0057 (0.0099)	0.0036 (0.0118)	0.0041 (0.0117)	
1-4 Employees	0.0072 (0.0066)	0.0101 (0.0080)	0.0105 (0.0080)	
5+ Employees	0.0256* (0.0121)	0.0292* (0.0143)	0.0289* (0.0143)	
1-40% Sales to Ind	-0.0018 (0.0096)	-0.0032 (0.0115)	-0.0048 (0.0115)	
41-90% Sales to Ind	0.0109 (0.0117)	0.0031 (0.0151)	0.0039 (0.0151)	
>90% Sales Individuals	0.0033 (0.0115)	-0.0020 (0.0159)	-0.0013 (0.0159)	
2-4 Owners	-0.0041 (0.0113)	0.0005 (0.0137)	-0.0071 (0.0135)	
5+ Owners	-0.0140 (0.0264)	0.0056 (0.0321)	0.0022 (0.0321)	
High Credit Score	0.0225 (0.0132)	0.0259 (0.0148)	0.0256 (0.0148)	
Mid Credit Score	0.0359** (0.0138)	0.0383* (0.0154)	0.0392* (0.0155)	
Low Credit Score	0.0669*** (0.0158)	0.0828*** (0.0182)	0.0834*** (0.0182)	
Lowest Credit Score	0.0636*** (0.0175)	0.0806*** (0.0203)	0.0809*** (0.0203)	
Revenue ($10,000)		0.03653 (0.0239)	0.0363 (0.0239)	
Net Profit ($10,000)		0.0932 (0.0891)	0.0929 (0.0891)	
Form 1040			-0.0868*** (0.0257)	-0.0053 (0.0173)
Form 1065			-0.0431	-0.0561*

				(0.0328)	(0.0237)
Form 1120				-0.0507	-0.0366
				(0.0278)	(0.0196)
Salary					0.0000
					(0.0000)
Net Receipts					0.0000
					(0.0000)
N	14,694	12,661	9,649	9.649	20,653

Models include year fixed effects.

Survival Models

Survival models are used to estimate the duration that each firm is in operation based on Wave 0 (2004) characteristics. For each model we fail to reject the null that hazard functions are proportional over time, so we estimate Cox proportional hazards models. These models address the full spell of firm operation and provide evidence on how early characteristics are associated with the length of business operations.[11]

Survival models of duration based on KFS measures of closure and exit are presented in Table 8. Results are fairly stable across specifications, but precision and the ability to reject the null of zero effect diminish as variables are added and sample size decreases. As with the OLS results, owner characteristics are more likely to be significant in estimations of firm exit. Compared to firms that start with young owners (under 30), firms that start with owners aged 40-64 have longer stints in the data before exit (i.e., lower hazards of exit). Firms that begin with owners who have graduate degrees are also associated with longer business duration. Echoing our OLS results, firms that begin with a high percent of direct-to-individual sales (greater than 90 percent) are associated with shorter overall firm duration. Firms with higher net profits in the baseline year were associated with longer duration.

Results for the tax filing measure of exit are presented in Table 9. These models provide little evidence that baseline owner demographics are related to firm duration. Using KFS control variables, the results suggest shorter survival duration for sole proprietorships; these results are consistent with tax data controls where we find that Schedule C (Form 1040) filers have the greatest exit hazards and therefore the shortest survival durations. Presence of a patent or trademark, more employees, and more owners are also associated with longer business duration.

[11] Additional results are available upon request from the authors.

Table 8: Survival Models of KFS Closed and Exit for Matched Data File

	(1) Closed in Next Wave	(2) Closed in Next Wave	(3) Closed in Next Wave	(4) Exit in Next Wave	(5) Exit in Next Wave	(6) Exit in Next Wave
Female	0.149*	0.117	0.162	0.132*	0.103	0.0548
	(0.0638)	(0.0758)	(0.0999)	(0.0516)	(0.0618)	(0.0826)
Owner Age 30-40	-0.223	-0.179	-0.0781	-0.178	-0.203	-0.0871
	(0.124)	(0.142)	(0.171)	(0.0997)	(0.115)	(0.138)
Owner Age 40-55	-0.305*	-0.300*	-0.287	-0.289**	-0.315**	-0.320*
	(0.119)	(0.137)	(0.165)	(0.0962)	(0.111)	(0.134)
Owner Age 55-65	-0.362**	-0.291	-0.185	-0.469***	-0.467***	-0.387*
	(0.134)	(0.154)	(0.191)	(0.109)	(0.126)	(0.157)
Owner Age 65+	0.212	0.245	0.341	0.0124	-0.00465	0.135
	(0.164)	(0.189)	(0.249)	(0.142)	(0.164)	(0.212)
Some College	-0.0275	-0.00654	-0.118	-0.0860	-0.0620	-0.0928
	(0.0942)	(0.109)	(0.144)	(0.0748)	(0.0874)	(0.114)
Associate's Degree	-0.193	-0.251	-0.110	-0.270**	-0.300*	-0.290
	(0.127)	(0.145)	(0.183)	(0.102)	(0.117)	(0.153)
Bachelor's Degree	-0.120	-0.103	-0.102	-0.217**	-0.214*	-0.234*
	(0.0960)	(0.112)	(0.144)	(0.0764)	(0.0901)	(0.116)
Graduate Study	-0.236*	-0.202	-0.359*	-0.270***	-0.278**	-0.332**
	(0.0968)	(0.116)	(0.156)	(0.0764)	(0.0924)	(0.122)
Asian	-0.524	-0.388	-0.606	-0.0685	0.0723	-0.0497
	(0.307)	(0.402)	(0.602)	(0.258)	(0.331)	(0.499)
Black	-0.158	-0.0670	0.0892	0.0783	0.199	0.196
	(0.280)	(0.377)	(0.552)	(0.246)	(0.323)	(0.490)
White	-0.354	-0.211	-0.211	-0.0903	0.0400	0.0466
	(0.255)	(0.345)	(0.510)	(0.228)	(0.299)	(0.454)
Other Race	-0.0725	0.139	0.0975	0.155	0.301	0.313
	(0.284)	(0.369)	(0.547)	(0.249)	(0.316)	(0.483)
Hispanic	0.0399	0.0363	-0.0442	0.125	0.206	0.107
	(0.142)	(0.169)	(0.224)	(0.111)	(0.130)	(0.172)
Citizen	0.244	0.211	0.410	-0.0951	-0.0640	-0.104
	(0.178)	(0.202)	(0.311)	(0.122)	(0.140)	(0.188)
LLC		-0.0650	0.0544		0.0529	0.136
		(0.0968)	(0.123)		(0.0788)	(0.100)

Subchapter S-Corp		0.0372	0.0354		0.0803	0.0535
		(0.102)	(0.136)		(0.0837)	(0.111)
C-Corp		0.0620	0.220		0.215	0.361*
		(0.145)	(0.187)		(0.114)	(0.146)
Partnership/ Other		0.122	0.155		0.133	0.173
		(0.174)	(0.223)		(0.142)	(0.180)
Patent or Trademark		0.155	0.0165		0.0480	-0.0366
		(0.0911)	(0.123)		(0.0750)	(0.0998)
1-4 Employees		-0.120	-0.0876		-0.0530	-0.0707
		(0.0753)	(0.0968)		(0.0605)	(0.0781)
5+ Employees		-0.147	-0.203		0.0479	0.0285
		(0.120)	(0.167)		(0.0907)	(0.123)
1-40% Sales to Ind		0.0265	0.350**		0.0180	0.170
		(0.106)	(0.132)		(0.0839)	(0.106)
41-90% Sales to Ind		0.201*	0.374**		0.138	0.254*
		(0.0991)	(0.135)		(0.0808)	(0.107)
>90% Sales Individuals		0.164	0.365**		0.142*	0.292**
		(0.0846)	(0.116)		(0.0681)	(0.0912)
2-4 Owners		-0.0523	-0.0811		-0.00148	-0.00409
		(0.0840)	(0.111)		(0.0664)	(0.0869)
5+ Owners		-0.0776	0.112		0.0615	0.00861
		(0.366)	(0.468)		(0.270)	(0.368)
High Credit Score		0.459	18.87***		0.188	1.661
		(0.596)	(0.255)		(0.395)	(1.012)
Mid Credit Score		0.399	18.82***		0.104	1.647
		(0.586)	(0.205)		(0.386)	(1.006)
Low Credit Score		0.490	18.96***		0.138	1.695
		(0.587)	(0.206)		(0.388)	(1.007)
Lowest Credit Score		0.750	19.16		0.411	1.903
		(0.602)	(.)		(0.403)	(1.018)
Revenue ($10,000)			4.264			5.269
			(4.833)			(3.574)
Net Profit ($10,000)			-129.4**			-74.83*
			(40.50)			(31.08)
N	2927	2188	1355	2927	2188	1355

Table 9: Survival Models of Tax Filing Exit for Matched Data File

	(1) Exit with Owner Controls	(2) Exit with Owner & Firm Controls	(3) Exit with KFS & Tax Data Controls	(4) Exit with Tax Data Controls
Female	0.0138	0.0031	-0.0055	
	(0.0178)	(0.0177)	(0.0170)	
Owner Age 30-40	-0.0116	0.0119	0.0166	
	(0.0320)	(0.0314)	(0.0304)	
Owner Age 40-55	0.0030	0.0175	0.0188	
	(0.0306)	(0.0300)	(0.0291)	
Owner Age 55-65	0.0293	0.0389	0.0305	
	(0.0349)	(0.0342)	(0.0332)	
Owner Age 65+	-0.0921*	-0.0764	-0.0832	
	(0.0470)	(0.0461)	(0.0444)	
Some College	-0.0055	0.0135	0.0142	
	(0.0266)	(0.0261)	(0.0250)	
Associate's Degree	0.0307	0.0429	0.0512	
	(0.0355)	(0.0347)	(0.0335)	
Bachelor's Degree	0.0237	0.0479	0.0506*	
	(0.0269)	(0.0266)	(0.0254)	
Graduate Study	-0.0176	0.0249	0.0335	
	(0.0267)	(0.0266)	(0.0254)	
Asian	-0.0908	-0.0436	-0.0055	
	(0.0789)	(0.0765)	(0.0732)	
Black	0.0421	0.0255	-0.0020	
	(0.0749)	(0.0726)	(0.0691)	
White	0.0276	0.0368	0.0578	
	(0.0686)	(0.0662)	(0.0630)	
Other Race	-0.0405	-0.0605	-0.0376	
	(0.0786)	(0.0759)	(0.0723)	
Hispanic	-0.0281	-0.0221	-0.0200	
	(0.0392)	(0.0379)	(0.0362)	
Citizen	0.0002	-0.0064	-0.0081	
	(0.0424)	(0.0408)	(0.0388)	
LLC		-0.0854***		

		(0.0224)		
Subchapter S-Corp		-0.2107*** (0.0239)		
C-Corp		-0.2006*** (0.0317)		
Partnership/ Other		-0.01591*** (0.0392)		
Patent or Trademark		-0.0205 (0.0207)	-0.0164 (0.0200)	
1-4 Employees		-0.0432** (0.0169)	-0.0179 (0.0164)	
5+ Employees		-0.0505* (.0254)	-0.0067 (0.0254)	
1-40% Sales to Ind		0.0161 (0.0234)	0.0128 (0.0226)	
41-90% Sales to Ind		0.0041 (0.0233)	-0.0062 (0.0223)	
>90% Sales Individuals		-0.0087 (0.0192)	-0.0218 (0.0185)	
2-4 Owners		-0.1087*** (0.0183)	-0.0444* (0.0173)	
5+ Owners		-0.0854 (0.0721)	0.0224 (0.0721)	
Form 1040			0.3220*** (0.0192)	0.3307*** (0.0176)
Form 1065			-0.0063 (0.0226)	-0.0164 (0.0210)
Form 1120			-0.0013 (0.0260)	-0.0151 (0.0249)
Salary			0.0000 (0.0000)	0.0000 (0.0000)
Net Receipts ($10,000)			0.0000 (0.0000)	0.0000 (0.0000)
N	3,683	3,597	3,504	3,657

Discussion

Estimates of business survival are sensitive to how we define firm closure versus exit, data source, and estimation method. With the exception of the most recent analysis of KFS survey data, most survey-based studies of business survival consider a firm to be "closed" if it is no longer observed in the database, as this is the only available measure. Our results suggest that this measure is likely to be closely tied to owner characteristics and might have more to do with preferences for survey participation than with the underlying firm outcomes that are perhaps of greater interest to policy makers. Our results also highlight that in cases where researchers have access to panel data, results surrounding business closure in the KFS survey data are not necessarily consistent with those involving exit from income tax records. Interestingly, firm exits from tax data are much more tied to credit ratings and firm employment and ownership characteristics rather than the owner demographics that are significantly associated with the survey measures of firm survival. The appropriateness of each dataset depends on the questions being addressed. For example, if one is estimating business tax revenue or tax filing responses, income reported through the tax system is the key outcome of interest. However, if one is interested in business activity regardless of tax reporting status, survey data might be more appropriate.

Our estimate of the firm exit rate from tax data, 16.7 percent, is lower than our estimate of the exit rate from the survey data (26.6 percent). This suggests that survey response attrition accounts for a non-negligible share of the survey exits. Conversely, tax exits are higher than confirmed survey closures of 8.6 percent, suggesting that some firms who cannot be contacted might actually be closed. These differences highlight the inherent difficulties in measuring firm longevity based on self-reported information. A key advantage of tax data is that measures of exit are consistently based on firm tax filings, but these measures are sensitive to changes in filing requirements and behavioral responses to tax policy and filing preferences.

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