Modeling Single-Establishment Firm Returns to the 2007 Economic Census

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Abstract

The Economic Census is one of the most important activities that the U.S. Census Bureau performs. It is critical for updating firm ownership structure and industry information for a large number of businesses in the Census Bureau's Business Register, impacting most other economic programs. We model the check-in rate for single-establishment firms by using a large number of variables that might be correlated with whether or not a firm returns a form in the Economic Census. These variables are broadly categorized as the characteristics of firms, measures of external factors, and the features of the survey design. We use the model for two purposes. First, by studying many of the factors that may be correlated with returns we aim to focus limited advertising and outreach resources to low-return segments of the population. Second, we use the model to investigate the efficacy of an unplanned intervention targeted at increasing return rates: using certified mailing for one of the form follow-ups.

Key words: Economic Census, multivariate analysis, paradata, responsive design

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1. Introduction

The Economic Census is the second largest data collection project at the U.S. Census Bureau after the Decennial Census. It provides a detailed picture of the U.S. economy every five years in terms of industry, geography, and over 20,000 data items collected on more than 500 forms. The Economic Census is also critical for updating the Business Register (BR) since it is the sampling frame for nearly every business survey conducted by the Census Bureau. In particular, it collects firm ownership and structure and detailed industry information at the establishment-level.

We use the terms *check-in* and *return* interchangeably. We define *check-in* equal to 1 if an establishment returned a form to the Census Bureau and equal to 0 otherwise. It is not meant to be confused with a *response*. In the 2007 Economic Census, the check-in rate of single-establishment firms (81%) was significantly lower than the rate for establishments owned by multi-establishment firms (91%). This is probably due in part to a long standing interest in easing respondent burden and facilitating returns for large companies, which represent a disproportional amount of the activity in the U.S. economy (Willimack (2002)). Single-establishment firms represent a large share (43%) of the total number of establishments sent a form in the Economic Census, roughly 2 million out of the 4.6 million total forms mailed.[1] We also only analyze the short and long census forms that collect detailed data for each establishment, dropping "classification" forms that only collect detailed NAICS industry information.[2] Since we focus only on single-establishment firms, we use the terms establishment and firm interchangeably.

In 2008, substantial changes were made to the mail-out plan aimed at increasing returns for this large group of firms since they were critical to reaching the overall check-in rate goal for the 2007 Economic Census.[3] These interventions demonstrate the flexibility of the program managers to be able to adapt to unexpected declines in check-in rates. In many instances, testing the efficacy of these interventions for the Economic Census occurs in other programs, such as the Annual Survey of Manufactures (ASM) or sometimes current surveys in non-manufacturing sectors. Neither of these is exactly comparable to the Economic Census due to differences in scope and the definition of the reporting units, so using model based propensity score matching is a way to test the benefits of these interventions in the Economic Census *ex post*.

The primary purpose of this paper is to develop a new multivariate analysis of small firms returning the short or long forms to the Census Bureau in the 2007 Economic Census. The model is being used as an additional source of information to better focus limited publicity, outreach, and fiscal resources to maintain or raise return rates in the 2012 Economic Census. We also use the model to better evaluate the efficacy of one treatment during the Census: sending the third form follow-up via certified mail. The model we construct will also be used to predict returns for 2012 Economic Census and to

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[1] The total universe of establishments is roughly 7 million. All establishments owned by multi-establishment firms are certainty cases, but the economic "census" samples single-establishment firms in most sectors.
[2] Roughly one million classification forms were mailed in 2007, with a final check-in rate of 88%.
[3] The Program Assessment Rating Tool (PART) is an assessment rating system developed by the Office of Management of Management and Budget to grade the effectiveness of federal agencies and federally funded programs. The PART score for the 2007 Economic Census check-in rate was 86%.

track and analyze differences between the predicted and actual check-ins in "real-time" during data collection.

2. The Literature

Our approach is similar to that used by the Center for Economic Studies to analyze the 2010 Decennial Census tract level return rates for the mail-out/mail-back operation and model enumerator level productivity during non-response follow-up operation. We model the likelihood that a firm mails their form back as a function of the characteristics of the firm, the local economic conditions, and the characteristics of the survey design and additional controls (industry and geography).

The survey methodology literature on modeling business survey response seems much less common than the literature for demographic surveys. One exception is Biffignandi and Pratesi (2002) who model the response rates to a web-survey in Italy. They model non-response using a logistic regression model with crude measures of size and industry and legal form of organization. They also model the time to respond. We are unable to exactly measure the time to respond in the 2007 Economic Census. We know when forms are returned (i.e. checked-in), but we only have a range of dates for mail-out. In 2012, additional paradata is being captured on the exact times when forms enter the postal stream that will allow us to exactly measure the time to respond and extend our analysis.

The check-in variable measures whether or not the establishment returned a form, and should not be confused with the response rate or a participation rate. Petroni et. al. (2004) describes the response rate measures used by both the Bureau of Labor Statistics (BLS) and the Census Bureau. Current efforts within the Census Bureau's Economic Directorate aimed at defining the response rate for the Economic Census and developing a cooperation rate (as a real-time proxy for the response rate) are ongoing, and upon completion could easily be incorporated into our analysis.

In 2002, changes to the design of the Economic Census forms resulted in substantial differences in the number of pages compared to 1992 and 1997 forms. Willimack (2006) provides a useful background section describing the change to the forms and the Economic Census program overall. In 2007, the forms were designed by the same system using the same basic guidelines and are comparable to 2002[4]. Willimack (2006) looks at the relationship between form-level return rates and questionnaire length, controlling for within sector economic factors (specifically changes in GDP and changes in employment). She finds that form length does seem to have a negative relationship with early return rates. However, the changes to the forms did not have a substantial impact in 2002, as the effect of page length was smaller than in the previous two censuses.

3. The Economic Census

The Economic Census is a program that combines collected data and administrative records to measure economic activity of U.S. business establishments. It is conducted

[4] The overall "look and feel" and content of the forms were very similar in 2002 and 2007, while some of the wording and order of items may have changed.

every five years, with reference years ending in "2" and "7". The actual data collection occurs primarily in the year after the reference year.

In 2007, there were roughly 7 million establishments and roughly 4.6 million (~66%) of them were sampled in the census. The establishments owned by multi-establishment firms are sampled with certainty (i.e. with a sampling weight of 1), which number roughly 1.6 million and account for the majority of business activity. Another 3 million single-establishment firms are also mailed Economic Census forms – roughly 1 million are mailed industry classification forms that only collect industry classification information, and 2 million are mailed short or long forms that collect detailed data. In this paper, we study only single-establishment firms that are mailed a short or long form.

The Economic Census is collected using two modes of data collection. The first is a standard mail-out/mail-back paper instrument and the second is an electronic reporting tool called "Surveyor" which is designed to facilitate reporting by multi-establishment firms, but is available to all respondents.[5] The two million single-establishment firms reported electronically roughly 2% of the time, so we ignore mode and focus only on whether or not a (paper or electronic) form was returned. The initial mailing occurred at the end of December 2007, with up to four follow-up mailings in 2008. The follow-up mailings were in mid-March, late April, June, and early August. In general, firms are mailed a form at each mailing, except for the final follow-up which is a letter.

For 2007, two mail interventions were conducted to encourage late returns to achieve Economic Census program goals. The first was during the third follow-up where 34 form types were mailed using certified mail instead of first class postage, in an effort to distinguish the census mailing. The second was sending a letter during the fourth follow-up, instead of a form. This letter reminded respondents about their legal obligation to report in the mandatory Economic Census and the possible penalties for failing to do so. This letter was not from a Census Bureau official, but from the Department of Commerce's Office of the Inspector General (OIG). Unlike the certified mailing, the OIG letter was send to virtually every delinquent firm and therefore we can't test how effective the strategy was.

4. Data

We do not provide a formal model of small firm behavior to describe who does or does not return their Economic Census form. We loosely follow the framework set out in Willimack et. al. (2002), where large firms compare the costs and benefits of completing and returning their form. We incorporate characteristics of the business, measures of the external environment, and survey design that their work describes as the important factors affecting large company returns. We consider this analysis of single-establishment firms as a complement to their work.

Analyses of check-in rates for Economic Census planning purposes generally uses tabulations at the industry or geographic level – a univariate approach. These aggregates may be broken out by multi-establishment versus single-establishment firms. "Third-

[5]For electronic reporting in 2012, single-establishment firms will only be offered a web-based direct internet reporting (DIR) instrument whereas multi-establishment firms will only be offered only the option to report using Surveyor.

quarter births" are another distinction made in weekly progress reports.[6] Using a model-based approach, we are able to simultaneously control for a large range of factors that could potentially influence whether or not an establishment returns a form. Our hypothesis is that characteristics of the establishment, factors external to the firm and characteristics of the survey design may influence whether or not the business returns a form. For example, one hypothesis is that larger firms are more likely to return a form than smaller firms. The data used in this analysis comes primarily from Economic Census microdata and paradata. Paradata is information collected about the conduct of the Economic Census and examples in this study are the dates forms were checked in at the Census Bureau's processing facility and the content of the instruments. We also match additional information, generally by geography, to investigate additional hypotheses such as whether or not the local economic conditions, such as the unemployment rate, are important factors for check-ins. Working with program area staff, we identified eleven groups of variables to describe the characteristics of the business, external factors, and survey design. Recall that one part of this exercise is to inform management on where to devote limited resources to maintain or improve return rates in 2012.

Table 1 describes the variables in our model. We measure the characteristics of the business: prior reporting status in 2002, age, size, industry, geography, and owner characteristics. These are factors we control for since they may be correlated with whether or not a firm returns a form. We describe some of the more interesting patterns of firm returns for a subset of these variables. One measure is firm size, where we use employment to create size categories. Our hypothesis is that the smaller the firm, the less likely they are to complete their Economic Census form. As firm size increases, we expect them to be more likely to respond.

Table 1. Model Variables – Description and Source

Variables	Description	Data Source
Check-in Status (CI)	**=1 if a form was returned, =0 otherwise**	**2007 EC paradata**
Business Characteristics		
2002 Reporting Status	Nonmail, mailed-returned form, mailed-no form returned	2002 EC microdata
Size	Employment size class dummies: 1-4 (omitted category), 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500+	2007 BR
Age	Age class dummies: 0-1 year (omitted category), 2-5, 6-10, 11-15, 16-20, >20	Longitudinal Business Database (LBD)
Industry	Six-digit NAICS Industry Indicators, Franchising	2007 BR
Geography	293 MSA indicators, Micropolitan dummy, non-metro (omitted	2007 EC microdata

[6] Administrative data from the IRS is used to determine which businesses are active during the reference year. At the time of the initial mailing in December 2007, only first and second-quarter administrative data are available. Third-quarter births are those firms that first report during the third quarter and these firms differ in terms of when they are mailed and how many times they can be followed up.

	category)	
Owner Characteristics	Frame Indicators for Black, Asian and Public ownership (omitted groups are Female, Hispanic, American Indian, Hawaiian, National (e.g. white males), and Other). Frame probabilities of Hispanic, Black, Asian, and Female.	2007 SBO Frame
External Factors		
County Economic Conditions	Unemployment rate level and growth, population, labor force	BLS, Census
Attitudes toward Census	2010 Mail-out/Mail-back return rates	2010 Decennial
Tract Demographic Characteristics	Median income, percent Hispanic, percent Black, percent Asian, percent linguistically isolated	2008 ACS
Survey Design		
Quality of the Business Register	Source of the Mail-out NAICS: Bureau of Labor Statistics (BLS), Migrated from previous BR (SSEL) in 2001, Other administrative source (e.g. IRS, SSA), Census Bureau (omitted category); tract level geography, Undeliverable As Addressed status, third-quarter births	2007 BR and paradata
Characteristics of the Economic Census instruments	Number of pages, number of items, number/concentration of industries that reported on the form, share of items by type (e.g. check-box inquiry)	2007 EC metadata and paradata
Treatments	Certified mailing, , extensions	2007 EC paradata

In addition to size, we also want to account for the age of the firm. We match firms to the Longitudinal Business Database (LBD) in order to identify firm age and then break the age distribution into six categories. Our hypothesis is that the older a firm, the more likely it is to respond in the Economic Census. This is partly because size and age are positively correlated, but also because older firms would be more likely to have knowledge of the Economic Census or even responded in an earlier census. In the model, we control for size and age, as well as prior experience with the Economic Census in 2002. Figure 3 clearly shows a monotonic relationship between age and return rates, with younger firms the least likely to respond and older age classes more likely to respond in a monotonic fashion. This is true not only of the final return rates, but also after late February 2008.

Another characteristic to control for is the race or gender of the owner. We know that the return rate for the 2007 Survey of Business Owners (SBO) was significantly lower than that of the Economic Census. Using indicators of race/ethnicity/gender from the 2007

SBO frame, we track the returns of likely Asian, Hispanic, Black and female owned businesses.[7]

We also measure the external conditions using aggregate data matched using geographic identifiers. We use the county unemployment rate level in 2007 and change in that variable from 2002 to 2007, as well as the size of the labor force in each county. We also proxy "attitudes towards the Census Bureau" by adding 2010 Decennial Census return rates at the census tract level. Additional tract level variables include median income, share of population Asian, share of population Black, share of population Hispanic, and finally percent of the population that is linguistically isolated. Imperfect coding of addresses to the tract level means that using these variables results in dropping a significant number of observations, so we ran specifications with and without them.

Finally, we calculate measures of survey methods using the available paradata and metadata. We measure the quality of the Business Register in two ways: the source of the industry code and the quality of the mailing address. We also measure the characteristics of the Economic Census instruments. The previous variables describe firm characteristics that the Census Bureau must take as given, where the latter variables are for the most part determined by Census and are possibly affected by changes to the program (e.g. changing the content of the forms).

We describe in detail one indicator of Business Register quality: the source of the NAICS industry code. We create four variables to describe the source: a Census-based code, a Bureau of Labor Statistics (BLS)-based code, a Standard Statistical Establishment List-based code, and an industry code from another non-BLS administrative code.[8] Current BR processing rules rank Census-based codes as the best source followed by codes from the BLS. Our hypothesis is that establishments with industry codes from these sources should perform similarly with the Census-based codes perhaps being slightly better.

The return rate for establishments with Census-based codes was over 13% higher than for establishments with BLS-based codes. BLS industry codes come from state-based ES-202 Unemployment Insurance programs, and the industry is in part used to determine the premiums. We therefore delve a little deeper and explore variation across states/industries between BLS and Census industry codes. Interestingly, we find that Census-based industry codes perform better in all 50 states and the District of Columbia, ranging from 8% (DC) to 18% (WY). We find that Census Bureau industry codes average 86% return rate. The average industry return rates, if the codes are from the BLS, is 72% and exhibits more variation. While a few industries have higher return rates if the codes are sourced from the BLS, the industry rates of return are on average about 14% higher if the code is sourced from the Census Bureau.

Indicators of the quality of the BR address are the incidence of "Undeliverable-As-Addressed" (UAA) and the ability of the Census Bureau's Geography Division to successfully code the address to the Census tract level. We also try to control for differences in mailing packages, since there are over 500 different form types. We

[7] In section 5, we also include a measure of the quality of the indicator which ranges between 0 and 1 and is essentially the likelihood of the indicator.

[8] The Standard Statistical Establishment List (SSEL) is the previous name for the BR, which was migrated to a new system in late 2001. The SSEL-based codes are those assigned prior to this migration, with the vast majority of them being Census-based codes assigned in the 1997 Economic Census which was also the first collected on a NAICS basis.

summarize this variation using the number of pages, the total number of items, the number of "industries" covered by each form, and the share of items that fall into different categories: write-ins, check-boxes, or dollar values. For the most part, single-establishment firms are mailed according to the same schedule in the Economic Census. We can measure some differences such as certified mailings for some form types, third-quarter births, and whether or not the firm was granted an extension on the deadline to report.

5. Model Results

In many respects, the Economic Census is distinct from other economic programs in that reporting units are establishments. Annual, quarterly, and monthly (current) surveys for retail, wholesale, and/or services are based on firms and EINs in combination with industry. Like the Economic Census, the Annual Survey of Manufactures (ASM) reporting units are establishments, and for that reason it is often used to test changes to the Economic Census. However, the single-establishment firms in the Economic Census are dominated by non-manufacturing industries so the ASM seems inappropriate for testing strategies to improve returns, as do the current surveys outside of manufacturing, since they are not based on the establishment. There is also tremendous heterogeneity in the forms that are distinct to the Economic Census, which is another reason why it is difficult to compare with other programs. We want to take characteristics of the survey design into account and it is unclear that we would be able to control for the variation in Census forms using information from other programs, the ASM, for example, only mails one type of form as compared to the Census of Manufactures which mails hundreds of different forms with many detailed inquiries about material inputs and product outputs. Since other surveys seem inappropriate for testing survey design changes to the Economic Census, it is even more important to use as much information as possible from the Economic Census itself. Developing a model of the check-in status will provide the foundation for evaluation, which we describe in section 5.1. In section 5.2, we use the model to evaluate one of the strategies expected to raise return rates in 2007: a certified mailing form follow-up.

5.1 Analysis of Return Rates

Following Greene (2008), we estimate the check-in status using a logit model with the independent variables described in the data section and listed in Table 1. The basic variable of interest, check-in status, is whether or not a firm mailed back their form. The indicator variable, CI_j, takes on a value of 1 if firm j returned their form and 0 otherwise. We model this variable as a function of the characteristics of the business, the external environment, and the survey design, represented by x_j.

$$Pr(CI_j = 1|x_j) = \frac{exp(x_j\beta)}{1 + exp(x_j\beta)} \qquad (1)$$

The full results are presented in Table 2, where we report the odds ratio and standard errors for all of our independent variables for several specifications. An odds ratio of 1 implies that the event is equally likely as it is for the omitted group. An odds ratio greater

than one implies that the event is more likely and an odds ratio less than one implies that the event is less likely. The standard errors take into account the sampling weights assigned to reporting units and the stratified nature of sampling. In this section we describe some of the highlights. These results include controls for both industry and geography, as well as taking into account both the sampling weights and strata. The statements below are not causal, but can be interpreted as correlations with a rich set of controls. The statements are made holding everything else in the model fixed.

Table 2. Logistic Model of 2007 Returns

Variables	Odds Ratio	Std. Err.	t
Employment: 5-9	1.050	0.001	47.82
Employment: 10-19	1.089	0.001	67.57
Employment: 20-49	1.085	0.002	52.61
Employment: 50-99	1.021	0.003	8.21
Employment: 100-249	0.861	0.003	-42.52
Employment: 250-499	0.706	0.005	-51.27
Employment: > 500	0.553	0.006	-58.24
Age: 2-5 yrs	1.410	0.002	214.29
Age: 6-10 yrs	1.584	0.003	253.85
Age: 11-15 yrs	1.830	0.004	291.98
Age: 16-20 yrs	2.073	0.005	315.66
Age: > 20 yrs	2.437	0.005	411.15
No 2002 return x BLS	0.210	0.000	-896.73
No 2002 return x Non-BLS	0.189	0.002	-202.78
No 2002 return x SSL	0.190	0.000	-751.18
2002 Return x BLS	0.936	0.008	-7.63
2002 Return x NonBLS	1.067	0.027	2.55
2002 Return x SSL	0.976	0.010	-2.47
2002 No mail x BLS	0.675	0.001	-341.12
2002 No mail x Non-BLS	0.858	0.002	-82.00
2002 No mail x SSL	0.837	0.001	-102.12
Log(unemployment rate)	0.723	0.002	-124.14
ΔLog(unemployment rate)	1.385	0.005	85.17
ΔLog(labor force)	1.476	0.011	52.23
Asian frame	0.787	0.001	-222.74
Asian probability	0.999	0.002	-0.46
Black frame	0.739	0.001	-191.75
Black probability	0.502	0.002	-191.95
Hispanic probability	0.594	0.001	-263.45
Female probability	1.104	0.001	76.93
# Pages	0.912	0.001	-103.64

# Items	0.999	0.000	-28.03
% Write-in items	0.150	0.004	-63.45
% Dollar items	1.833	0.040	27.86
% Checkbox items	0.376	0.007	-52.05
# Write-in chars	1.000	0.000	50.94
Industry form count	1.031	0.000	70.03
Industry form HHI	1.000	0.000	9.78
No tract x UAA	0.026	0.000	-1463.66
Tract x No UAA	0.992	0.001	-7.29
Tract x UAA	0.032	0.000	-847.98
Third Quarter Birth	0.451	0.001	-502.03
Extension of Reporting Deadline	1.322	0.002	165.90
Public Company frame	0.955	0.004	-9.88
industry controls	yes - six-digit NAICS		
geography controls	yes - 293 Metro, 1 Micro		
observations	1849058		

First, we look the relationship between the characteristics of the business and whether or not they return a form. Calculating the check-in rates by size category shows an inverted U-shaped distribution, where form returns are low for the (omitted) smallest size group then rise as size increases, but decline for the largest categories of firms actually doing worse than smallest category. The model indicates a pattern that after controlling for other factors firms with more than 250 employees perform significantly worse than the omitted smallest size category of 1-4 employees. This inverted U-shaped pattern seems puzzling, but could be explained if larger firms are both resource constrained but also sufficiently complex that reporting is quite burdensome. In 2007, return rates for establishments owned by multi-establishment firms were highest for the largest companies and lowest for the smallest, so this result could also be seen as a continuation of the pattern for the overall size distribution of firms.

The odds ratios for the age categories indicate that all age groups perform better than the youngest group (0-1 years, the omitted group), and the check-in rates are increasing with age. We also include gender/ethnicity/race indicator variables, but also the likelihoods of being in each category from the frame as well. Specifically, we include the probabilities of being classified as Hispanic or Female. We also include two race indicators, Asian and Black, as well as interaction of these indicators with the probabilities of being classified in these races. The omitted category is all other SBO frame groups including female, Hispanic, American Indian, Hawaiian, national (e.g. white males), and other. The results are consistent with women owners being more likely to return their form and Hispanic less likely. Blacks and Asians have lower likelihoods relative to all other firms not in these groups.

We also include a range of factors that fall into the external factors group. We find a number of robust results. The higher the unemployment rate in the county, the less likely the firm is to respond. When we include tract level characteristics, we also find that they are important. The 2010 Decennial Census mail-back return rates, meant as a proxy for "local attitudes towards the Census Bureau", are an important factor. The 2007 returns

are positively associated with 2010 returns. Variables for the share of minority population and linguistically isolated are all negatively correlated with form returns in the Economic Census.

The final group of factors we term as "survey methodology" variables, and they describe variation across firms in how the census was conducted. Earlier in the paper we discussed the observed difference in return rates from different administrative sources in the BR by industry and geography. The difference between the check-in rates was consistently worse for establishments with BLS codes as compared with Census codes. In the model we include both the check-in status of the firm in the 2002 Economic Census and the source of the industry code. Returning a form in 2002 is highly correlated with returning a form in 2007, relative to the non-mail cases in 2002. In these models we also find that establishments with BLS codes are significantly less likely to return a form.

Since firms that didn't return a form in 2002 must almost certainly have a BLS code prior to the 2007 Economic Census, we fully interact the firm's status in 2002 {nonmail, mailed-nonresponse, mailed-returned form} with the source of the industry code {Census, administrative data – BLS, administrative data – non-BLS}. When interacted with the "2002 non-mail" indicator, we find that establishments with BLS sourced industry codes perform worse relative to Census derived industry codes. The variables "no tract x UAA", "tract x no UAA", and "tract x UAA" are the interaction of the establishment missing a tract code and Undeliverable-As-Addressed (UAA) status, with the omitted group of the firm being assigned a Census tract and not having a UAA status. All three groups are less likely to respond, but UAA status matters the most, as one would expect.[9]

The set of variables that describe the survey instrument are in general not significant, with the exception of number of pages, but not a very large effect, with an odds ratio of ~.94. This finding is consistent with Willimack (2002).

5.2 Analysis of Certified Mailing Treatment

In 2007, approximately 130,000 single-establishment firms were mailed a third follow-up using U.S. Postal Service certified mailing, at a cost of $4/package versus $.50/package using standard mail.[10] Since this was not a planned randomized experiment, we will use our model results from section 5.1 to evaluate the cost effectiveness of the certified mailing. We use nearest neighbor matching as described by Smith and Todd (2005) in identifying a group of controls to be compared with the firms which were included in the certified mailing (the treatment group). In their review of the propensity score matching literature in labor economics, they summarize three criteria from Heckman, Ichimura and Todd (1997) and Heckman, Ichimura, Smith, and Todd (1998) that limit the bias when using these methods: (i) the same data sources (i.e., the same surveys or the same type of administrative data or both) are used for participants and nonparticipants, so that earnings and other characteristics are measured in an analogous way, (ii) participants and nonparticipants reside in the same local labor markets, and (iii) the data contain a rich set of variables that affect both program participation and labor market outcomes.

[9] In the paradata, we observe cases where UAAs are mailed multiple times, but they are not always returned by the U.S. Postal Service as UAA. This is why UAA status=yes doesn't perfectly predict nonresponse.
[10] We exclude Island Areas, the cost difference times the form counts imply that this treatment cost over $450,000. Current plans for 2012 economic census call for sending 160,000 forms via certified mail.

As these studies apply to demographic data on workers, we will translate to our business data. First, our data comes from the same source(s) – both treatment and control propensities are derived using administrative data to construct characteristics of the businesses, external factors are linked using geographic identifiers, and metadata and paradata sources describe differences in survey methods for all business in the Economic Census. Second, while we do not have "local labor markets" we do classify firms into industries. We are unable to restrict the matches to be within the same NAICS industry, since form types match closely to detailed industry. We explored the idea of matching at the two-digit or four-digit level, but at the time of the third mailout, there were simply too few potential donors for each treatment. Finally, the certified mail cases were selected by form type so we know exactly how firms were selected for participation and we have a rich set of variables that describe whether or not a firm responds in the Economic Census. Given all of these factors, we feel that using propensity score matching to evaluate this treatment in the Economic Census is feasible, although inferior to the first best of using an experimental design to randomly select firms from each form type.

We use nearest neighbor matching with replacement. We select firm *j* from the set of potential controls, I_0, to match a treated firm *i* so that the control firm is closest to the treated firm in terms of the predicted probability of return calculated from the logit model

$$C(P_i) = \min_j \left\| P_i - P_j \right\|, j \in I_0. \qquad (2)$$

P_i and P_j are predicted return probabilities using model from Table 2, but run only for the firms that still hadn't returned a form at the time of the third follow-up. The potential set of controls I_0 is defined as all single-establishment firms which were not included in the certified mailing and had not mailed back a form by June 4, 2008, the first date that certified mail cases were selected. In addition, they can't be classified as third quarter births or have an unexpired extension on June 4.

Since we select control firms with replacement, we check how often we selected the same control for different treatment cases and we find we selected a firm at most twenty-four times. We implemented a regression specification similar to those in Table 2, where we include all control cases, and another specification where we only include each control once. These two specifications are equivalent to a weighted versus non-weighted approach, respectively, in handling the controls. The results, not reported for brevity, show the treatment makes firms significantly more likely to respond in the Economic Census, and we find that the effects of other variables are for the most part consistent with the results from Table 2 that are estimated on the entire population of single-establishment firms in the Economic Census. We also calculated the average effect of the treatment on both the control and treatment groups, based on the estimation results using only the treatment and control firms. The combinations of treatment-treated and control-untreated are observed in the data and match very closely since they were picked that way. They differ slightly since we also include the "treatment" variable to estimate the effect of the treatment, in addition to the original explanatory variables used in Table 2. We estimate roughly a 5 percentage points increase in return rates from the certified mail treatment. Using the predictions from the model which uses each control only once implies that the effect is closer to a 10 percentage points increase. These two estimates together with the costs provided from the program areas works out to a cost of $21-$47 per additional return using certified mail.

6. Conclusion

The Census Bureau is working in an environment where it is growing ever more expensive to maintain return rates. It is likely that even with additional resources we could see a decline in return rates. As budget constraints on programs become tighter, program managers will need model-based tools to evaluate which strategies are cost effective in encouraging returns. Our goal in this paper is to model the check-in status of single-establishment firms in the 2007 Economic Census. The model allows us to identify a number of characteristics correlated with lower return rates. We then use the model to evaluate the efficacy of a treatment (certified mailing) intended to raise check-in rates. Using propensity score matching to identify a control group, we find that the certified mailing resulted in a 5-10 percentage points higher check-in rate. This implies a cost per additional return of approximately $21 to $47. Given the lack of sufficiently detailed 2007 paradata about other treatments, such as phone calls to companies, we aren't able to compare the cost effectiveness of other treatments with the certified mailing.

This paper also provides the foundation for a more detailed analysis of the 2012 Economic Census mailout/mailback campaign beginning in the December 2012. For the population under study in this paper, that campaign is described in detail in appendix B. A new management information system will provide a daily feed of updates on the status of firms, as well as more detailed information about when and how Census contacts firms and vice versa. Building on the static return rate model for 2007, we will combine time series information on the patterns of contact to estimate a hazard model that can be used to predict when firms will respond to the Economic Census. We also plan to use the model to evaluate any treatments planned or unplanned in 2012. For example, given our finding that large single-establishment firms seem to report at lower rates, we plan to mail a random sample of the single-establishment firms with over 250 employees a Contact Exchange Card (CEX). The CEX is a program geared towards for large- and medium-sized multi-establishment firms. We mail them during the summer prior the census mailing in an effort to alert them to the upcoming census and learn who at the company will be responsible for reporting.

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