Factors Affecting Early Return Rates on the 2002 Economic Census: Assessing The Impact of the Number of Questionnaire Pages

Diane K. Willimack
U.S. Census Bureau [1]

Key Words: establishment surveys, questionnaires, respondent burden

1. Introduction

A recurring question in survey methodology is the effect of survey length on response rates. For self-administered paper forms, a common ad hoc measure of length is the number of questionnaire pages. The typical hypothesis is that response rates fall as the number of pages increases. This paper examines the effect of the number of questionnaire pages on response rates in U.S. economic censuses. Not only are there hundreds of questionnaire versions, tailored by industry, but also formatting changes over time that have affected the length of economic census forms. Considering the survey form as our unit of analysis, we used multivariate methods to study potential relationships between the number of questionnaire pages and economic census response rates over time.

We begin by providing background and a limited literature review on the effects of survey length on response rates. We then consider how the conceptual framework for establishment survey participation motivates our multivariate empirical models for addressing the research question. After describing our data, we build our empirical models and present results from multivariate estimation. We close with a discussion of the implications of our findings.

2. Background

2.1 The U.S. Economic Census

The U.S. Census Bureau conducts an economic census every five years, for years ending in '2' and '7'. Data are used to benchmark the status of the U.S. economy at detailed industry and geographic levels, as well as to provide data for estimating U.S. Gross Domestic Product. To support these uses, the economic census collects detailed data on employment, payroll, and sources of revenue for each establishment, or physical location, of a business.

Questionnaires for the economic census are tailored by industry, historically resulting in more than 450 versions. Much of the basic content remains constant across censuses, such as questions requesting data about employment, payroll, and revenue details. Modifications occur to address structural changes in the economy, and special inquiries vary from census to census.

Prior to the 2002 Economic Census, forms were printed on legal size paper (8½ x 14 inches). Their format varied by sector. Many of the forms for retail, wholesale and service sector industries featured a 2-column layout, while manufacturing, mining, and construction forms utilized single-column formats. The 1992 and 1997 Economic Census forms ranged from 2 to 16 pages in length.

Paper questionnaires for the 2002 Economic Census underwent some major formatting changes in an attempt to standardize the "look and feel" across industries. In addition, new software designed to generate both paper and electronic forms automatically required as much standardization across forms as possible, in order to take full advantage of its efficiency. While the 1997 Economic Census offered computerized self-administered questionnaires (CSAQs) for a limited number of forms, the 2002 Economic Census was the first to offer electronic reporting as a response option for all eligible establishments.

To achieve the desired standardization for the design of 2002 Economic Census forms, all industries adopted the single-column format. In addition, in response to feedback from respondents (Sudman et al., 2000), forms were redesigned to fit on standard letter size paper (8½ x 11 inches). As a result of these two major formatting changes, the 520 different forms for the 2002 Economic Census ranged from 3 to 27 pages in length. There was also some expansion of content for this census, though not substantial.

Survey managers were seriously concerned that response rates might decline substantially as a result of accumulated changes lengthening economic census forms. This concern motivated research to address the question: Did the number of questionnaire pages affect response rates differently in the 2002 Economic Census than in past censuses?

[1] This report is released to inform interested parties of ongoing research and to encourage discussion of work in progress. The views expressed on statistical, methodological, or operational issues are those of the authors and not necessarily those of the U.S. Census Bureau.

2.2 The Literature

Studies of the effects of survey length on response rates show mixed results (Dillman, 2000; Mangione, 1995; Bogen, 1993). Often the effect of length is confounded with other factors, such as content (Dillman, 2000; Kristal et al., 1994), collection mode (Mond, 2004), and salience (Bean & Roszkowski, 1995; Biner & Kidd, 1994). Moreover, the effect of questionnaire length can be mitigated by design factors or follow-up strategies (Sunbar et al., 2001; Dillman 2000), or response-inducement techniques such as incentive use (Biner & Kidd, 1994; Mooney et al., 1993). Thus, it is difficult, and perhaps inappropriate, to generalize, since the effect of survey length on response rates seems to depend on a variety of survey conditions.

3. Modeling Factors that Affect Response Rates

3.1 The Conceptual Model

Our underlying conceptual model for investigating factors affecting 2002 Economic Census response rates is the framework for business survey participation proposed by Willimack et al. (2002), who contend that businesses weigh the cost of response burden against their goals of remaining viable and profitable. The costs and benefits of survey participation are both affected by attributes of the external environment within which the business operates, internal attributes of the business itself, and attributes of the selected respondent's role within the organization, along with survey design features controlled by the survey organization.

A business's external environment includes economic conditions, the survey-taking climate, and legal or regulatory requirements imposed upon the business. Internal attributes of the business affecting the survey participation decision include the availability of data, which in turn is associated with the industrial characteristics of the business, its organizational structure and complexity, and management requirements. Other internal factors include the degree to which activities rely on information exchanged with the outside world, company policy, and the availability of resources to respond to data requests. Moreover, respondent selection is under the control of the business, and respondents' abilities to meet external data requests, including surveys, depends on their authority to release data, their access and ability to obtain the requested data, and their motivation to do so.

Survey organizations can impact the costs and benefits of survey participation through selecting survey design features that reduce response burden or support business goals. Practically every survey design decision potentially has an impact, from the sample design to data collection strategies to confidentiality pledges.

3.2 Defining the Empirical Model

We now define selected variables to develop an empirical model for the above conceptual model. These variables are summarized in Table 1.

First, our dependent variable is the form-level return rate as of the first week of June of the collection year. Rather than a response rate that removes ineligible cases from the denominator and unusable returns from the numerator, the return rate measures the volume of forms mailed that are actually returned, and is defined:

$$\text{Return Rate} = \frac{\text{Receipts} + 2^{\text{nd}}\text{-time Undeliverables}}{\text{Number of Forms Mailed}}.$$

Since the reference period for the economic census is the end of a calendar year, data collection actually occurs during the following year. That is, the 2002 Economic Census was collected during the year 2003. Although, in general, the economic census due date at mail-out is Feb. 12, nonresponse follow-up continues until collection closeout in October. While routine follow-up mailings continue early on, more earnest requests ensue as closeout nears. Therefore, we selected the first week of June as the referent for our study, as an intermediate point in nonresponse follow-up, after routine mailings have occurred and before demanding "end-game" strategies kick in.

Tailoring economic census forms by industry results in hundreds of different questionnaire versions for which return rates are monitored. These form-level return rates constitute the dependent variable in our model. Thus, it is important to note that we are not modeling response propensities, that is, the likelihood of individuals to respond to a survey. Instead, our dependent variable is an aggregate return rate.

We have defined several independent variables believed to be representative of or associated with the attributes described for the conceptual model. Among the attributes affecting a business's external environment are economic conditions. In a study of the effects of social, economic, or political conditions on household survey response rates, Harris-Kojetin and Tucker (1999) found that better economic times were associated with increases in refusal rates, negatively impacting response rates. If such an effect is evident among surveys of households and individuals, it seems reasonable to expect a relationship between response rates in surveys of businesses and economic conditions, such as economic recession or expansion.

The National Bureau of Economic Research monitors

Table 1: Independent Variables Used in Multivariate Regression Analysis

Concept / Variable	Definition
Dependent Variable	
Response Rate	Form-level return rate
Independent Variables	
External Environment	
%GDP-Change	Percent change in annual U.S. GDP, relative to the previous year, by sector
%Emp-Change	Percent change in total annual U.S. employment, relative to the previous year, by sector
Characteristics of the Business	
Industrial Sector	Series of dichotomous indicator variables for: Construction, FIRE, Manufacturing, Retail, Services, Utilities, Wholesale (Mining is the omitted sector)
Survey Design	
Pages	Number of pages making up the questionnaire version
Mode	Dichotomous variable reflecting the availability of electronic reporting mode for the questionnaire version

quarterly changes in employment and gross domestic product to determine whether and when the U.S. economy has entered or emerged from a recession (*www.nber.org*). Annual sector-level employment and GDP figures were obtained from published sources (*www.bea.gov*) for the two years prior to the collection year. Percent annual change was calculated for each sector and associated with forms assigned to that sector.

We define an industrial sector variable to summarize internal business attributes that may be associated with response rates. A series of dichotomous variables represent sector defined in terms of the 2-digit Standard Industrial Code (SIC) industry to which a given form is assigned. Although the 2002 Economic Census utilized the North American Industrial Classification System, forms were mapped to their SIC industries.

Although included in the Willimack et al. framework, variables associated with individual respondents are excluded here, since we are not examining individual response propensities.

We define two variables associated with survey design. The first, our target variable of interest, is the number of questionnaire pages that make up a given form. Only pages containing questionnaire content are counted; blank pages are not. In addition, we hypothesize alternative functional forms of the page-length variable, investigating not only a linear effect, but nonlinear quadratic and cubic forms as well.

Our second attribute of survey design is a dichotomous variable indicating whether an electronic version was available to respondents for a given form.

3.3 The Data

The data consist of form-level return rates for the 1992, 1997 and 2002 Economic Censuses as of the first week of June during their collection years, 1993, 1998, and 2003, respectively. These are displayed in Table 2, along with the number of questionnaire versions and page-length ranges for each census year. The total of 1,459 questionnaire versions across these three census years constitutes our record count forming the basis for regression analysis and estimation.

Early June return rates are displayed by sector in Table 3, along with the average page length of forms assigned to that sector. Also displayed are the correlations between return rates and form length, which are all negative and statistically different from zero, suggesting an inverse relationship. That is, it appears that, for all sectors, return rates decreased as the number of questionnaire pages increased.

Note that the lowest mean sector-level return rates of 67.91% and 68.71% appear in, respectively, Mining and Manufacturing, the sectors that also have the longest average form lengths, at 10.26 and 9.79 pages, respectively. However, with the exception of Finance, Insurance and Real Estate (FIRE), these sectors also show the weakest correlations between return rate and form length. On the other hand, the Services sector claims the highest early return of 75.44% and nearly the shortest form length at 4.95 pages, with one of the strongest correlations. Generally speaking, with the exception of FIRE, the inverse correlation between return rates and form length is weaker for longer forms, suggesting wider variations in return rates as the number of questionnaire pages increases.

Table 2: Return Rates by Census Year, 1st week of June of the collection year

Census Year	Number of Question-naire Versions	Number of Questionnaire Pages		Mean Return Rates Across All Versions
		Minimum	Maximum	
1992	488	2	14	77.34%
1997	451	2	16	69.50%
2002	520	3	27	65.19%

Table 3: Economic Census Return Rates and Form Length Means and Correlations, by Industry

Industrial Sector	Mean Return Rate	Mean Number of Pages per Form	Correlation (return rate, #pages)
Mining	67.91%	10.26	-0.4683
Manufacturing	68.71%	9.79	-0.4661
Retail	70.09%	5.14	-0.5225
Utilities	71.71%	4.48	-0.5168
Wholesale	73.46%	6.35	-0.6577
Construction	73.88%	6.07	-0.5784
Finance, Insurance & Real Estate (FIRE)	75.01%	5.33	-0.2967
Services	75.44%	4.95	-0.6239
Overall	70.59%	8.90	-0.6061

3.4 Limitations

First and foremost, it must be noted that our models of return rates are behavioral in nature, indicative of possible relationships in the observed data. It is inappropriate to use the estimated models for predictive purposes or to infer causality between the independent and dependent variables.

Some measurements are confounded in the variables we have defined. Consider the variable indicating the availability of electronic reporting options. No electronic option was formally offered for the 1992 Economic Census, while computerized self-administered questionnaires (CSAQs) were available for a limited number of forms in the 1997 Economic Census and offered for all forms in the 2002 Economic Census. Thus, the availability of an electronic reporting option is confounded with census year. Industrial sector is also confounded amongst multiple variables – the sector indicator variable and annual sector-level changes in employment and GDP. However, these variables do not exhibit evidence of collinearity, and thus are retained in the models. The explanatory value of each of these variables will be described in the results, despite the inherent confounds.

The empirical model contains no variables controlling for questionnaire content across census years. Although conceptually simple, an observable measure of content is not straightforward, as questionnaire items themselves are not consistent or constant across versions. Controlling for content would best be handled in a designed experiment. Development of an acceptable content measure remains for future research.

4. Results

We estimated several multivariate models exploring the effects of the factors relative to one another. To assess the impact of variables individually and across model formulations, one should consider the relative magnitudes of each estimated coefficient, along with its statistical significance and its sign (positive or negative).

We begin by estimating main effects models simply to assess the overall impact of each variable on early June return rates, regardless of census year. We then reformulate the models including interaction terms with census year for many of the key variables. This enabled simultaneous comparisons of estimated coefficients across census years, using partial F-tests to test the hypothesis H_0: 1992 = 1997 = 2002 = 0 for key variables. Results for selected models[2] appear in Tables 4 and 5.

4.1 Main Effects

We begin by estimating main effects models simply to assess the overall impact of each variable on early June return rates, regardless of census year. The estimated effects of questionnaire length in pages, annual changes in GDP and employment, industrial sector, and electronic mode availability on early economic census return rates are displayed in Models A, B, and C, shown in Table 4. The adjusted-R^2 values for these models are 0.28, 0.31 and 0.33, respectively.

In all three models, the estimated coefficients for the page length variable, expressed in linear form, are negative and significantly different from zero. This evidence suggests that, in general, economic census return rates fell as the number of questionnaire pages increased.

In Model C, a quadratic form specifies a nonlinear relationship between form length and return rates. A variable defined as the square of the number of pages is added to the model and found to be statistically significant. Its positive value, paired with the negative linear coefficient, suggests that the inverse relationship between page-length and return rates diminished (in absolute value) as the number of pages increased.

Estimated coefficients for industrial sector indicator variables vary in their magnitudes, signs and significance. For all formulations of the empirical model, we reject the hypothesis of no sector differences. That is, it appears that response rates differ by industrial sector.

Although confounded with industrial sector, the

[2] Intermediate models not included in the paper may be obtained from the author upon request.

Table 4: Estimated Main Effects Models

	Estimated Coefficients[a]		
Variables	A	B	C
Intercept	82.01 *(<0.0001)*	81.26 *(<0.0001)*	85.02 *(<0.0001)*
Pages	-1.48 *(<0.0001)*	-1.12 *(<0.0001)*	-2.46 *(<0.0001)*
Pages squared			-0.07 *(<0.0001)*
%GDPChange	0.00 *(0.9908)*	-0.24 *(0.13)*	0.02 *(0.8996)*
%EmpChange	-0.06 *(0.01)*	-1.08 *(<0.0001)*	-1.18 *(<0.0001)*
Industrial Sector	*(<0.0001)*[b]	*(<0.0001)*[b]	*(<0.0001)*[b]
Construction	0.25 *(0.9068)*	0.69 *(0.7541)*	0.93 *(0.6533)*
FIRE	1.07 *(0.4040)*	5.07 *(0.0131)*	3.97 *(0.0487)*
Manufacturing	-0.16 *(0.9205)*	-1.22 *(0.4338)*	-1.06 *(0.4881)*
Retail	-3.99 *(0.0256)*	-0.16 *(0.9313)*	-1.68 *(0.3506)*
Services	2.20 *(0.2626)*	6.08 *(0.0022)*	5.58 *(0.0043)*
Utilities	-4.80 *(0.0487)*	-3.26 *(0.1721)*	-3.85 *(0.1015)*
Wholesale	0.88 *(0.6184)*	2.96 *(0.0916)*	1.58 *(0.363)*
Mode		-7.53 *(<0.0001)*	-6.44 *(<0.0001)*
Adjusted R^2	0.2806	0.3103	0.3324

[a] Numbers in *(italics)* are p-values.
[b] p-values for testing hypothesis H_0: Construction=FIRE= Manufacturing= Retail=Services=Utilities=Wholesale=0

employment change variable is statistically significant, suggesting that it accounts for additional variation in economic census response rates not captured by sector alone. The effect is negative, suggesting an inverse relationship between sectoral employment growth and economic census response rates. The effects of relative annual changes in GDP are not statistically significant, however.

Of particular interest are results when a variable indicating the availability of an electronic version of the form is added in Model B. The addition of this "mode variable" improves the fit of the model, and its coefficient estimate is negative and highly significant. Superficially, this suggests that offering electronic reporting dampens response rates – a potentially disconcerting portent for Web surveys.

However, a reasonable explanation is found from examining data collection and check-in processes for the 2002 Economic Census. Electronic reporting software was released a month after paper economic census forms were mailed, and large companies, who were strongly encouraged to report electronically, were given an automatic filing extension. As a result, returns from many large companies were delayed beyond the early June reference date for this research. In addition, electronic returns had not been processed at this time, and thus were not counted in the early June return rates.

We decided to retain the "mode variable" in subsequent formulations of the models in this study because it appears to account for these events. In a sense, inclusion of the "mode variable" removes variation in the data due to these circumstances, and the degree to which the models effectively explain the remaining variation in the data may be more "purely" attributed to the other variables, particularly the subject of this research – the number of pages in a paper questionnaire.

4.2 Interaction Effects

We reformulated the models to facilitate testing for differences in the effects of time on response rates – i.e., enabling simultaneous comparisons of estimated coefficients across census years, using partial F-tests to test the hypothesis H_0: 1992 = 1997 = 2002 = 0 for key variables. This was done by adding indicator variables[3] and interaction terms[4] for economic census reference years. Although the resulting full model is not included here due to space constraints, statistical results will be discussed to provide a context for subsequent explanatory models.

Estimated coefficients for the census year indicator variables in the full model were not together statistically different from zero (F=1.39, p=0.2428).[5] We also fail to reject the hypothesis of census year differences in the effects of GDP and employment changes on return rates (GDP: F=0.68, p=0.5663; employment: F=0.95, p=0.4170). This suggests that the effects of economic conditions on return rates did not vary over time.

[3] Indicator variables were added for 1997 and 2002; 1992 was the omitted variable.
[4] Interaction terms were not added for the industrial sector indicator variables or for the mode variable. The latter inherently includes a year effect by definition, since an electronic mode was not offered for any 1992 Economic Census form but was available for all 2002 Economic Census forms. Thus the inclusion of a Year x Mode interaction would introduce collinearity.
[5] A year effect was found in other formulations of the model, but disappeared when nonlinear terms were added for the number of questionnaire pages.

For subsequent analysis, census year indicator variables were removed, along with terms representing the interactions between census year and changes in GDP or employment. Remaining model formulations include a single intercept term and only cross-census variables representing changes in GDP and employment. We also investigated and eliminated six outliers with response rates below 20%.[6] Model D in Table 5 represents the resulting reduced formulation of the model. Removing the six outliers improved the fit of the model, increasing the adjusted-R^2 from 0.39 to 0.43.

Statistical testing supports rejecting the hypothesis of no differences in the coefficient estimates, by year, for both the linear and quadratic page variables. This suggests that the effect of questionnaire length on response rates varied across economic censuses.

The quadratic formulation of the model, which provides for a nonlinear association between response rates and questionnaire length counted in pages, seems, nevertheless, counter-intuitive. The negative linear pages term and the positive quadratic term represent a concave-up shape for a plotted curve. Although that may reasonably represent the observed data – a sharp decline in response rates during the initial increases in the number of questionnaire pages, which flattens as page length increases – this shape suggests that resulting return rates would eventually increase again as the number of pages creeps upward. Therefore, for our final model formulation, Model E, we added a cubic term for the number of questionnaire pages, interacting with census year to discern any effects of time.

Results in Table 5 for the estimation of Model E show that Page x Year interactions are statistically significant for the linear, quadratic and cubic variables. In addition, regardless of the functional form of the page-length variable, we reject the hypothesis that estimated coefficients are equal across census years. That is, the effect of the number of questionnaire pages on economic census response rates differed for at least one of the census years in the model.

Table 6 displays results from pairwise comparisons of the page-length terms, by economic census year. For the linear term, the estimated coefficients for 1992, 1997, and 2002 all differ significantly from one another. For the quadratic and cubic terms, the 1992 and 1997 parameters fail to differ significantly from one another. Only the estimated coefficient for 2002 is significantly different from the others.

Table 5: Estimated Models with Year Interactions

	Estimated Coefficients[a]	
Variables	D	E
Intercept	88.99 *(<0.0001)*	98.40 *(<0.0001)*
*Pages * Year*	*(<0.0001)* [b]	*(<0.0001)* [b]
1992	-3.95 *(<0.0001)*	-9.94 *(<0.0001)*
1997	-6.11 *(<0.0001)*	-11.92 *(<0.0001)*
2002	-2.86 *(<0.0001)*	-5.78 *(<0.0001)*
*Pages-squared * Year*	*(<0.0001)* [b]	*(<0.0001)* [b]
1992	0.21 *(<0.0001)*	1.14 *(<0.0001)*
1997	0.33 *(<0.0001)*	1.23 *(<0.0001)*
2002	0.09 *(<0.0001)*	0.33 *(<0.0001)*
*Pages-cubed * Year*		*(<0.0001)* [b]
1992		-0.04 *(<0.0001)*
1997		-0.04 *(<0.0001)*
2002		-0.01 *(0.0006)*
%GDPChange	0.26 *(0.0844)*	0.24 *(0.1154)*
%EmpChange	0.03 *(0.9062)*	-0.085 *(0.7562)*
Industrial Sector	*(<0.0001)* [c]	*(<0.0001)* [c]
Construction	2.35 *(0.2004)*	4.08 *(0.0298)*
FIRE	1.29 *(0.4765)*	2012 *(0.2479)*
Manufacturing	2.04 *(0.1369)*	1.29 *(0.3480)*
Retail	-3.38 *(0.0379)*	-2.25 *(0.1755)*
Services	1.25 *(0.4913)*	2.14 *(0.2515)*
Utilities	-1.90 *(0.3606)*	-1.42 *(0.4940)*
Wholesale	1.12 *(0.4819)*	2.57 *(0.1108)*
Mode	-3.58 *(0.0307)*	-3.43 *(0.0724)*
Adjusted R^2	0.4334	0.4433

[a] Numbers in *(italics)* are p-values.
[b] p-values for testing hypothesis H_0: 1992=1997=2002=0
[c] p-values for testing hypothesis H_0: Construction=FIRE= Manufacturing= Retail=Services=Utilities=Wholesale=0

[6] Outliers were from four 1997 Manufacturing forms, one 2002 Retail form and one 2002 Utilities form.

Table 6: Pairwise Comparisons of Page-Length Terms, by Economic Census Year

Variable	Estimated Coefficient	Differ from 1997?	Differ from 2002?
*Pages * Year*			
1992	-9.94	p=0.0028	p<0.0001
1997	-11.92		p<0.0001
2002	-5.78		
*Pages-squared * Year*			
1992	1.14	p=0.5278	p<0.0001
1997	1.23		p<0.0001
2002	0.33		
*Pages-cubed * Year*			
1992	-0.04	p=0.7564	p<0.0001
1997	-0.04		p<0.0001
2002	-0.01		

5. Discussion

Consider the implications of the estimated relationships between economic census response rates and the number of questionnaire pages, holding all other factors constant. The negative linear and positive quadratic page length terms mean that the marginal decrease in return rates diminishes as the number of questionnaire pages increases. Response rates fall sharply with initial increases in the number of pages, but then flatten as length increases further.

Although small in magnitude, the estimated coefficients for the cubic page terms are statistically significant. They are negative, meaning that the curve changes from concave-up to concave-down at the inflection point. As the number of questionnaire pages increases, response rates decrease at a decreasing rate – that is, they flatten – then they decrease at an increasing rate.

Note that for each page-length variable, the estimated coefficient for 2002 is substantially and statistically less than coefficients for the same variables for other census years. The absolute value of the linear effect of the number of questionnaire pages on 2002 return rates is roughly half that of the previous two censuses (5.78 versus 9.94 or 11.92). Similarly, for the quadratic and cubic terms, the absolute values of the page length effect on 2002 return rates are roughly one quarter of those for the 1997 and 1992 Economic Censuses. Thus, not only was the effect of questionnaire length on 2002 return rates significantly different from previous censuses, it was smaller.

This can be seen graphically in Figures 1a, 1b, and 1c, which illustrate the shapes of the curves representing our estimated models with respect to the number of questionnaire pages for the 1992, 1997 and 2002 Economic Censuses, respectively. The charts also include representations of the 95% confidence intervals around the estimates. Not only are the implications of the cubic form demonstrated, it can be clearly seen that the curve for 2002 is flatter than the other two, illustrating the diminished effect of questionnaire length on 2002 Economic Census return rates.

Figure 1a: Estimated Model for 1992, with Upper (U) and Lower (L) Confidence

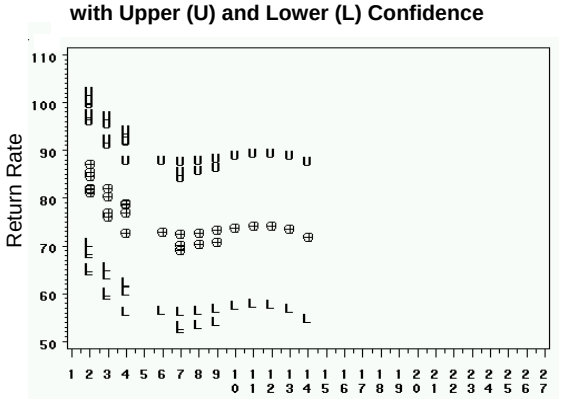


Figure 1b: Estimated Model for 1997, with Upper (U) and Lower (L) Confidence Bounds

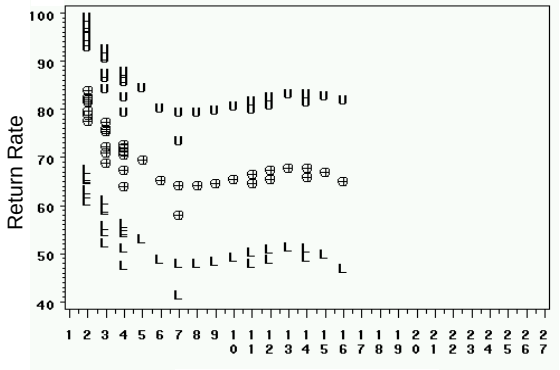
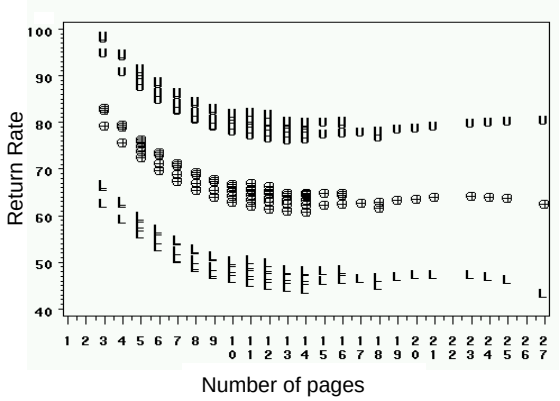


Figure 1c: Estimated Model for 2002, with Upper (U) and Lower (L) Confidence



This can be further demonstrated by using basic calculus and identifying the equations for each curve that represent the rates of change in return rates per incremental change in the number of questionnaire pages:

$$1992 \text{ rate of change} = -9.94+2.28(\#\text{pages})-0.12(\#\text{pages})^2$$

$$1997 \text{ rate of change} = -11.92+2.46(\#\text{pages})-0.12(\#\text{pages})^2$$

$$2002 \text{ rate of change} = -5.78+0.66(\#\text{pages})-0.03(\#\text{pages})^2$$

The smaller incremental rate of change for 2002 is evidence of the diminished effect of questionnaire length on response rates that year as compared to the previous two censuses. The points of local minima, local maxima and inflection for each curve appear in Table 7. The inflection point occurs at successively larger numbers of pages, further illustrating that the relationship between page-length and return rates has flattened over time.

6. Summary and Conclusions

2002 Economic Census questionnaires underwent formatting changes that increased the number of pages for its paper forms, raising managers' concerns that response rates would decline as a result. This study sought to address the research question: Did the effect of questionnaire length on return rates to the 2002 Economic Census differ from previous censuses?

Results from multivariate regression analysis strongly support the conclusion that the relationship between the number of questionnaire pages and economic census return rates did indeed differ for the 2002 Economic Census as compared to 1992 and 1997. However, the difference was contrary to management concerns. The negative relationship between return rates and questionnaire length was not exacerbated by the overall increase in the number of pages due to reformatting; rather, 2002 differed in that the effect was smaller than in previous censuses. Not only did the effects of questionnaire length on economic census return rates differ across census years, it appeared to have diminished over time as rates of change were smaller and curves flattened.

Table 7: Local Minima, Maxima, and Inflection Points, Based on Model Parameter Estimates, by Census Year

Census Year	Local Minima		Local Maxima		Inflection Point	
	Number of pages	Return rate[a]	Number of pages	Return rate[a]	Number of pages	Return rate[a]
1992	6.78	70.9%	12.22	74.1%	9.50	72.6%
1997	7.86	61.3% 57.8%[b]	12.64	63.5% 60.0%[b]	10.25	62.4% 58.9%[b]
2002	Does not exist		Does not exist		11.00	58.0%[b]

[a]Base response rate for Mining and no changes in annual GDP or Employment
[b]Mode = 1

Acknowledgements

The author expresses gratitude to Nancy Robbins for substantial technical assistance. JPSM Junior Fellows Amy Todd and Natasha Zoretich also assisted with this research. The author further acknowledges challenging feedback and support from Rita Petroni, Ruth Runyan, and Howard Hogan, along with managers of economic research areas and the economic census. Helpful review comments were also received from James Hunt.

References

Bean, A.G. & M.J. Roszkowski (1995) "The Long and Short of It," *Marketing Research*, 7:20-27.

Biner, P.M. & H.J. Kidd(1994) "The Interactive Effects of Monetary Incentive Justification and Questionnaire Length on Mail Survey Response Rates," *Psychology & Marketing*, 11: 483-492.

Bogen, K. (1993) "The Effect of Questionnaire Length on Response Rates – a Review of the Literature," Working Papers in Survey Methodology, SM96/05, Washington, D.C.: U.S. Census Bureau.

Dillman, D.A. (2000) *Mail and Internet Surveys: The Tailored Design Method*. New York: Wiley.

Harris-Kojetin, B. & C. Tucker (1999) "Exploring the Relation of Economic and Political Conditions with Refusal Rates to a Government Survey," *Journal of Official Statistics*, 15:167-84.

Kristal, A.R. et al. (1994) "Does Using a Short Dietary Questionnaire Instead of a Food Frequency Improve Response Rates to a Health Assessment Survey?" *Journal of Nutrition Education*, 26: 224-229.

Mond, J.M. et al. (2004) "Mode of Delivery, But Not Questionnaire Length, Affected Response in an Epidemiological Study of Eating-Disordered Behavior," *Journal of Clinical Epidemiology*, 57:1167-1171.

Mooney, G. et al. (1993) "To Pay or Not to Pay: That is the Question," presented at the American Association of Public Opinion Research, St. Charles, IL.

Mangione, T. (1995). *Mail Surveys: Improving the Quality*, Applied Social Research Methods Series, Vol. 40, Thousand Oaks, CA: Sage Publications.

Subar, A.F. et al. (2001) "Is Short Always Better? Relative Importance of Questionnaire Length and Cognitive Ease on Response Rates and Data Quality for Two Dietary Questionnaires," *American Journal of Epidemiology*, 153:404-409.

Sudman, S. et al. (2000) "Exploratory Research at the U.S. Census Bureau on the Survey Response Process in Large Companies," *Proceedings of the 2nd International Conference on Establishment Surveys*, ASA.

Willimack, D.K. et al. (2002) "Understanding Unit and Item Nonresponse in Business Surveys," ch. 14 in S*urvey Nonresponse*, R.M. Groves et al., ed., New York: Wiley.