Nonresponse Bias Analysis of Average Weekly Earnings in the Current Employment Statistics Survey October 2013

Diem-Tran Kratzke
Bureau of Labor Statistics, 2 Massachusetts Ave, N.E., Washington DC 20212

Abstract

The nonresponse bias of average weekly earnings in the Bureau of Labor Statistics' Current Employment Statistics (CES) survey is assessed. The impetus for this study is the low response rate for hours and earnings data in the CES survey, a longitudinal survey of business establishments, that provides monthly estimates of employment and average weekly earnings, among other statistics. Although we cannot produce a theoretical bias and do not have "true" figures of average weekly earnings, we can assess the direction and relative magnitude of bias by comparing CES employment and earnings to employment and wages of the Quarterly Census of Employment and Wages (QCEW) program. The QCEW program collects employment and wages from employers covered under the States' Unemployment Insurance (UI) tax systems on a quarterly basis. Records of the QCEW are used as the frame for the CES survey and QCEW employment data are independent population controls for CES employment figures on an annual basis.

Key Words: nonresponse, bias, CES, QCEW, employment, earnings, wages.

I. Introduction

In this paper, we examine the nonresponse bias of average weekly earnings derived from employment and payroll data of the Current Employment Statistics (CES) survey. As a nationwide monthly establishment survey, it provides monthly estimates of employment and average weekly earnings, among other estimates, at the national, State, and industry and area detail levels. It uses data from the Quarterly Census of Employment and Wages (QCEW) program to benchmark its employment on an annual basis. The QCEW represents a comprehensive list of all business establishments covered under the Unemployment Insurance (UI) systems in the States and serves as a frame for the CES survey. There are coverage differences between the two programs. The QCEW includes government and agricultural industries while the CES excludes them. The CES includes some non-UI-covered employment such as student workers and employment of railroads. The CES earnings include overtime pay but not irregular bonuses or commissions, whereas the QCEW wages include all bonuses and other items not covered in CES such as severance pay, profit distribution, incidental costs, employer contributions to deferred compensation plans, and stock options. Both CES earnings and QCEW wages include paid holidays, vacation, and sick leave.

Since response rates are a useful indicator for the risk of nonresponse bias, the low response rate in earnings called for a review of potential bias in average weekly earnings. Average weekly earnings is a ratio of weekly earnings and employment; therefore, bias of both employment and weekly earnings affect the bias of average weekly earnings. In this paper, we examine the reporting behavior for employment and earnings and compare statistics between respondents and non-respondents.

II. Data Background

2.1 Data Source

We have available four years of CES and QCEW employment and earnings/wage data from October 2007 through September 2011. We link micro data of these two sources

and include only industries that are covered under both programs. We compare data at the subgroup and Total Private (national private nonfarm employment) levels.

Both programs use the pay period including the 12th of the month as the reference period for employment. Employers also report earnings to the CES survey for the pay period that includes the 12th of the month. Figures of CES earnings are converted to weekly earnings based on the pay schedules (weekly, biweekly, or monthly). Employers under the UI systems report monthly employment and quarterly wages to the QCEW program. To obtain QCEW weekly wages, quarterly wages are distributed evenly over the 13 weeks of the quarter. To distinguish between the CES and QCEW employment and earnings/wage figures, CES employment will be referred to as *AE* (All Employment) and CES earnings will be referred to as *PR* (Payroll), whereas QCEW employment will be referred to as *EMP* and QCEW wages as *WAGE*. The CES average weekly earnings (*AWE*) and the QCEW average weekly wages (*AWW*) are computed by dividing the weekly earnings or weekly wages, respectively, by employment.

Although the QCEW data have their own biases and there are differences in earnings and wages, we will consider QCEW employment and wages as the "truth" when we compare CES and QCEW data. This is reasonable given that QCEW employment is used as the benchmark for the CES program. We also expect that administrative data of employment and wages for tax purposes would have fewer errors than survey data.

2.2 Unit of Analysis

The CES survey unit is the UI account. In the sample selection process, UI accounts within each State are randomly selected from among those in the same size class, industry, and geographical area. All establishments under the selected UIs at the time of selection are considered to be in the sample.

Although the CES program encourages survey units to report data at the establishment level, not all employers are willing and/or able to do so. The CES reporting unit could therefore be at either the establishment or UI level. If it is at the UI level, its reported employment would be prorated among its establishments if information for proration is available (such as its employment composition based on a previous benchmark).

In this paper, the UI account is used as the unit of analysis. We may not be able to accurately compute the response rates using reporting units or establishments for various reasons. The reporting unit does not have a consistent size class or industry classification because the values of these variables can be for one establishment or for several. Information on the number of establishments in a reporting unit may not be accurate for non-respondents. If establishments are reported together under one reporting unit and their data do not get prorated, we would have missing information at the individual establishment level.

2.3 Subgroups

To see if response rates and data items differ by some characteristics of the UI account, we include subgroups in our analysis. The subgroups are industry, UI size class, certainty status, record type, method of collection, length of pay, and report timeliness. We do not have information for method of collection, length of pay, and report timeliness for all non-respondents, but only for those respondents who report at least one data item.

2.3.1 Industry

The CES program produces estimates for supersectors, which are groupings of similar industries. They are listed in Table 2.3 under Allocation Industry Classification (AIC).

2.3.2 Size Class

Each UI account is assigned a size class based on its maximum employment over the most recent twelve months at the time the annual sample frame is constructed. The list of size classes is shown in the same Table 2.3 as the list of supersector codes.

2.3.3 Certainty Status

Units that are selected with certainty have a selection weight of one. Otherwise, unit weight is the inverse of the probability of selection. Note that bias is present if there is nonresponse among the certainty units, although the degree and influence of this bias on survey estimates need to be evaluated further (Thompson, 2009).

2.3.4 Record Type

We classify each UI account as single if it consists of one establishment or multi if it consists of two or more establishments.

2.3.5 Method of Collection

Data for CES are collected by various methods: Computer-assisted telephone interview (CATI), direct electronic data transmission via Electronic Data Interchange (EDI), the Internet (WEB), and other methods (OTH) such as touchtone data entry, mail, and fax.

2.3.6 Length of Pay

Companies' pay schedules such as monthly, semi-monthly, biweekly, and weekly have different lengths of pay. Preliminary results suggest that semi-monthly and biweekly categories may not be coded consistently over time. Therefore we combine these two into the biweekly category in this study.

2.3.7 Reporting Timeliness

Preliminary estimates for CES are revised as more reported data become available. Reporters that have data used in the preliminary estimates are classified as early reporters. Reporters that have data used only in revised estimates are late reporters. Data from employers that report after final estimates are published are not used in estimation.

III. Empirical Investigation

3.1 Response Rates

We compute three types of response rates: unweighted response rate (*RRU*), weighted response rate (*RRW*), and total quantity response rate (*TQRR*). In CES survey in which a small number of large establishments may account for a major proportion of the population total, *TQRR* may be a better indicator of the quality of estimates than *RRU*.

Formulas in this paper refer to the set (or number) of respondents as *RESP* and the set (or number) of sample units as *SAMP*. The set (or number) of units reporting employment is called *AERESP* and the set (or number) of earnings respondents is called *PRRESP*.

The unweighted response rate *RRU_SAMP* is the ratio of the number of reporting units (either reporting employment or earnings) to the number of sample units.

$$RRU\_SAMP = \frac{Number\ of\ \ reporting\ \ units}{Number\ of\ \ sample\ units}$$

The *RRU_SAMP* for employment is referred to as *RRU_SAMP_AE* and that for earnings is referred to as *RRU_SAMP_PR*.

For a particular subgroup, the numerator and denominator consist of units within that subgroup. We cannot construct *RRU_SAMP* for subgroups of collection mode, length of pay, and reporting timeliness, because we do not have information on these subgroups for non-respondents. Preliminary results show that the set of earnings respondents could be considered a subset of employment respondents because virtually all employers who report earnings also report employment (BLS, 2013a). Therefore, we can compute earnings response rates among units who report employment as:

$$RRU\_AERESP = \frac{Number\ of\ units\ reporting\ earnings}{Number\ of\ units\ reporting\ employment}$$

The weighted response rate *RRW* is computed by summing sampling weights across all units. The numerator for *RRW_SAMP* is the sum of the weights over responding units and the denominator is the sum of the weights over sampled units.

$$RRW\_SAMP = \frac{\sum_{RESP} WEIGHT}{\sum_{SAMP} WEIGHT}$$

where *RESP* is either the set of employment respondents (*AERESP*) for *RRW_SAMP_AE,* or the set of earnings respondents (*PRRESP*) for *RRW_SAMP_PR*.

The total quantity response rate *TQRR* is defined as the weighted proportion of key estimates reported by responding units or obtained by equivalent quality sources (Thompson & Oliver, 2012). We use QCEW data in computing the total quantity response rate *TQRR_SAMP* as follows:

$$TQRR\_SAMP = \frac{\sum_{RESP} (WEIGHT*Y)}{\sum_{SAMP} (WEIGHT*Y)}$$

where *Y* is QCEW employment when we compute employment rate *TQRR_SAMP_AE* and is QCEW wages when we compute earnings rate *TQRR_SAMP_PR*.

At the Total Private level, rates are computed with sample units as the base. Figure 3.1.1 shows graphs of three types of response rates for employment and earnings at the Total Private level over time. Table 3.1 lists the average rates for each year and their overall means. All rates have an increasing trend over time. The unweighted and weighted rates show a seasonal pattern where rates increase at times of annual sample updates. The weighted and total quantity rates are higher than the unweighted rates for employment and the reverse is true for earnings. In general, *TQRR* is closer to *RRW* than to *RRU*.

At the subgroup levels, the seasonal pattern for *RRU_SAMP* holds across industries and in small size classes (1-6), single UI accounts, non-certainty units, and units of CATI collection mode. The unweighted and weighted response rates are identical for certainty units for they have the weight of one. In most subgroups, the weight comparisons are similar to Total Private, that is, the weighted and total quantity rates are higher than the unweighted rates for employment and the reverse is true for earnings.

High response rates for employment do not always mean high response rates for earnings. For example, Construction has low *RRU_SAMP_AE* but high *RRU_SAMP_PR* compared to other industries. Both employment and earnings response rates are consistently higher for singles compared to multis and for non-certainty units compared to certainty units. It is interesting to note that rates for singles are almost identical to those for non-certainty units. Inspection shows that 92% of single UIs are non-certainty units and 91% of non-

certainty UIs are single. We observe larger differences in rates between certainty and non-certainty units than between multis and singles.

Figure 3.1.2 shows graphs of earnings response rates among employment respondents (*RRU_AERESP)* by subgroups. They do not have the seasonal pattern exhibited in *RRU_SAMP* because their numerator and denominator move up or down together. Late reporters have higher response rates than early reporters, biweekly units have higher response rates than monthly and weekly units, WEB reporters have higher response rates than CATI or EDI reporters.

Across subgroups, low total quantity response rates for earnings are observed in industries of Mining & Logging and Transportation & Warehousing (21% on average), in size classes 7 and 8 (23% on average), in certainty units (22% on average), in multi units (24% on average), in units with monthly pay schedules (38% on average), and in units reporting by EDI (32% on average).

3.2 Respondents versus Non-Respondents on Frame Variables

We assess the differences between respondents and non-respondents by comparing QCEW data between respondents and all sample units and between earnings respondents and employment respondents.

The percent difference of QCEW employment between employment respondents (*AERESP*) and sample units (*SAMP*) is computed as:

$$PDIFF\_EMP = 100\% * \frac{AVG\_EMP_{AERESP} - AVG\_EMP_{SAMP}}{AVG\_EMP_{SAMP}}$$

where *AVG_EMP* is the average QCEW employment per unit within the corresponding set.

The *AVG_EMP* for *AERESP* is computed as:

$$AVG\_EMP_{AERESP} = \frac{\sum_{AERESP} WEIGHT * EMP}{AERESP}$$

The *AVG_EMP* for *SAMP* is similarly constructed.

The percent difference of QCEW wages between earnings respondents (*PRRESP*) and sample units (*SAMP*), *PDIFF_WAGE*, is constructed the same way as for *PDIFF_EMP*.

The QCEW average weekly wages (*AWW*) is defined as:

$$AWW = \frac{\sum WEIGHT * WAGE}{\sum WEIGHT * EMP}$$

where the summations are over the same appropriate set.

The percent difference of *AWW* between respondents and whole sample is:

$$PDIFF\_AWW = 100\% * \frac{AWW_{RESP} - AWW_{SAMP}}{AWW_{SAMP}}$$

Table 3.2 lists the percent differences of employment, wages, and average weekly wages among different response sets by year and their overall mean differences at the Total Private level. In general, the wage differences are in the same direction as the employment differences. The average weekly wage differences are always negative. They

are larger (in absolute values) in *PRRESP* versus *SAMP* and in *PRRESP* versus *AERESP* than in *AERESP* versus *SAMP*.

Although the average weekly wage differences between earnings respondents and whole sample are relatively small at the Total Private level, the monthly differences at the subgroup levels could be large. Across subgroups, for most of the time, earnings respondents have lower QCEW average weekly wages (negative differences) compared to whole sample or to employment respondents. The exception is in Other Services industry and EDI collection mode where QCEW *AWW* for earnings respondents are consistently larger than those of whole sample (positive differences).

3.3 Comparison of CES Employment between *PRRESP* and *AERESP*

In this section, we compare CES employment between the set of employment respondents (*AERESP*) and the set of earnings respondents (*PRRESP*).

The percent difference of CES employment is computed as:

$$PDIFF\_AE = 100\% * \frac{AVG\_AE_{PRRESP} - AVG\_AE_{AERESP}}{AVG\_AE_{AERESP}}$$

where *AVG_AE* is the average CES employment per unit within the corresponding set. It is computed as:

$$AVG\_AE_{RESP} = \frac{\sum_{RESP} WEIGHT * AE}{RESP}$$

where *RESP* is either *AERESP* or *PRRESP*.

Table 3.3 lists the yearly average CES employment per unit for *AERESP* and *PRRESP* and their percent differences at the Total Private level. Figure 3.3 shows the CES employment (average per unit) at the Total Private level for the two sets of respondents over time. We see that earnings respondents have lower CES employment (average per unit) than employment respondents, indicating a difference in employment structure between the two sets. There is a potential systematic bias due to the fact that larger firms are less likely to report earnings.

Across subgroups, the discrepancies of reported CES employment between *AERESP* and *PRRESP* are larger in Mining & Logging, Transportation & Warehousing, Utilities, and Other Services compared to other industries; in the smallest size class 1 and the largest size class 8 compared to other size classes; and in monthly units compared to units of other categories of pay schedules. Overall, the smallest percent discrepancies are in Health Services, size classes 2-7, non-certainty and single units, and weekly units.

3.4 Error (CES versus QCEW)

In this section, we compare the differences between CES and QCEW data within the same set of respondents. The data items to be compared are employment, earnings/wages, and average weekly earnings/wages. We will consider QCEW data as the "population" values and refer to the percent difference as the percent error.

The percent error for employment (*PERR_AE*) is computed as:

$$PERR\_AE = 100\% * \frac{\sum WEIGHT * AE - \sum WEIGHT * EMP}{\sum WEIGHT * EMP}$$

where *AE* is CES employment and *EMP* is QCEW employment, both over the same set of respondents, either *AERESP* or *PRRESP*.

The percent error for earnings (*PERR_PR*) is similarly constructed.

The percent error for average weekly earnings for *PRRESP* is computed as:

$$PERR\_AWE = 100\% * \frac{AWE - AWW}{AWW}$$

where *AWE* is the CES average weekly earnings and *AWW* is the QCEW average weekly wages, both of earnings respondents (*PRRESP*).

Figure 3.4 shows the percent error for employment, weekly earnings, and average weekly earnings for the set of earnings respondents *PRRESP*. The errors for employment are close to zero, indicating that CES and QCEW employment are similar. However, there are potential problems with earnings data. Errors for earnings are consistently negative (CES earnings are smaller than QCEW wages), indicating possible under-reporting problems for earnings. The differences in earnings figures have peaks in the first and last quarter of the year, due to the fact that QCEW wages include annual bonuses that are typically paid at the end or beginning of the year, but not included in CES earnings.

By subgroups, errors of average weekly earnings are consistent with errors at the Total Private level. Large negative errors are observed for industries of Mining & Logging and Financial Services, for size classes 1 and 2, and for monthly units. In general, weekly units have lower errors compared to biweekly or monthly units, singles have lower errors compared to multis, non-certainty units have lower errors compared to certainty units, and early reporters have lower errors compared to late reporters.

3.5 Average Weekly Earnings/Wages of Respondents versus Average Weekly Wages of Whole Sample

Previously, we compared QCEW figures of average weekly wages (*AWW*) among sets of respondents to the whole sample; and CES average weekly earnings (*AWE*) to QCEW average weekly wages (*AWW*) within the same set of earnings respondents. In this section, we put these results together and compare CES *AWE* and QCEW *AWW* of respondents to QCEW *AWW* of the whole sample. The whole sample can be considered as the set of respondents with 100% response rate, and using data on the whole sample should yield the best estimates. We will consider QCEW *AWW* of the whole sample as the benchmark for CES *AWE*.

Table 3.5.1 lists the *AWE* and *AWW* figures based on different sets of respondents by subgroups, averaged over the 48 months in study. Next to each *AWE* or *AWW* figure is the percent difference of that figure and the benchmark, the QCEW average weekly wages of the whole sample.

We see that the set of employment respondents *AERESP* has the closest QCEW average weekly wages to those of the whole sample *SAMP*. The CES *AWE* figures of *PRRESP* are uniformly lower than the QCEW *AWW* figures of the same set and of the whole sample *SAMP*. In a few instances, the respondents have higher QCEW *AWW* figures compared to those of the whole sample; but for the most part, they are lower.

We do not have figures of QCEW *AWW* based on the whole sample for the subgroups of length of pay, collection modes, or report timeliness because we do not have values of these subgroups for non-respondents. Table 3.5.2 lists the *AWE* and *AWW* figures based on *PRRESP* compared to *AWW* based on *AERESP* for these subgroups, averaged over the 48 months. The results are consistent with the other four subgroups shown in Table 3.5.1; that is, figures of *QCEW AWW* of the set of earnings respondents *PRRESP* are lower than those of the set of employment respondents *AERESP*.

Figure 3.5 shows the CES *AWE* and QCEW *AWW* figures under different respondent sets and under the whole sample at the Total Private level. The graphs of QCEW *AWW* have peaks in the first and last quarters of the year due to bonuses. We obtain the highest QCEW *AWW* from the sample if there is 100% response rate. The QCEW *AWW* based on *AERESP* are much closer to those based on *SAMP* than those based on *PRRESP*. In addition, the CES *AWE* figures are much lower than the QCEW *AWW* figures based on the same set of respondents *PRRESP*. Compared to the whole sample's average weekly wages, the CES average weekly earnings based on *PRRESP* have large negative differences in industries of Mining & Logging, Nondurable Goods, and Financial Services; in size class 1; and in units with monthly pay schedules.

IV. Conclusion

For the four years in study, the response rates for both employment and earnings increase over time. This is a good sign showing that the increased effort of the CES program to improve response rates has had a positive effect. The results are consistent with the increasing trend found in Petroni et al. (2004) due to an intensive effort of the CES data collection centers to elicit and maintain responses from companies.

However, there are areas of concern. The information gathered in this study suggests a potential downward bias in average weekly earnings due to nonresponse. The response rates and differences between respondents and non-respondents are not uniform across subgroups, suggesting that nonresponse is not random and that levels of bias differ by subgroups. We summarize our findings below.

4.1 Possible under-representation of wages from earnings respondents

The concern is that the weighted and total quantity response rates are lower than the unweighted response rates for earnings. Furthermore, the unweighted response rates for earnings are uniformly lower than the unweighted response rates for employment. The weighted response rates estimate the proportion of the population measured while the total quantity response rates reflect the proportion of employment/earnings covered by the sample. While employment respondents account for a larger proportion of total population employment than their response rates indicate, earnings respondents account for a smaller proportion of total population wages than their response rates indicate. This is true whether we look at the proportion of wages of earnings respondents over the whole sample (*PRRESP* versus *SAMP*) or over the set of employment respondents (*PRRESP* versus *AERESP*). This under-representation of wages carries a risk for nonresponse bias of earnings.

4.2 Earnings respondents' wages are lower than non-respondents' wages

When we compare respondents and non-respondents by comparing QCEW employment and wages of earnings respondents (*PRRESP*) with those of employment respondents (*AERESP*) and with whole sample (*SAMP*), we see that *PRRESP* tends to have lower employment and wages than *AERESP* and *SAMP*. However, lower employment and wages do not always result in lower average weekly wages. At the subgroup levels, average weekly wages of *PRRESP* could be higher than average weekly wages of *AERESP* even when both employment and wages of *PRRESP* are lower than those of *AERESP*. Positive differences occur in Construction industry, and in size classes 1 and 2. However, in general and at the Total Private level, average weekly wages of earnings respondents are lower than those of employment respondents and of whole sample. This indicates that there are inherent differences between earnings respondents and non-respondents and thus there is a potential for a negative bias in earnings figures.

4.3 Under-representation in earnings of large firms

The set of earnings respondents reports lower CES employment than the set of employment respondents, indicating that earnings respondents tend to be smaller firms than non-respondents. In other words, larger firms tend not to report earnings. This result is consistent with findings in Phipps & Toth (2012) where "nonresponse tends to coincide with higher pay." Although this does not necessarily result in bias for earnings estimates, the potential for bias exists.

4.4 CES reported earnings are lower than QCEW wages

When we compare employment and earnings/wages of CES reporters to their QCEW employment and wages within the same respondent set, both CES employment and earnings tend to be smaller than QCEW figures. Differences in earnings/wages tend to be larger than differences in employment (in absolute values), causing CES average weekly earnings to be smaller than QCEW average weekly wages. Although this could be due to differences in earnings/wage definitions of the two programs, the negative differences are persistent over different subgroups and throughout the year. Here is another potential for earnings to be under-estimated.

4.5 Average weekly earnings/wages based on respondents are smaller than average weekly wages based on the whole sample

We work under the assumption that the QCEW average weekly wages of the whole sample are close to the population values. Therefore, we compare average weekly wages of different sets of respondents against the QCEW average weekly wages of the whole sample. We find that the set of employment respondents (*AERESP*) provides wage figures that are closer to the whole sample figures than the set of earnings respondents (*PRRESP*). In addition, CES average weekly earnings based on *PRRESP* are much smaller than QCEW average weekly wages based on the whole sample.

The findings here are consistent with the results cited in the BLS report (2013a). In the BLS report, wages based on the whole sample are very close to the population values at the Total Private level across time. Wages based on the set of employment respondents are larger than wages based on its subset of earnings respondents.

V. Caveats and Recommendation

The comparisons of CES average weekly earnings and QCEW average weekly wages do not provide direct evidence on the issue of bias because of differences in the earnings/wage concept and because the QCEW program has its own reporting and nonresponse errors. Also, the analysis in this paper is for employment and weekly earnings and their ratios at the aggregated level of subgroups or Total Private, and does not provide bias estimates of the final estimates of average weekly earnings as produced by the CES program at more detailed area levels. The CES estimator for average weekly earnings is a product of "link-and-taper" estimates of average hourly earnings and average weekly hours (BLS, 2013b). The link-and-taper estimate is a weighted average of the current month's sample estimate and the previous month's final estimate. Final estimates of both average hourly earnings and average weekly hours also involve final estimates of employment. We did not consider hours in the study because although hours are collected for CES, they are not available in QCEW databases. An in-depth study of the bias would include variances, bias estimates for final estimates, and nonresponse adjustments (either by post-survey weighing or another non-weighing adjustment method).

The CES final estimates of average weekly earnings in comparison with estimates of wages from other surveys could be found in the BLS report (2013a). The comparisons in the report suggest a strong potential downward bias of average weekly earnings in the CES program, consistent with the results shown in this paper.

It is worthwhile to note that under-reporting in both employment and earnings (when CES data are lower than QCEW data) does not translate to negative errors in average weekly earnings, nor does over-reporting of employment and earnings translate to positive errors in average weekly earnings. For example, in Other Services industry, while the set of earnings respondents (*PRRESP*) has lower CES employment and earnings than QCEW figures, and it has lower CES employment than the set of employment respondents (*AERESP*), its average weekly earnings are larger than QCEW average weekly wages.

A low response rate also does not necessarily translate to a larger error. For example, the larger size classes 7 and 8 have lower response rates than other size classes, but the size classes with the largest percent error in average weekly earnings are the smaller size classes 1 and 2.

Some subgroups consistently have large differences between respondents and non-respondents and between reported data and QCEW data. If resources are limited, we should concentrate our efforts in improving response rates in these subgroups. In particular, we want to aim for improvement in solicit response and better data from Mining & Logging, Non-durable Goods, and Financial Services.

The response rates should be evaluated and monitored to make sure the trend holds and that corrective measures are implemented in a timely manner if response rates drop. As Thompson (2009) points out, monitoring response and assessing the potential for nonresponse bias should be on-going, under the domain of a statistical control process.

Disclaimer

Any opinions expressed in this paper are those of the author and do not constitute policy of the Bureau of Labor Statistics.

References

Bureau of Labor Statistics. (2013a). An Investigation into nonresponse bias in CES hours and earnings. *Internal Report of the CES Hours and Earnings Bias Study Team.*

Bureau of Labor Statistics. (2013b). Employment, hours, and earnings from the establishment survey. *BLS Handbook of Methods*, Chapter 2.

Petroni, R., Sigman, R., Willimack, D., Cohen, S., & Tucker, C. (2004). Response rates and nonresponse in establishment surveys – BLS and Census Bureau. *Presented at the Federal Economic Statistics Advisory Committee.*

Phipps, P., & Toth, D. (2012). Analyzing establishment nonresponse using an interpretable regression tree model with linked administrative data. *The Annals of Applied Statistics, 6*(2), 772-794.

Thompson, K.J. (2009). Conducting nonresponse bias analyses for two business surveys at the U.S. Census Bureau: Methods and (some) results. *Proceedings of the Section on Survey Research Methods, Joint Statistical Meetings.*

Thompson, K.J., & Oliver, B.E. (2012). Response rates in business surveys: Going beyond the usual performance measure." *Journal of Official Statistics, 28*(*2*), 221-237.

Appendix

Table 2.3. Allocation Industry Classification and size class definitions

Industry (Supersector) Definition		Size Class Definition	
AIC	**Industry**	**Employment**	**Size Class**
10	Mining & Logging	1 - 9	1
20	Construction	10 - 19	2
31	Durable Goods	20 - 49	3
32	Nondurable Goods	50 - 99	4
41	Wholesale Trade	100 - 249	5
42	Retail Trade	250 - 499	6
43	Transportation & Warehousing	500 - 999	7
44	Utilities	1000+	8
50	Information		
55	Financial Activities		
60	Professional & Business Services		
65	Health Services[1]		
70	Leisure & Hospitality		
80	Other Services[2]		

Table 3.1. Response rates for employment and earnings at Total Private level – by year

YEAR	Rates for Employment			Rates for Earnings		
	RRU_AE	***RRW_AE***	***TQRR_AE***	***RRU_PR***	***RRW_PR***	***TQRR_PR***
1	50.94	51.97	52.57	27.44	27.02	25.89
2	53.42	54.66	55.53	29.97	29.00	27.96
3	56.97	58.73	58.85	33.16	32.41	30.45
4	59.73	61.96	60.75	36.12	35.65	32.49
Overall	55.27	56.80	56.80	31.67	31.00	29.22

Table 3.2. Percent differences of QCEW data items among different sets – Total Private level by year

YEAR	***AERESP* VS *SAMP***			***PRRESP* VS *SAMP***			***PRRESP* VS *AERESP***		
	EMP	***WAGE***	***AWW***	***EMP***	***WAGE***	***AWW***	***EMP***	***WAGE***	***AWW***
1	3.21	1.36	-1.79	0.26	-5.65	-5.89	-2.87	-6.91	-4.16
2	3.95	2.60	-1.29	-1.47	-6.71	-5.32	-5.24	-9.10	-4.08
3	3.30	0.99	-2.24	-2.39	-8.18	-5.93	-5.53	-9.08	-3.76
4	1.71	-0.41	-2.09	-4.75	-10.04	-5.56	-6.37	-9.68	-3.54
Overall	2.90	1.10	-1.74	-2.42	-7.76	-5.48	-5.18	-8.78	-3.79

[1] AIC 65 is usually Education & Health Services. However, Education is not included in this study because CES does not collect earnings for this sector.

[2] AIC 80 usually includes religious organizations. However, religious organizations are not included in this study because CES does not collect earnings for this sector.

Table 3.3. CES employment (average per unit) of *AERESP* and *PRRESP* and their percent differences – Total Private level by year

	CES Employment		
YEAR	***AERESP***	***PRRESP***	**% Diff**
1	629	544	-13.56
2	557	514	-7.73
3	540	490	-9.34
4	542	503	-7.25
Overall	565	511	-9.62

Table 3.5.1. CES *AWE* and QCEW *AWW* of *AERESP* and *PRRESP* – and their percent differences to QCEW *AWW* of the whole sample – by subgroups

Respondent Set		***AERESP***		***PRRESP***				**Whole Sample**
		QCEW *AWW*		**CES *AWE***		**QCEW *AWW***		**QCEW *AWW***
Industry	10	1,405	-4	1,105	-25	1,289	-12	1,471
	20	980	1	945	-3	984	1	972
	31	1,131	-1	973	-15	1,087	-5	1,144
	32	963	-4	739	-26	865	-13	999
	41	1,218	-1	1,005	-19	1,151	-7	1,234
	42	577	-3	510	-14	574	-3	592
	43	770	-3	677	-15	792	-1	798
	44	1,491	1	1,301	-12	1,423	-4	1,480
	50	1,421	3	1,150	-17	1,331	-4	1,381
	55	1,282	-5	1,001	-26	1,198	-11	1,347
	60	983	0	875	-11	963	-2	987
	65	839	0	727	-13	782	-7	837
	70	426	2	350	-16	400	-5	419
	80	677	-1	630	-8	710	4	685
Size	1	1,070	9	687	-30	1,005	2	986
	2	933	6	770	-13	991	12	884
	3	901	2	770	-13	888	0	885
	4	870	0	774	-11	841	-4	873
	5	891	-3	792	-14	857	-7	918
	6	923	-2	783	-16	855	-9	937
	7	930	0	771	-17	856	-8	930
	8	959	-2	842	-14	964	-1	976
Certainty Status	No	891	0	772	-13	852	-4	889
	Yes	960	-2	837	-14	954	-2	976
Record Type	Multi	882	-1	750	-16	844	-6	893
	Single	883	-2	797	-11	853	-5	898
Total Private		882	-2	783	-13	848	-5	897

Table 3.5.2. CES *AWE* and QCEW *AWW* of *PRRESP* and their percent differences to QCEW *AWW* of *AERESP* – by subgroups

Respondent Set		*PRRESP*				*AERESP*
		CES *AWE*		QCEW *AWW*		QCEW *AWW*
Length of Pay	Biweekly	786	-14	873	-4	911
	Monthly	854	-20	992	-7	1,070
	Weekly	769	-7	810	-2	829
Collection Mode	CATI	744	-14	817	-6	865
	EDI	828	-4	952	11	860
	OTH	796	-14	887	-4	921
	WEB	818	-12	893	-4	931
Timeliness	Early	784	-11	852	-3	881
	Late	778	-14	865	-4	900

Figure 3.1.1. Employment and earnings response rates at Total Private level

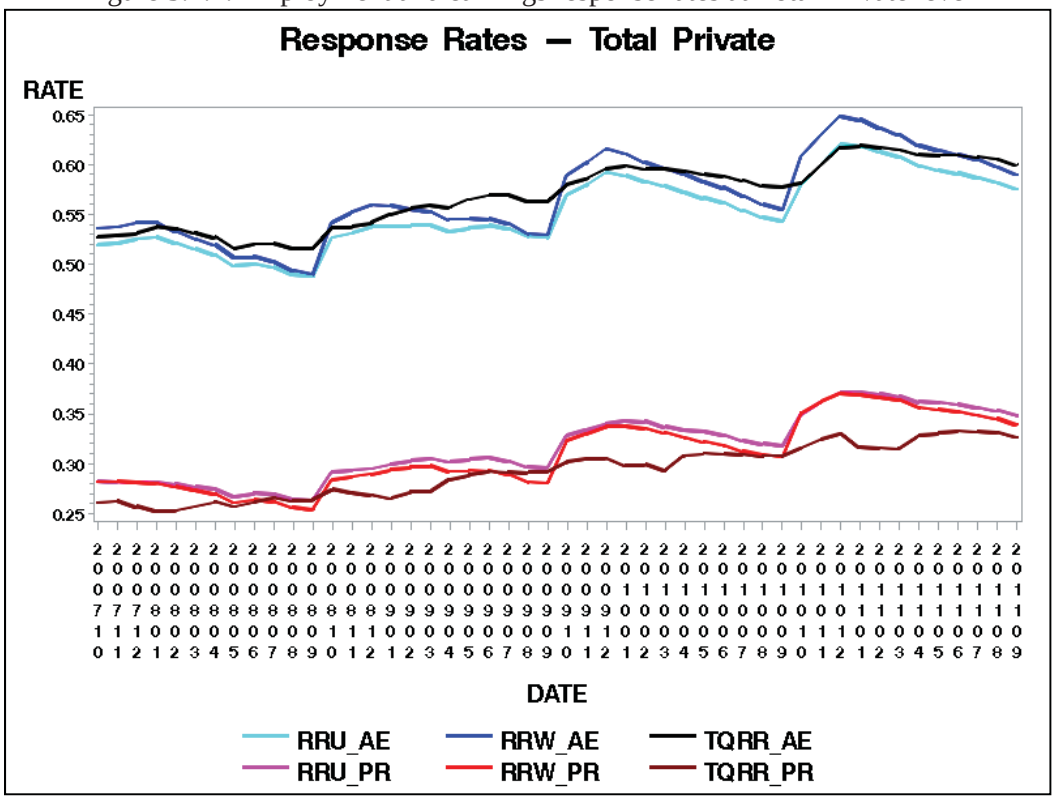

Figure 3.1.2. Unweighted earnings response rates among employment respondents (*RRU_AERESP*) by subgroups

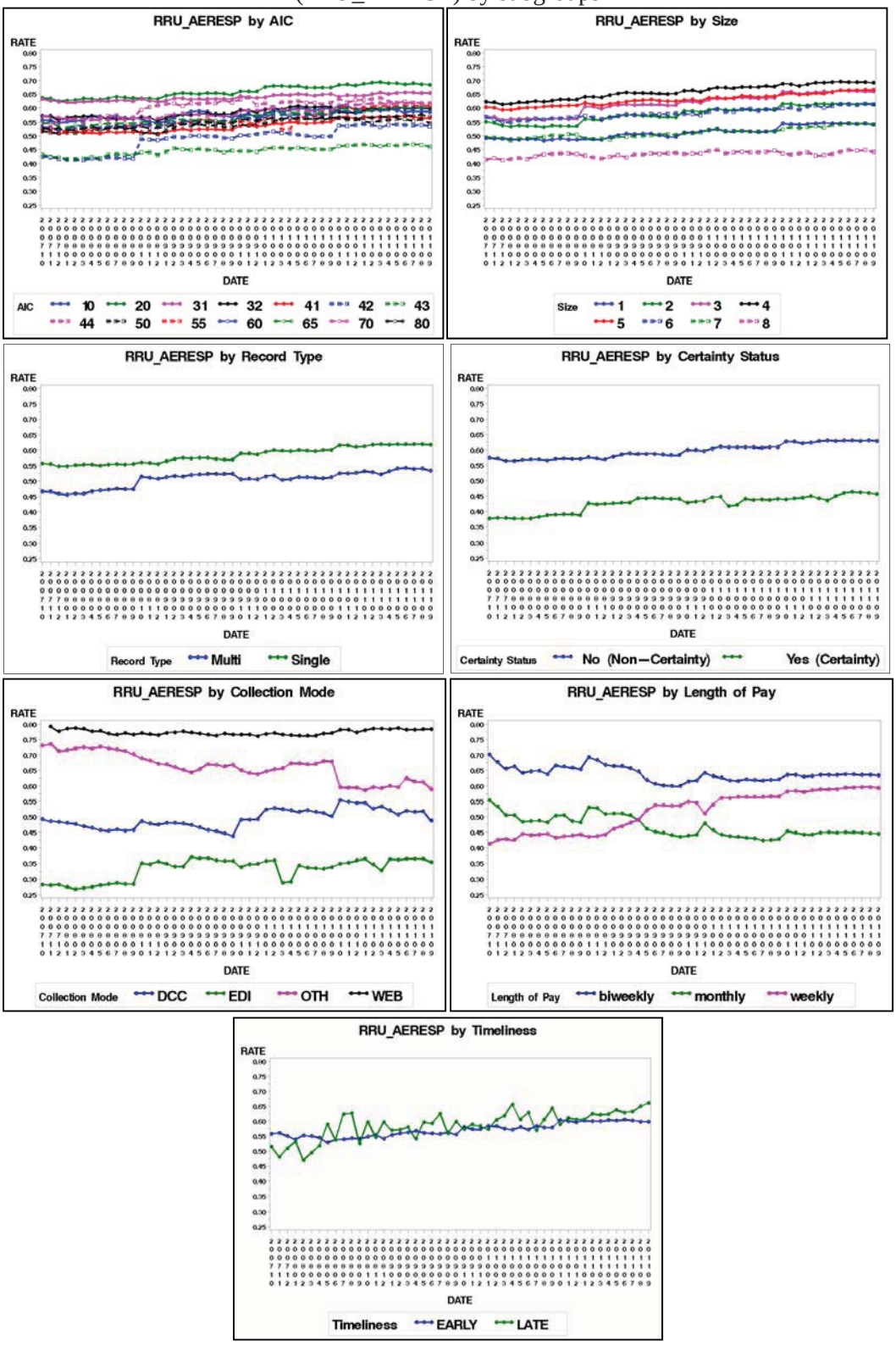

Figure 3.3. CES employment (average per unit) of *AERESP* and *PRRESP*

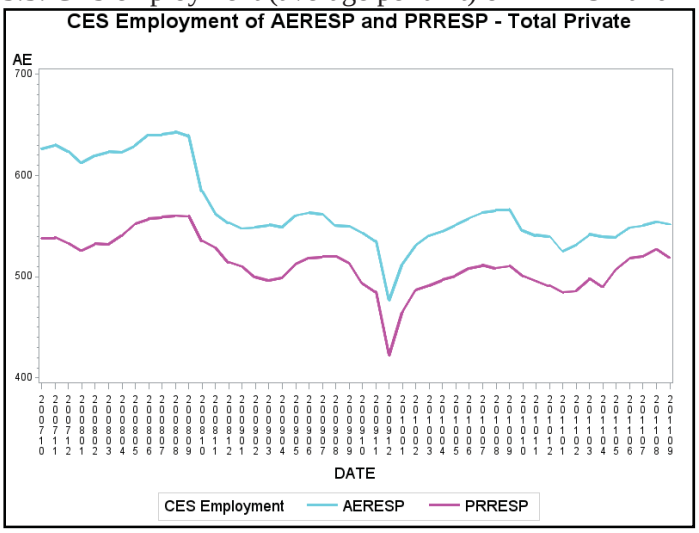

Figure 3.4. Percent errors of data items (CES vs. QCEW) based on *PRRESP*

Figure 3.5. *AWE* and *AWW* based on respondent sets and whole sample