MEMORANDUM

TO: File

FROM: Division of Economic and Risk Analysis[1]

SUBJECT: Potential effect on pay ratio disclosure of exclusion of different percentages of employees at a range of thresholds

DATE: June 4, 2015

Introduction

To assist the Commission in developing final rules regarding pay ratio disclosure,[2] staff in the Division of Economic and Risk Analysis analyzed the potential effects on the pay ratio calculation of the exclusion of different percentages of employees. Excluding some employees from the determination of median employee compensation, which some commenters suggested, can affect the calculation of that median and thus change the ratio of the annual total compensation of the principal executive officer (PEO) to the median of the annual total compensation of employees ("pay ratio").

Data, Assumptions, and Methods

Quantification of the potential effect of the exclusion of certain categories of employees (for example, employees in foreign countries or part-time, seasonal, or temporary employees) up to a certain percentage of the registrant's workforce, on the pay ratio calculation is limited by our lack of comprehensive data on the intra-company distribution of compensation of these categories of employees at companies that may be subject to the rule. Projections below are based on evidence obtained from other studies, aggregate statistics, and other assumptions that may result in over- or underestimating the magnitude of the effect.

We make the following assumptions for each threshold considered: 1. companies have excluded the percent of employees equal to the specified percentage threshold; and 2. the distribution of pay is described by a lognormal distribution.[3] We note that the first assumption implies that the

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[1] This is a memo by the Staff of the Division of Economic and Risk Analysis of the U.S. Securities and Exchange Commission. The Commission has expressed no view regarding the analysis, findings, or conclusions contained herein.

[2] On September 18, 2013, the Commission proposed amendments to Item 402 of Regulation S-K to implement Section 953(b) of the Dodd-Frank Wall Street Reform and Consumer Protection Act. *See* SEC Release No. 33-9452 (Sept. 18, 2013) [78 FR 60560].

[3] A distributional assumption is necessary because we do not observe the actual distribution of wages within the affected firms in the data available to us. This assumption is motivated by the positive skewness in dollar wages and the distribution of log of wages approximating normal distribution (e.g. Blundell, R., Reed, H., Stoker, T.,

estimates will overstate the magnitude of the effect of the exclusion on the pay ratio calculation if the actual percent of excluded employees is below the particular threshold level.[4] We also assume that the level of PEO pay is independent of the exclusion threshold.

We use several estimates of variability in the log of pay based on prior studies:

- Barth et al. (2014)[5] estimate within-establishment variance and overall variance in the log of annual worker wages based on their analysis of the Census Longitudinal Employer-Household Dynamics (LEHD) database, which contains earnings of millions of workers and their place of employment from unemployment insurance files for California, Colorado, Idaho, Illinois, Maryland, North Carolina, Oregon, Washington, and Wisconsin, as well as estimates based on the combined dataset containing matched LEHD and Current Population Survey (CPS) data; within-establishment variance of the log of annual earnings is reported to be 0.287 (51% of total variance in earnings) based on the LEHD data in Table 1 and 0.253 (46% of total variance in earnings) based on the matched LEHD-CPS data in Table 3, which yields within-establishment standard deviation of the log of annual earnings of 0.54 and 0.50, respectively.

- Leonesio and Del Bene (2011)[6] provide estimates of overall variance in the log of annual worker wages based on the Social Security Administration's 2004 Continuous Work History Sample (CWHS) data on the earnings records of approximately 1 percent of the population with SSNs issued since 1935; Medicare earnings (with no top coding for high earners) are available for 2004; variance of the log of annual wages of earners making at least $5,000 (in 2000 dollars) is 0.69 for men and 0.53 for women according to Tables 1 and 2 of that paper, respectively; based on the findings of prior studies that cross-establishment variance in wages may comprise half or more of the overall variance,[7] we divide those numbers by two to

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2003, Interpreting aggregate wage growth: The role of labor market participation, American Economic Review, Vol. 93(4), pp. 1114-1131; Measuring the distribution of wages in the United States from 1996 through 2010 using the Occupational Employment Survey, BLS Monthly Labor Review, May 2014, http://www.bls.gov/opub/mlr/2014/article/measuring-the-distribution-of-wages-in-the-united-states-from-1996-through-2010-using-the-occupational-employment-survey-1.htm).

4 For example, for a 2% exclusion threshold, our estimates will overstate the magnitude of the effect of the exclusion on the pay ratio calculation if the actual percent of excluded employees is 1.5%.

5 See Barth, E., Bryson, A., Davis, J., Freeman, R., 2014, It's Where You Work: Increases in earnings dispersion across establishments and individuals in the U.S., IZA Discussion Paper No. 8437.

6 See Leonesio, M., Del Bene, L., 2011, The distribution of annual and long-run US earnings, 1981–2004, Social Security Bulletin, Vol. 71(1), pp. 17-33.

7 Barth et al. (2014) show that most of the variation in the log of earnings of US workers can be attributed to differences across establishments rather than to within-establishment wage differences. The May 2014 Monthly Labor Review analysis of Occupational Employment Survey data through 2010 shows that 57% of variance in log of wages can be attributed to the worker's establishment. Similar conclusions are found in the Sunday and Pfuntner (2008) analysis of 2004 BLS National Compensation Survey data (Sunday, K., Pfuntner, J., 2008, How widely do wages vary within jobs in the same establishment? BLS Monthly Labor Review, February 2008, pp. 17-50); Lazear and Shaw (2007) analysis of 1998 data for the United States and other countries (Lazear, E., Shaw, K., 2007, Wage structure, raises and mobility: International comparisons of the structure of wages within and across firms, NBER Working Paper 13654); and Davis and Haltiwanger (1991) analysis of 1986 data on the

obtain estimates of within-establishment variance in the log of wages, convert them to standard deviations, and average the resulting estimates for men and women, yielding estimated within-establishment standard deviation of 0.55.

- Figure 5 of the May 2014 Monthly Labor Review study[8] presents overall wage variance estimates, with no imputations, of 0.365 based on the 2010 Occupational Employment Survey (OES) and of 0.347 based on the 2010 Current Population Survey (CPS); variance in wages across establishments is estimated to explain close to 57% of overall variation in wages; as we do above, we divide variance estimates by two to obtain a proxy for within-establishment variance in log wages and convert them to standard deviations, yielding the estimates of 0.43 and 0.42, respectively.

- As an alternative, we repeat the analysis using estimates of wage dispersion from federal employee data, which is disclosed publicly at the employee level by each covered agency, enabling us to extract intra-agency estimates of wage dispersion and convert them to standard deviations. Estimates based on the log of annual federal employee wages from the ten largest agencies covered by OPM data varied from 0.24 to 0.54.[9]

To obtain estimates of the effect of excluding a particular percentage of employees on the pay ratio, we consider a lognormal distribution of pay using various estimates of the standard deviation of the log of pay that broadly incorporate the ranges of estimates from the above studies: 0.25, 0.35, 0.45, and 0.55. For each threshold, we compute the effects of excluding a certain percentage of observations from the distribution.

We evaluate two broad alternatives related to excluded pay observations and their effects on the calculation of the pay ratio:

- Scenario I: All excluded observations are below the median for the underlying distribution of pay. The exclusion of these observations is expected to decrease the pay ratio estimate relative to the pay ratio estimate for the underlying distribution.

- Scenario II: All excluded observations are above the median for the underlying distribution of pay. The exclusion of these observations is expected to increase the pay ratio estimate relative to the pay ratio estimate for the underlying distribution.

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dispersion in production worker wages across plants and within plants (Table 2 in Davis, S., Haltiwanger, J., 1991, Wage dispersion within and between U.S. manufacturing plants, 1963-1986, NBER working paper 3722).

[8] See Measuring the distribution of wages in the United States from 1996 through 2010 using the Occupational Employment Survey, BLS Monthly Labor Review, May 2014, http://www.bls.gov/opub/mlr/2014/article/measuring-the-distribution-of-wages-in-the-united-states-from-1996-through-2010-using-the-occupational-employment-survey-1.htm).

[9] Estimates based on federal employees may understate intra-firm wage differentials in the private sector due to the higher rate of unionization among federal employees (See Hirsch, B., Macpherson, D., 2003, Union membership and coverage database from the Current Population Survey: Note, Industrial and Labor Relations Review, Vol. 56(2), January 2003, pp. 349-54 and data at http://unionstats.gsu.edu/).

Different scenarios may apply to different firms and categories of excluded employees. If some excluded observations are above and some are below the median for the underlying distribution, the effect will be in the range between Scenarios I and II.

For example, based on U.S. Bureau of Economic Analysis (BEA) data, employees of U.S. multinational firms outside the U.S. on average receive lower compensation than employees located inside the U.S.[10] However, for some firms with employees outside the U.S. in highly skilled occupations or firms with employees in jurisdictions with high labor costs in U.S. dollar terms, some employees outside the U.S. may receive higher compensation than employees located inside the U.S. Some research finds lower average hourly pay for part-time employees than for full-time employees.[11] In addition, part-time and seasonal employees are likely to work fewer hours in a typical year than full-time employees.

We evaluate the effects on the pay ratio calculation of excluding different percentages (between 1% and 20%) of pay observations from a lognormal distribution for each set of assumptions about intra-company standard deviation of the log of pay (σ) and for each scenario concerning excluded pay observations (Scenarios I and II). The effect of the exclusion is computed as the percentage change in the pay ratio after the exclusion is applied relative to the pay ratio computed without the exclusion, holding other assumptions unchanged. For instance, our analysis assumes that the level of PEO pay, the underlying pay distribution for the entire workforce, and the extent of reliance on various categories of employees are independent of the implementation of a specific exclusion definition or threshold.

Our estimates of the effect on the pay ratio calculation of excluding different percentages of employees are sensitive to the assumptions about the lognormal distribution of wages and the level of intra-firm dispersion in the log of pay. For example, if actual intra-firm standard deviation is higher (lower) than the levels considered, the estimates will understate (overstate) the magnitude of the effect of the exclusion on the accuracy of the pay ratio. Finally, we note that registrants subject to the rule may have more intra-firm variation in employee pay than individual establishments in the surveys cited above. It is also possible that intra-firm variation in employee pay evolves over time.

Results

Table 1 and Figure 1 summarize the potential effects of various exclusion thresholds on the estimate of the pay ratio using the assumptions described above. As shown in the table, the potential effect on the pay ratio estimate varies depending on the percentage of observations

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[10] According to BEA data, in 2012 the average compensation in dollar terms of employees of foreign affiliates of U.S. multinational companies was 42% (40% for employees of majority-owned foreign affiliates) lower than the average compensation of employees of U.S. parents (BEA data on Direct Investment and MNE, http://bea.gov/iTable/iTable.cfm). These aggregate figures do not account for differences in non-U.S. employee compensation among different U.S. multinational companies. Data on median foreign worker compensation at U.S. multinationals is not available from this source, so we use averages.

[11] See Hirsch, Barry, 2005, Why do part-time workers earn less? The role of worker and job skills, Industrial and Labor Relations Review, Vol. 58(4), pp. 525-551, showing the presence of an average part-time wage penalty, in part explained by a differential in skills between full-time and part-time employees.

excluded, the scenario related to excluded pay observations, and the assumed level of intra-firm standard deviation of the log of pay. For a given scenario and standard deviation assumption, the effect is larger in magnitude when a larger percentage of employees is excluded.

For instance, under the assumptions above, the exclusion of 5% of employees may cause the pay ratio estimate to decrease by up to 3.4% in Scenario I or to increase by up to 3.5% in Scenario II. The exclusion of 10% of employees may decrease the pay ratio estimate by up to 6.7% or increase it by up to 7.2%, depending on the scenario considered. The exclusion of 15% of employees may decrease the pay ratio estimate by up to 9.9% or increase it by up to 11%, depending on the scenario considered. Under a 20% threshold, the pay ratio may decrease by up to 13% or increase by up to 15%, depending on the scenario considered.

For a given scenario and percentage excluded, the effect is larger in magnitude when standard deviation is assumed to be higher.

Table 1. Potential effects on the pay ratio of the exclusion of various percentages of employees under alternative scenarios and assumptions

Standard deviation (sigma)	**0.25**		**0.35**		**0.45**		**0.55**	
Scenario	I	II	I	II	I	II	I	II
Percentage threshold								
1%	-0.3%	0.3%	-0.4%	0.4%	-0.6%	0.6%	-0.7%	0.7%
2%	-0.6%	0.6%	-0.9%	0.9%	-1.1%	1.1%	-1.4%	1.4%
3%	-0.9%	0.9%	-1.3%	1.3%	-1.7%	1.7%	-2.0%	2.1%
4%	-1.2%	1.3%	-1.7%	1.8%	-2.2%	2.3%	-2.7%	2.8%
5%	-1.6%	1.6%	-2.2%	2.2%	-2.8%	2.9%	-3.4%	3.5%
6%	-1.9%	1.9%	-2.6%	2.7%	-3.3%	3.4%	-4.1%	4.2%
7%	-2.2%	2.2%	-3.0%	3.1%	-3.9%	4.0%	-4.7%	5.0%
8%	-2.5%	2.5%	-3.5%	3.6%	-4.4%	4.6%	-5.4%	5.7%
9%	-2.8%	2.9%	-3.9%	4.0%	-5.0%	5.2%	-6.0%	6.4%
10%	-3.1%	3.2%	-4.3%	4.5%	-5.5%	5.8%	-6.7%	7.2%
11%	-3.4%	3.5%	-4.7%	5.0%	-6.0%	6.4%	-7.3%	7.9%
12%	-3.7%	3.8%	-5.1%	5.4%	-6.6%	7.0%	-8.0%	8.7%
13%	-4.0%	4.2%	-5.6%	5.9%	-7.1%	7.6%	-8.6%	9.4%
14%	-4.3%	4.5%	-6.0%	6.4%	-7.6%	8.3%	-9.2%	10.2%
15%	-4.6%	4.8%	-6.4%	6.8%	-8.2%	8.9%	-9.9%	11.0%
16%	-4.9%	5.2%	-6.8%	7.3%	-8.7%	9.5%	-10.5%	11.7%
17%	-5.2%	5.5%	-7.2%	7.8%	-9.2%	10.1%	-11.1%	12.5%
18%	-5.5%	5.9%	-7.7%	8.3%	-9.7%	10.8%	-11.8%	13.3%
19%	-5.8%	6.2%	-8.1%	8.8%	-10.3%	11.4%	-12.4%	14.1%
20%	-6.1%	6.5%	-8.5%	9.3%	-10.8%	12.1%	-13.0%	15.0%

Figure 1. Potential effects on the pay ratio of the exclusion of various percentages of employees under alternative scenarios and assumptions