

Report on Industry Births and Deaths in PPI Frames

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Abstract

An analysis of weighted establishments was done for 490 6-digit [NAICS](#) industries covering the period January, 1990 to March, 2018. The analysis uses establishment employment as the weight variable and calculates annual totals of: Industry employment, employment births and deaths, and rates of employment births and deaths. The standard deviations of total employment, employment births and employment deaths are also calculated. The results of the analysis for four industries (212112, 312120, 312140, and 333131)¹ are discussed. For ease of display, only results for 2010 – 2018 are presented. The results may be used to determine which industries merit more frequent resampling based for example on the rates of births and deaths, and the standard deviation measures.

Key words: NAICS, Employment births, Employment deaths, Rates of employment births, Rates of employment deaths, resampling.

Disclaimer: The opinions expressed in this paper are those of the author and do not represent policy of the BLS.

Introduction

The Producer Price Index (PPI) program resamples each of its 6-digit NAICS industries every 5-8 years. For industries in traditional sectors like mining, agriculture and manufacturing -- characterized by high barriers to entry, high levels of concentration and gradual adaptation to new technologies -- the length of time between resamples is not concerning given their gradual pace of change with respect to the entry of new firms and the demise of existing firms. For industries which are technology and information intensive, and which have high rates of both new entrants and old firms going bankrupt, however, the current length of time between resamples may be considered too long.

The purpose of this analysis is to calculate weighted statistics for NAIC 6-digit industries and to use these statistics to inform when or how frequently these industries should be resampled. Using employment as the weight variable, data from the Longitudinal Database (LDB) is used to calculate statistics on: employment totals, employment births and deaths, rates of establishment births and deaths, and standard deviations of employment totals, births and deaths. The analysis has similarity to the **Quarterly Census of Employment and Wages (QCEW)** report which is a quarterly count of employment and wages reported by employers.² The definitions used to determine in-scope establishments are provided by the LDB. Results for four industries are presented. The analysis begins with a description of the data and methodology, followed by a discussion of the results, the conclusion and

¹ 212112--Bituminous Coal Underground Mining, 312120—Breweries, 312140—Distilleries, 333131-- Mining Machinery and Equipment Manufacturing

² <https://www.bls.gov/cew/>

the appendix. In the appendix are examples of how the definitions of births and deaths are applied to determine the establishment birth and death date.

Data

The analysis uses quarterly data on sampling unit employment from the LDB beginning in January, 1990 and terminating in March, 2018. (The LDB series starts in 1990.) The total number of employees for a sampling unit for a particular year is the number recorded for that unit in the fourth quarter of the year. (Each unit has four records for the year. The fourth record is the one that's chosen to represent the total employment for that unit for the year.) Sampling unit births and deaths are not identified in the database so they had to be determined by the following set of birth/death rules used by the LDB: Sampling units with at least 5 records and at least 1 quarter of positive employment and sampling units with at least 6 records and zero quarters of positive employment. Sampling units with 4 or fewer records were excluded from the analysis and establishments with exactly 5 records all of which are zero were also excluded.

The total number of employees in an industry is not an exact summation of the total number of employees from the previous year plus births for the current year minus deaths for current the year. This is because employment changes for individual establishments within an industry are not captured in the data. An establishment is counted as a birth if it has no entry or zero quarterly employment for the prior 4 quarters. An establishment is counted as a death if it has no entry or zero quarterly employment in the subsequent 4 quarters.

Methodology

The total number of employees for industry X in year Y is the sum of the fourth quarter employment record for every establishment in industry X for year Y. To determine birth and death dates for an establishment the following criteria are used: An establishment is counted as a birth if it has no entry or zero quarterly employment for the prior 4 quarters. An establishment is counted as a death if it has no entry or zero quarterly employment in the subsequent 4 quarters. After unique establishment birth and death dates were identified, employment records for these establishments were summed to get aggregate employment births and deaths for the industry. The total employment for the current year is the sum of the total employment for the previous year plus births for the current year minus deaths for the current year. The total employment will not necessarily add up to account for births and deaths for the year because establishment records in the LDB may not reflect all the quarterly or yearly changes in establishment employment levels. Employment birth rates are employment births divided by total employment. Employment death rates are employment deaths divided the total employment. The standard deviation uses the employment for each establishment for each quarter as the unit of measure.

Results

The results for total industry employment, employment births and deaths, standard deviation of total employment, and standard deviation of employment births and deaths are presented in several tables and graphs. The table for total employment shows the total employment for each industry for 2010 - 2017. The table for employment births shows the total number of industry employment births and birth rates for 2010 - 2017. The table for employment deaths shows the total number of employment deaths and death rates for 2010 - 2017. Standard deviation results are displayed in a table and a graph with a regression line to indicate slope and trend.

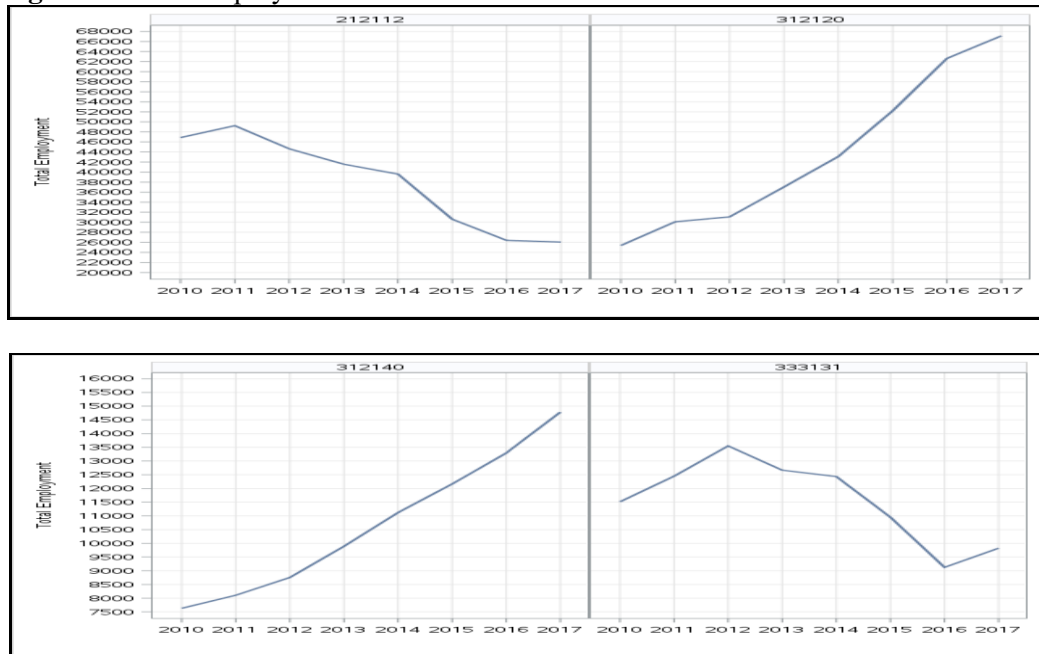
Total Industry Employment

For the four industries shown, 312120 and 312140 show dramatically rising employment. 212112 and 333131 show more stable employment changes over the period. Dramatic changes in total employment indicate industries that are undergoing rapid change.

Table 1: Total Employment 2010 – 2017

Year	NAIC			
	212112	312120	312140	333131
2010	46871	25373	7631	11513
2011	49241	30102	8107	12447
2012	44641	31073	8755	13550
2013	41574	37038	9891	12665
2014	39599	43096	11121	12435
2015	30595	52208	12164	10951
2016	26383	62652	13292	9124
2017	26056	67139	14782	9823

Figure 1: Total Employment 2010 -- 2017



Employment Births

Births have increased quite dramatically for 312120 (indicating that this industry is changing quite rapidly) and fallen precipitously for 333131. Total births for 212112 and 312140 have moved less dramatically. The birth rates for 312120 are consistently high.

Table 2: Employment Births -- 2010 - 2017

Year	NAIC							
	212112		312120		312140		333131	
	Births	Rate	Births	Rate	Births	Rate	Births	Rate
2010	2494	5.32%	373	1.47%	153	2.00%	797	6.92%
2011	592	1.02%	3342	11.10%	810	9.99%	256	2.06%
2012	745	1.67%	1087	3.48%	498	5.69%	1549	11.43%

2013	1369	3.29%	2793	7.54%	441	4.46%	686	5.42%
2014	3393	8.57%	2442	5.67%	670	6.02%	440	3.54%
2015	4131	13.50%	4152	7.95%	546	4.49%	317	2.89%
2016	2163	8.20%	4427	7.07%	595	4.48%	124	1.36%
2017	1805	6.93%	5793	8.63%	181	1.22%	76	0.77%

Figure 2: Employment Births -- 2010 – 2017



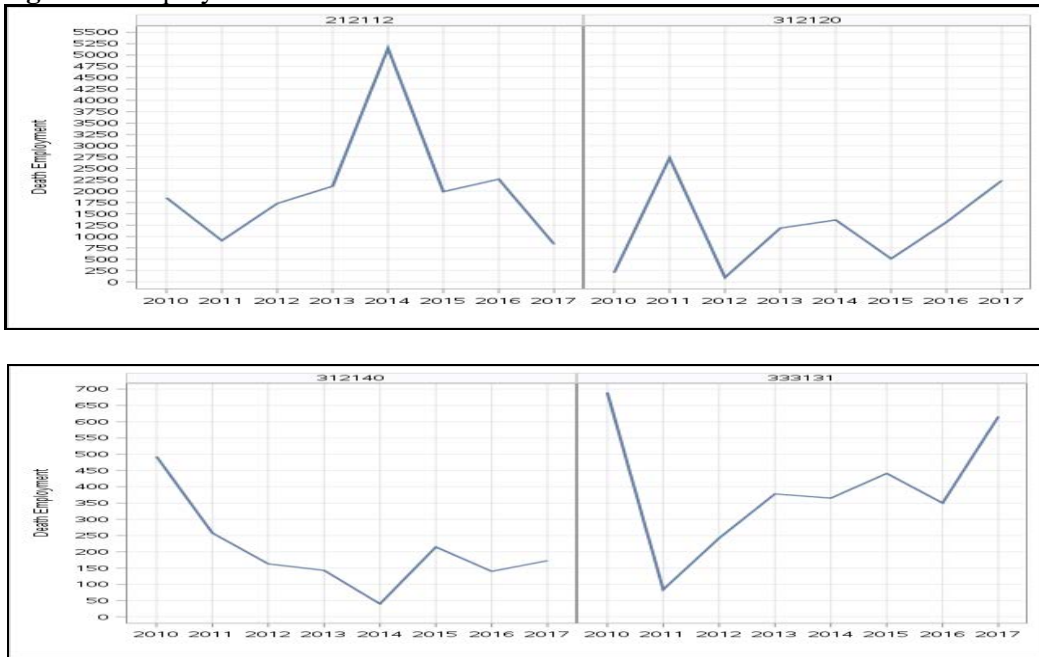
Employment Deaths

Deaths for 312120 have increased dramatically (indicating rapid industry change). Deaths for 212112 increased dramatically but have since fallen towards the end of the period. Deaths for 333131 fell dramatically before rising equally dramatically. Deaths for 312140 fell consistently before rising slightly over the period. Death rates for 212112 and 333131 appear to be consistently high.

Table 3: Employment Deaths -- 2010 - 2017

Year	NAIC							
	212112		312120		312140		333131	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
2010	1855	3.96%	202	0.80%	493	6.46%	690	5.99%
2011	910	1.85%	2732	9.08%	258	3.18%	84	0.67%
2012	1729	3.87%	96	0.31%	163	1.86%	242	1.79%
2013	2109	5.07%	1186	3.20%	143	1.45%	378	2.98%
2014	5151	13.01%	1365	3.17%	40	0.36%	365	2.94%
2015	1988	6.50%	511	0.98%	215	1.77%	441	4.03%
2016	2265	8.59%	1319	2.11%	140	1.05%	350	3.84%
2017	831	3.19%	2237	3.33%	173	1.17%	616	6.27%

Figure 3: Employment Deaths -- 2010 – 2017



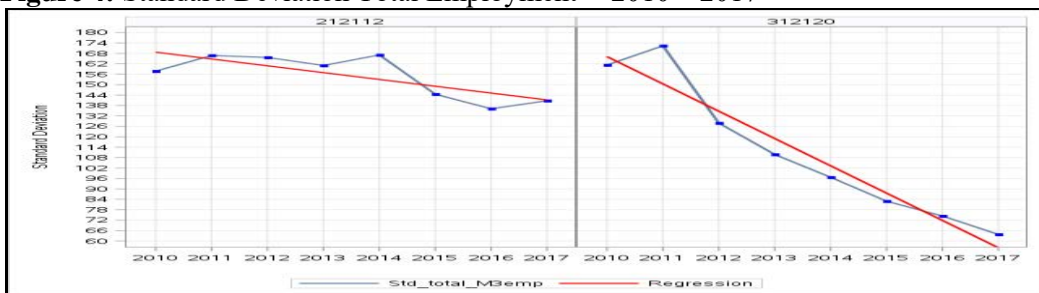
Standard Deviation of Total Industry Employment

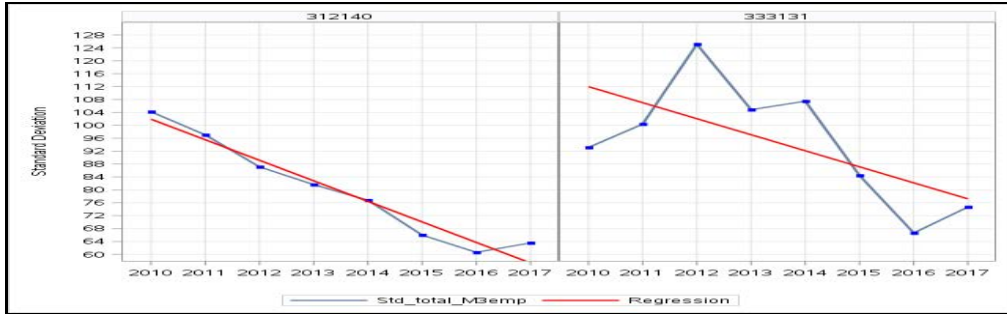
To use the standard deviation to assess industry volatility, the focus is on evaluating their graphs to see to see if they’re stable, increasing or decreasing without regard to their levels. Mostly flat trends indicate a stable industry while noticeably rising or falling trends indicate rapid change. The standard deviation for 212112 is remarkably stable while for the other three industries it has fallen noticeably over the period.

Table 4: Standard Deviation Total Employment -- 2010 – 2017

Year	NAIC			
	212112	312120	312140	333131
2010	157.75	161.30	104.19	93.14
2011	166.80	172.38	97.02	100.38
2012	165.66	127.88	87.13	125.11
2013	161.02	109.80	81.62	104.84
2014	167.09	96.68	76.79	107.47
2015	144.50	82.89	66.01	84.45
2016	136.12	74.38	60.64	66.66
2017	140.76	63.77	63.57	74.69

Figure 4: Standard Deviation Total Employment -- 2010 – 2017





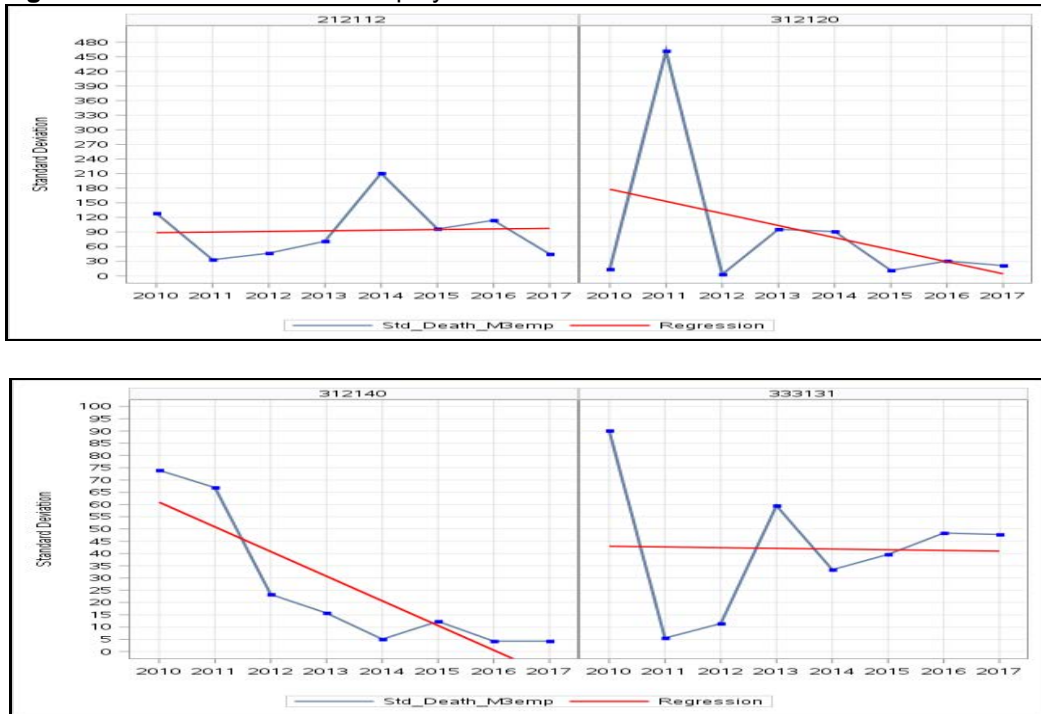
Standard Deviation Employment Births

The standard deviation of employment births for 212112 is increasing. For industries 312120 and 312140 the standard is low and stable. For 333131 the standard deviation is declining.

Table 5: Standard Deviation Employment Births -- 2010 – 2017

Year	NAIC			
	212112	312120	312140	333131
2010	92.07	6.69	10.22	94.62
2011	17.22	202.98	49.89	13.62
2012	48.16	7.82	17.18	279.51
2013	76.81	29.22	18.58	37.18
2014	160.17	10.02	13.67	67.62
2015	316.90	17.02	5.95	14.77
2016	145.43	10.56	9.60	11.97
2017	182.17	105.40	6.66	9.40

Figure 5: Standard Deviation Employment Births -- 2010 - 2017



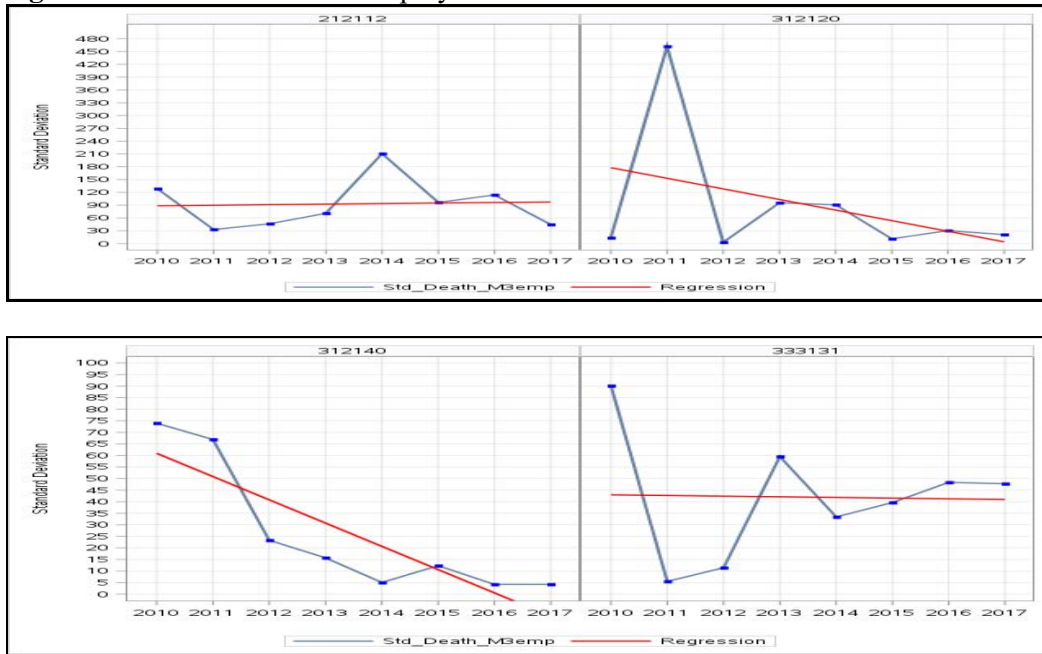
Standard Deviation Employment Deaths

The standard deviation of employment deaths for 212112 is low and stable. For 333131 the trend is also stable though at the beginning of the period the standard deviation fell dramatically, rose and then leveled off. For industries 312120 the standard deviation rose dramatically, fell equally sharply before settling into a stable pattern. For 312140 the standard deviation rose dramatically, fell equally sharply before settling into a stable pattern. For 312140 the standard deviation has fallen sharply before levelling off.

Table 6: Standard Deviation Employment Deaths -- 2010 – 2017

NAIC				
Year	212112	312120	312140	333131
2010	128.54	13.58	73.96	90.13
2011	33.22	461.77	66.91	5.49
2012	46.58	3.10	23.29	11.41
2013	71.11	95.72	15.70	59.51
2014	210.65	91.08	5.01	33.38
2015	96.50	11.28	12.29	39.64
2016	114.13	30.53	4.19	48.35
2017	44.74	21.12	4.22	47.75

Figure 6: Standard Deviation Employment Deaths -- 2010 - 2017



Conclusion

Industry samples in the PPI are normally drawn approximately every seven years. For rapidly changing industries, it might be necessary to resample at shorter time intervals. The statistics calculated in this analysis (total employment, employment births and deaths) may be used to determine which industries merit more frequent resampling. An industry with high levels of births and deaths – which is a good indication that the industry is undergoing rapid change – may need to be resampled more often than a less active industry. The standard deviation of the statistics analyzed may also factor into when to resample an industry. From the preceding analysis, the only industry which wouldn't warrant more frequent resample is 212112.

**Appendix
Data**

Case 1: Unit reported for exactly five quarters with at least one quarter of positive employment. This is illustrated in the table. This unit is counted as a birth in 20083 and a death in 20093.

NAIC	SAMPLING UNIT	REPORTING YEAR/QUARTER	EMPLOYMENT
334220	316721233	20083	1
334220	316721233	20084	0
334220	316721233	20091	0
334220	316721233	20092	0
334220	316721233	20093	0

Case 2: Unit reported for six to nine quarters and no positive employment. In the case shown in the table below, birth occurs on 19901 and death is on 19904.

NAICS	SAMPLING UNIT	REPORTING YEAR/QUARTER	EMPLOYMENT
311340	059490774	19901	0
311340	059490774	19902	0
311340	059490774	19903	0
311340	059490774	19904	0
311340	059490774	19911	0
311340	059490774	19912	0
311340	059490774	19913	0
311340	059490774	19914	0

Case 3: Unit reported for six to nine quarters and at least one positive employment record. In the table below birth occurs on 20142 and death is on 20151. If the last record for this unit had been positive then death would have been recorded as 20161.

NAICS	SAMPLING UNIT	REPORTING YEAR/QUARTER	EMPLOYMENT
311352	369422081	20142	1
311352	369422081	20143	0
311352	369422081	20144	0
311352	369422081	20151	0
311352	369422081	20152	0
311352	369422081	20153	0
311352	369422081	20154	0
311352	369422081	20161	0

Case 4: Unit reports for ten or more quarters, all of which have zero employment. Birth occurs on 19911 and death occurs at 19912.

NAICS	SAMPLING UNIT	REPORTING YEAR/QUARTER	EMPLOYMENT
311340	098579749	19901	0
311340	098579749	19902	0
311340	098579749	19903	0
311340	098579749	19904	0
311340	098579749	19911	0
311340	098579749	19912	0
311340	098579749	19913	0
311340	098579749	19914	0
311340	098579749	19921	0
311340	098579749	19922	0

Case 5: Unit reports for ten or more quarters with at least one positive quarter of employment. Shown below is a unit with 11 records, ten of which are positive. In this case, birth occurs at 19901 and death is at 19922.

NAICS	SAMPLING UNIT	REPORTING YEAR/QUARTER	EMPLOYMENT
313111	276932791	19901	14
313111	276932791	19902	15
313111	276932791	19903	15
313111	276932791	19904	14
313111	276932791	19911	11
313111	276932791	19912	7
313111	276932791	19913	6
313111	276932791	19914	6
313111	276932791	19921	6
313111	276932791	19922	5
313111	276932791	19923	0