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**AN ANALYSIS OF KEY DIFFERENCES IN MICRO DATA:
RESULTS FROM THE BUSINESS LIST COMPARISON PROJECT**

by

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Abstract

The Bureau of Labor Statistics and the Bureau of the Census each maintain a business register, a universe of all U.S. business establishments and their characteristics, created from independent sources. Both registers serve critical functions such as supplying aggregate data inputs for certain national statistics generated by the Bureau of Economic Analysis. This paper examines key micro-level differences across these two business registers.

Key words: Business register, business list.

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An Analysis of Key Differences in Micro Data: Results from the Business List Comparison Project

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Abstract

The Bureau of Labor Statistics and the Bureau of the Census each maintain a business register, a universe of all U.S. business establishments and their characteristics, created from independent sources. Both registers serve critical functions such as supplying aggregate data inputs for certain national statistics generated by the Bureau of Economic Analysis. This paper examines key micro-level differences across these two business registers.*

Key words: Business register, business list.

1. Introduction

The Bureau of Labor Statistics (BLS) and the Bureau of the Census (BOC) each publish aggregate statistics concerning U.S. business activity using data from the agencies' business lists. The BOC publishes industry statistics on number of establishments, employment, and payroll at the national, state, and county levels in its *County Business Patterns* series while the BLS publishes analogous statistics in its *Employment and Wages Annual Averages* series. When there are significant differences across these publications for similar economic concepts, it raises questions for data users. Some of these differences are caused by known differences in the statistics, for example in the scope of activity covered, but other differences are more difficult to explain. One of the most intensive data users of both BLS and BOC data is the Bureau of Economic Analysis (BEA). BEA uses aggregate statistics from BLS and BOC to create national economic indicators. Thus, BEA is vitally interested in understanding differences in the aggregate statistics from both agencies. Fixler and Landefeld (2006) succinctly summarize the importance of consistent data concepts for BEA's many data products. In addition to the impact on national, state and regional statistics, they note that these differences can have a very real impact on people's lives. For example, they note that payroll differences at the state level between the two agencies "could have a significant impact on the allocation of state Medicaid funds, which uses BEA per capita state personal income to determine the federal share of payments for each state (p.93)." This current paper provides a unique analysis of certain key micro level differences concerning payroll highlighted in Fixler and Landefeld (2006).

This paper is part of a long-running project devoted to understanding differences in the business lists used by both agencies. The BLS and the BOC each hold separate list files of the universe of U.S. businesses created from different sources. In addition to being the sources for publications and for BEA's aggregate statistics, these business lists also are used as the sampling frames from which surveys and censuses are drawn and provide benchmarks for survey data. Thus, similarities and differences in these lists are of critical interest. The project consists of three major stages of analysis: analysis of published aggregate data and a two-phased analysis of confidential micro data. While the first two stages of the project examined differences in the number of establishments, employment, and payroll, the third stage of the project focuses on payroll.

The results from the project are subject to strict confidentiality rules and thus can only be made public under certain conditions. Abiding by these conditions, the results from each of the three stages of the project have been released to the public via presentations at the Joint Statistical Meetings. In each case, a conference paper has also been published. Below we briefly describe the results from the earlier papers that are relevant to the current paper.

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Becker *et al* (2005) reports the results from the comparison of aggregate published data. The authors find that the BLS register has more establishments than the BOC register but the BOC has more employment and payroll than the BLS for the 2001 reference year. While BOC has more payroll than does BLS at the national level, this is not the case for all sectors or for all states. A comparison at the sectoral level reveals that the sectors with the largest payroll differences are Management and Manufacturing. BOC has more payroll than does BLS for Management (about \$95 billion more) while BLS has more payroll than does BOC for Manufacturing (about \$86 billion more). Concerning states, the authors find that while BOC has higher payroll at the national level, in 27 states it has lower payroll than does BLS.

The results from the first-stage of the micro data analysis are described in Elvery *et al* (2006). These authors also used 2001 as a reference year. The authors matched the micro data from the two agencies using the Employer Identification Number (EIN), which is also the matching process used in the current paper. An EIN is an identification number used by a business legal entity for reporting to the Internal Revenue Service (IRS). The EIN is the only identifier available on both lists. An EIN-level observation can represent one or more establishments. The fact that there are many business uses of EINs can lead to difficulties in matching EINs between the two lists (as discussed later in this paper). Using an analytical sample (similar to that which we will describe below), Elvery *et al* found that of the EINs found on both lists, 77 percent had payroll within plus or minus 2.5 percent of that from the other list. Not surprisingly, EINs that represent only a single establishment had higher match rates than EINs that represent more than one establishment.

The results from Becker *et al* (2005) and Elvery *et al* (2006) and the concerns expressed in Fixler and Landefeld (2006) motivated and guided the micro level analysis in this final stage of the project. The paper is organized as follows. In section 2 we describe the business registers paying particular attention to known differences as they relate to payroll. Section 3 describes the analytical micro dataset that we constructed using the business list data attempting to control for known differences in the two lists. In Section 4 we summarize overall differences in payroll. Section 5 describes state differences in payroll. Section 6 describes industry differences in payroll focusing on wage differentials in Texas's headquarters and oil and gas industries and in California's computer and electronic product manufacturing industries. We present our conclusions in Section 7.

2. The Business Registers

The BLS register includes monthly data on employment and quarterly data on total wages (payroll), industry classification and geographic location. BLS' principal source of information on businesses is the State Workforce Agencies (SWA). Using a state-assigned unemployment insurance identification number, U.S. businesses are required to report quarterly wages and monthly employment each quarter to the SWAs in compliance with the State Unemployment Insurance Tax (UI) laws. The BLS business register also incorporates information from the Multiple Worksite Report (MWR), which collects monthly employment and quarterly wage information on establishments associated with multi-establishment firms within a state. Industry codes for new UI accounts (entries) are based on information collected by the Status Determination Form; thereafter, businesses are included in the three-year rotation for the Annual Refiling Survey, thus all businesses are surveyed once every three years.

The BOC register includes data for mid-March employment, annual and first quarter payroll, industry classification, and geographic location. The Internal Revenue Service (IRS) is the primary source of information on businesses on the BOC business register, providing information on the existence, location and operating status of businesses from the Business Master File and the Business Income Tax and Payroll Tax forms. In addition to the IRS data, the BOC receives other data, primarily industry classification codes, from the Social Security Administration (SSA) and BLS. Each quarter, BLS matches BOC supplied EINs and provides establishment-based information on location, industry classification codes, and ownership type particularly for new and small businesses. These industry codes covered over 3 million businesses in 2007 alone and now account for about 30 percent of the Census Bureau's business codes (Economic Report of the President (2008)). The BOC register includes information from the Economic Census and the Report of Organization Survey (ROS). The Economic Census, conducted once every five years, collects detailed economic data from all multi-unit companies and a large sample of single-establishment companies. The ROS is collected every year and covers about 30 percent of the multi-unit companies and a small selection of business

entries that have not yet been identified as multi-units but are likely to be based on administrative records indications.

Certain definitional differences exist between the two lists. BLS data include all workers and payroll items covered by Federal and state UI laws. A few organizations, employees and payroll items that are not covered in the UI system are therefore not part of the BLS data but may be included in the BOC list. For example, Washington State and Alaska exclude corporate officers and their salaries and bonuses from UI coverage and that may contribute to differences in payroll and to a lesser degree, employment, between BLS and BOC. Nevertheless, the BLS list covers approximately 98 percent of U.S. business activity in nonfarm payrolls.

Data for the BOC register are updated continuously although a more comprehensive maintenance and collection is done every five years with the economic census. BLS collects, matches and reconciles each quarter a comprehensive universe of U.S. business establishments capturing change on a flow basis. The scope of the BLS Quarterly Census of Employment and Wages (QCEW) data is larger than the BOC data including several additional industries. For example, BLS includes the entire public administration sector, agricultural production, postal workers and private households while BOC excludes most of these establishments. Finally, BLS and BOC have different revision policies for published data. BLS publishes its data quarterly with a six-month lag and revises the published data every quarter for the prior quarters in the same calendar year. BOC does not revise its *County Business Patterns* published data.

3. Analytical Sample

The micro data used for this project are from BLS' longitudinally-linked QCEW microdata and BOC's Business Register. The micro comparison in this paper uses a joint analytical sample that focuses on records in scope for both agencies. This was also the case for the earlier micro analysis that used the 2001 reference year. The methods were improved for the 2003 reference year, but broadly speaking the results from this paper are comparable to those in Elvery *et al* (2006). Prior to matching the data, both agencies cleaned their data and created variables that are as consistent as possible across the two lists. The following states were excluded from the analysis because their laws or policies prohibit BLS from sharing their data with BOC: Massachusetts, Michigan, New Hampshire, and New York. BOC's measure of payroll is rounded to thousands and the rounding process is different for single-units and multi-units. We construct a payroll measure from the BLS data to mimic the BOC measure as closely as possible. The cleaning of the BOC data included restricting the data to active establishments (those with payroll greater than zero). To match the timing of the BOC's business register, we aggregate the quarterly BLS data to annual data.

The establishment-level data were aggregated to the EIN level because EIN is the only numerical identifier available on both files. Establishments, industry, and location cannot always be compared directly because the comparison is at the EIN level. Instead, we created variables that count the number of these under each EIN. For example, for any given EIN we compare how many industries are under that EIN for BLS and BOC.

There are 6.1 million unique EINs in the BLS and BOC data for 2003. We are able to match 4.6 million of these, which represents 75 percent of the EINs. There are 0.9 million EINs in the BLS list and 0.6 million EINs in the BOC register that cannot be matched. Because of the differences in coverage between the two lists, we restrict the remainder of the analysis to EINs that meet both agencies' coverage rules. From both sources, we drop EINs that have zero payroll or zero employment. Notice that this will mean that we drop BOC EIN births that started operating after March (therefore had no mid-March employment) but had payroll later in the year. For BLS EINs, we drop EINs that are entirely out of scope for the *County Business Patterns* (CBP). We also drop the component of BOC EINs that were not included in the CBP sample. We call the resulting sample the analytical sample. The analytical sample has 4.5 million unique EINs.

Both BLS and BOC treat single-units differently from multi-unit establishments when collecting data. Both agencies collect detailed information on multi-units through special surveys. BLS relies on the Multiple Worksite Reports and BOC relies on the Report of Organization Survey to provide information on these multi-units. Thus one must be cautious when comparing data for EINs that are multi-units in one file and single-units in the other file. In the analysis that follows, we account for the differences in multi-unit status. We create eight categories of EINs based upon whether they are considered a single-unit or a multi-unit by each of the two agencies. Each EIN is assigned a

two-letter code based on whether it is designated a single-unit (S), multi-unit (M), or not in the data. The first letter in the code refers to the BLS designation and the second letter refers to the BOC designation (e.g., MS refers to an EIN that is classified as a multi-unit by BLS but a single-unit by BOC). Our main focus in this paper is on the EINs that can be matched and thus we are interested in four groups of EINs. Moreover, in this paper, we have essentially combined the two groups MS and SM into a group that we call mixed. Thus we focus on matched single units (SS), matched multi-units (MM), and matched mixed units (MS and SM).

4. Overview of Payroll Differential

A quick comparison of the published data from BOC's *County Business Patterns* and BLS' *Employment and Wages Annual Averages* over time shows an interesting difference between employment and payroll. Ignoring other differences and controlling only for the private sector of BLS, this comparison shows that over the period 1993-2003, BOC has more employment than does BLS in all years and this difference has recently grown over time (see Figure 1). In contrast, there are some years in which BOC has more payroll than does BLS and some years in which the reverse is true. In all years, the payroll difference is relatively small as compared to the employment difference. According to these publications for 2003, BLS has \$4,016 billion in payroll for total private, while BOC has \$4,041 billion in payroll. Thus, the payroll difference in 2003 is about negative 25 billion dollars (all differences are BLS minus BOC) which is less than 1 percent of total payroll (averaged over the two agencies). As noted above, this difference may reflect many known differences. We attempt to control for these differences by focusing on our analytical sample.

Using the analytical sample for 2003, BLS has an annual payroll of \$3,528 billion and BOC has an annual payroll of \$3,351 billion yielding a payroll gap of positive \$177 billion (5 percent). Notice that the payroll gap for the analytical sample differs from that of the published data in terms of both magnitude and sign.¹ Much of this large payroll gap is due to EINs that cannot be matched over the lists. The overall payroll gap falls to \$32 billion when focusing only on EINs that appear on both lists (matched single units, matched multi-units, and matched mixed units). The analysis that follows mostly concerns cases in which we can compare payroll at matched EINs across the two lists. At the EIN-level for these matched cases, there are roughly the same number of EINs with a positive payroll gap as there are EINs with a negative payroll gap. If we sum up all of the EINs with a positive payroll gap we have a \$294 billion gap while on the negative side we have a negative \$262 payroll gap. Thus the positive net payroll difference of \$32 billion understates the absolute differences at the EIN-level since positive and negative differences are partially offsetting.

The differences in the payroll gaps across EINs grouped by the multi-unit status are shown in Table 1. Matched multi-units show a payroll gap of positive \$55 billion, while matched singles show a payroll gap of negative \$8 billion, and the two mixed cases show a combined gap of negative \$15 billion. In addition, the underlying gross difference for the matched multi-units dwarfs those of the other groups. For example, the sum of the negative payroll differences for matched multi-units is about 10 times that for single units, while the sum of their positive payroll differences is about 20 times that of single units. Further analysis of the differences in the matched multi-unit group reveals that a small number of EINs account for much of the payroll gap. A limited analysis of these observations shows that some of the differences for these cases with large payroll gaps are a result of differences in scope (which can only be imperfectly controlled for) and inherent difficulties in EIN-level comparisons. It is important to keep in mind that a difference at an EIN-level for a multi-unit company may simply be a difference in apportioning activity to multiple EINs of a single company across the two datasets. We found some cases in which the reported data on one list were simply incorrect. In these cases, the discrepancy brought an observation to our attention and we were able to determine that one list had an error through independent verification. These cases in which we were able to determine that one list has a reporting error highlight the usefulness of direct comparisons of micro data.

In sum, when we are able to control for *some* known differences in the data between the two lists, the small and negative payroll difference in the published data becomes a small and positive payroll difference. Underlying this relatively small net payroll difference are many offsetting positive and negative gross payroll differences at the EIN-

¹ In Becker *et al*, the crude correction for scope differences applied to the aggregate data reduces the size of the payroll gap from negative \$37 billion to negative \$16 billion. (see Table 1 of Becker *et al*).

level. That is, it does not appear to be the case that one agency simply has more payroll than the other for all of its EINs. Not surprisingly, EIN-level payroll differences are especially important for multi-units; however, it is important to keep in mind that the EIN-level comparison has limitations. In addition to the national payroll gap, there are several states and industries with large payroll differences. These differences are addressed in more detail in the sections that follow.

5. State Payroll Differentials

Fixler and Landefeld (2006) point to several cases of significant payroll discrepancy at the state level, such as Alaska and Washington State. They conjecture that this payroll difference may be partly driven by coverage differences, stating “[o]ne possible answer to the source of this discrepancy could lie in the recording of stock options, bonuses, and fringe benefits in employee compensation (p.93).” Washington State is cited as an example, with BOC reporting payroll growth at nearly twice the rate of BLS reported payroll growth.

According to states’ employer handbooks, Washington and Alaska do not require the collection of corporate officers’ information (Department of Labor (2003)). Therefore, in these two states, BLS has a smaller employment coverage than BOC. However, each quarter Washington State provides BEA with supplemental data on corporate officers’ wages as well as exercised stock options. BEA uses this data in its calculations of state wages which eliminates significant payroll differences due to scope as a major issue for BEA.

To help verify, we analyzed Washington State’s 2001 and 2003 matched analytical sample which showed BOC reported more payroll than BLS. Cross-tabulations by size-class and 2-digit NAICS industry sector showed more BOC payroll than BLS in many cells.

6. Industry Payroll Differentials

A key concern with published BLS and BOC data, highlighted by Fixler and Landefeld (2006), is differences in payroll by industry between the two lists. Three industries, Mining, Quarrying and Oil and Gas Extraction (“Mining”); Management of Companies and Headquarters (“Headquarters”); and Manufacturing have significant differences in the published payroll data. In this section, we provide an in-depth analysis of the micro data for Mining and Headquarters in Texas and Manufacturing and Wholesale Trade in California.

As Table 2 shows, BLS’ published Mining payroll total was about 22 percent higher than BOC’s and almost three-quarters of this difference (71 percent) was attributable to the state of Texas. Published 2003 data also show the BLS having 77 percent less payroll in Headquarters than BOC. When looking only at the state of Texas, BLS has about 40 percent more payroll in Mining than BOC while BOC has more than six times the total Headquarters payroll that BLS reports. Therefore, some BLS establishments in Mining may be a headquarters operation for a mining company that BLS coded based on the operating activity, Mining. A detailed review of such cases showed that it is difficult to determine the best way to classify these establishments.

The majority of the payroll difference in Mining in Texas is in matched EINs, EINs found in both the BOC and BLS registers, where BLS had significantly more payroll in those EINs than BOC. However, the majority of the Texas payroll difference in Headquarters is from unmatched EINs, EINs found only in the BOC register in Headquarters. Given these differences, further steps described below were taken to determine if some of the activity classified by BLS in Mining EINs may have been allocated to one of the unmatched EINs listed in Headquarters by BOC.

As Table 3 shows, published 2003 data show the payroll figure for Manufacturing (NAICS 31-33) is about 13 percent higher on the BLS list than on the BOC list. California accounts for more of this difference than any other state and within California more than three quarters of the payroll difference between the two lists is attributable to computer manufacturing (NAICS 334). When the BLS EINs in computer manufacturing were matched to the BOC list, the EINs accountable for the majority of the payroll difference were found to be classified on the BOC list in another sector, particularly Wholesale Trade.

While it seems likely that differences in establishment classifications by BOC and BLS at the same companies may explain a substantial part of the industry differences between the two lists, the lack of a common establishment-level

identifier makes matching individual establishments and comparing their industry codes very difficult. The next-best alternative was to construct and link quasi-establishments by aggregating the establishment-level data on both sides to EIN, industry and geography cells (or *quasi-establishments*).

Tables 4 and 5 show the results of the (*quasi*) establishment links for Mining and Headquarters in Texas and Manufacturing and Wholesale Trade in California. The top four rows of each table show the share of industry activity accounted for by increasingly loose matches between the BLS and BOC quasi-establishments. For example, in California's manufacturing sector (Table 5), 52 and 55 percent of BLS and Census payroll respectively was accounted for by quasi-establishments that matched on EIN, five-digit zip code and two-digit NAICS code. The next row shows that an additional 11 percent of BLS and Census payroll is accounted for by matching the remaining quasi-establishments on a looser EIN, three-digit zip code and two-digit NAICS code combination. The last two rows show the shares of BLS and BOC activity accounted for by linking the remaining unmatched BLS manufacturing quasi-establishments to the unmatched BOC wholesale quasi-establishments. Only about 4-9 percent of activity (summing the last two numbers) was captured in these cross-industry links in Table 4 while the total for Table 5 cannot be determined due to disclosure suppression.

Tables 4 and 5 show that for most of the sectors the quasi-establishments link reasonably well and account for about one half and two thirds of the overall activity but for BLS-mining, Census-management, and to some degree Census-wholesale trade, only small fractions of the overall activity is matched. Interestingly, the cross-industry matches capture as much as a quarter of the remaining activity in these sectors - indicating that the differences in the published data for these industry/state combinations may be explained by differences in industry coding of establishments belonging to moderately large companies.

7. Conclusions

Using the micro data allows us to control for *some* of the known differences in the data. In the analytical sample we find a small positive payroll gap (of about 5 percent). There is tremendous heterogeneity underlying this positive payroll gap. There is roughly the same number of EINs with a positive payroll gap as a negative payroll gap. Multi-unit EINs have a disproportionate share of cases where the payroll gap is positive (that is, where BLS has more payroll than does BOC). We also find that the multi-unit cases are impacted by a small number of observations. A limited examination of these cases reminds us to be cautious in drawing conclusions based on EIN-level comparisons from the analytical sample due to issues concerning scope and differences in how a company may apportion activity to its EINs when reporting to the BLS and the BOC.

In sum, although the aggregate published data look similar, when looking at more disaggregated levels of detail, such as the state or industry level, important differences arise. After coverage differences are accounted for, one cause of these differences is assigned industry codes. A goal of this paper was to provide guidance to the two agencies concerning benefits from potential data sharing. The results of the project provide some examples of where data sharing would be beneficial for BLS and BOC as well as downstream data users such as BEA. First, individual records could be routinely compared and checked for inconsistencies. This would increase the quality and consistency of the data on the two individual lists. Second, data processes that might yield differences could be identified, allowing the source of the differences to be addressed. Third, the greater consistency of the data from BLS and BOC would enable BEA and other data users to produce higher quality statistics using data combined from the two agencies.

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Group	Levels		Differences	
	BLS	BOC	Level	Percent
Matched				
Multi-units (MM)	1,876,580.8	1,821,037.2	55,543.6	3.0
Single Units (SS)	827,687.5	836,077.2	-8,389.7	-1.0
Mixed (MS+SM)	507,081.0	521,621.9	-14,540.9	-5.8
Unmatched				
Multi-units	172,362.8	73,343.3	99,019.5	80.6
Single units	81,023.1	98,537.7	-17,514.6	-19.5
Not classified	63,318.2	0	63,318.2	
Total	3,528,053.4	3,350,617.3	177,436.1	5.2

Note: in millions of dollars.

Table 2: Mining and Headquarters in the U.S. and Texas						
Geography	Industry	BLS	CBP	Difference	% Difference	% Total Difference
U.S.	Mining	31,162,713	24,657,845	6,504,868	21%	97%
U.S.	Headquarters	119,977,745	212,485,849	-92,508,104	-77%	100%
Texas	Mining	11,785,447	7,023,231	4,762,216	40%	71%
Texas	Headquarters	2,632,487	19,292,242	-16,659,755	-633%	18%

Table 3: Manufacturing and Computer Manufacturing in California and U.S.						
Geography	Industry	BLS	CBP	Difference	% Difference	% Total Difference
U.S.	Manufacturing	663,931,332	576,057,897	87,873,435	13%	100%
California	Manufacturing	82,287,627	67,751,831	14,535,796	18%	17%
California	Computer Manuf	28,324,103	17,113,569	11,210,534	40%	13%

Table 4: Texas Mining and Management				
Sector	Match Variables (Industries Matched)	Percent of Payroll Matched		
		Census Payroll	BLS Payroll	
Mining (NAICS 21)	EIN,Zip5,NAICS2 (BOC-21 to BLS-21)	21	12	
	EIN,Zip3,NAICS2 (BOC-21 to BLS-21)	34	14	
	EIN,Zip (BOC-55 to BLS-21)		26	
	EIN (BOC-55 to BLS-21)		D	
Management (NAICS 55)	EIN,Zip5,NAICS2 (BOC-55 to BLS-55)	5	39	
	EIN,Zip3,NAICS2 (BOC-55 to BLS-55)	2	13	
	EIN,Zip (BOC-55 to BLS-21)	12		
	EIN (BOC-55 to BLS-21)	D		

Note: D denotes suppressed data.

Table 5: California Manufacturing and Wholesale Trade				
Sector	Match Variables (Industries Matched)	Percent of Payroll for		
		Census Payroll	BLS Payroll	
Manufacturing (NAICS 31)	EIN,Zip5,NAICS2 (BOC-31 to BLS-31)	55	52	
	EIN,Zip3,NAICS2 (BOC-31 to BLS-31)	11	11	
	EIN,Zip (BOC-42 to BLS-31)		3	
	EIN (BOC-42 to BLS-31)		1	
Wholesale Trade (NAICS 42)	EIN,Zip5,NAICS2 (BOC-42 to BLS-42)	31	49	
	EIN,Zip3,NAICS2 (BOC-42 to BLS-42)	5	7	
	EIN,Zip (BOC-42 to BLS-31)	6		
	EIN (BOC-42 to BLS-31)	3		

Note: D denotes suppressed data.