FORECASTING FUTURE EMPLOYMENT OPPORTUNITIES FOR FOOD, AGRICULTURE, AND NATURAL RESOURCES HIGHER EDUCATION GRADUATES USING ADJUSTED BUREAU OF LABOR FORECASTS

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[†] See Also: Faculty Paper Number FP02-06 for alternate methodology.

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ABSTRACT

Forecasts of the number of future professionals required for an ongoing safe, efficient US food system are highly important. The demand for adequately prepared higher education graduates must be met by the US Food, Agriculture, and Natural Resources Education System. Without accurate forecasts of the human resource needs of the food sector of the economy, adequate professionals may not be available when needed. This research effort makes use of Bureau of Labor Statistics (BLS) forecasted employment opportunities. The estimation of professionals required in the food and agriculture sectors of the economy is developed by selecting and manipulating data from the BLS model that is relevant to food and agriculture careers. These forecasts of needed professionals can be used by Directors of Resident Instruction to manage the educational system to meet the food sector demands for adequately educated human resources.

KEYWORDS: employment; employment opportunities; food; agriculture; natural resources; directed graphs; education; bureau of labor

INTRODUCTION

While the analytical model presented in Faculty Paper 02-07, "Forecasting Future Employment Opportunities for Food, Agriculture, and Natural Resources Higher Education Graduates using Econometric Estimation Techniques," has merits for providing reliable forecasts of employment, the authors are aware it also has limitations. For example, the notably small sample size of observations and the need for a method to expand the data to reflect the total number of graduates from all colleges of agriculture and natural resources (instead of only those institutions which have submitted data in the past). Since only about 60% of institutions with agriculture and natural resource higher education programs submit placement data to FAEIS, the data estimates must subsequently be expanded to represent the total population. In order to develop a system of forecasting that is not hindered by such limitations, the authors developed an alternative methodology based on national employment data, thus avoiding both small sample size problems and expansion problems as well. This alternate methodology, BLS_{WA} (Bureau of Labor Statistics, with adjustments), utilizes employment data gathered from the Bureau of Labor Statistics (BLS), a division of the United States Department of Labor (USDoL), and several macroeconomically-determined expansion factors to provide an accurate estimate of both current and future employment of graduates from colleges of agriculture and natural resources.

COLLECTION OF DATA

While the ideal scenario for collection of data would include presenting a survey instrument to all of the thousands of potential employers for agriculture and natural resources graduates nation-wide, this approach falls outside the scope of both the

monetary and time allotments for this project. In addition, the sample pool of possible employers for the survey must be selected with several factors in mind: 1. A great percentage of graduates with college of agriculture and natural resources degrees often find employment outside of the directly-related food and fiber sector; 2. Many agriculture and natural resource graduates, much like graduates from virtually any degree program, are forced to find initial employment in a position in which they intend to use as merely a stepping-stone until a position in the occupation of choice become available, thus casting initial employment surveys conducted by some institutions as essentially invalid. Actual data collection of current employment of agriculture and natural resource graduates would therefore be an enormous task.

In light of these considerations however, the authors have spent considerable effort in developing a feasible approximation method that, while not a definitive explanation, offers a reasonable solution to the above-mentioned problems of estimating and forecasting demand for agriculture and natural resources graduates. This methodology is fully capable of providing both estimates of current employment of and future demand for agriculture and natural resources graduates.

In order to develop a deeper understanding of the employment outlook for agriculture and natural resource graduates, the USDoL has provided a general synopsis of the state of employment in the United States as a whole. While researching individual employment opportunities within the entire food and fiber system via the *Occupational Outlook Handbook* published by the USDoL, the authors determined that the database of occupational and industry employment generated and published by the BLS did, in fact contain much of the employment information needed to develop an estimation of

agriculture and natural resource employment demand[2]. This data would, however, require a great deal of manipulation to extract the portions of employment that can be directly linked to the food and fiber sector. Once these data processes designed to obtain the food, agriculture, and natural resource component of total projected employment are completed, these estimates can be used with BLS forecasts to predict future employment opportunity estimates.

Bureau of Labor Statistics Data

In order to allow customized searches and queries, the BLS makes their entire data matrix, consisting of employment information for 650 individual occupations within 314 industries, available for download through their FTP site via the Internet[3]. Once downloaded from the BLS site, the authors determined which of the industries, and more specifically, which occupations, are related, and to what degree, to the food and fiber system within the United States[4]. After careful consideration of all 314 industries and 650 occupations, the authors determined data from 29 industries, and 78 occupations, divided into 6 sectors, within each industry would yield an accurate approximation of the total openings available to our specific graduates. For a complete listing of these industries and their SIC codes (Standard Industrial Classifications, now referred to as North American Industry Classification System (NAICS)) and the selected occupations, see Appendix A.

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[2] For information concerning the data-gathering and projections procedures implemented by the BLS, see Chapter 13 of *BLS Handbook of Methods*. Available at this address: http://www.bls.gov/opub/hom/homch13_a.htm
[3] Data available for download at the following site: ftp://146.142.4.23/pub/special.requests/ep/ind-occ.matrix
[4] The assistance of Dr. Ed Rister, Professor in the Agricultural Economics Department at Texas A&M University, is appreciated. Dr. Rister played an important role in selecting the industries and occupations that should be considered as part of the food and agriculture employment and estimating the percent of each employment category that was filled by food and agriculture graduates.

Using the taxonomy devised by the BLS for their data matrix, the authors queried all records concerning each of the selected occupations for each of the 29 industries into several spreadsheets in order to perform the necessary calculations and manipulations. Once these data were attained, a table was constructed consisting of 29 columns representing each selected industry and 78 rows representing the selected occupations representing food and natural resource employment opportunities. Additionally, several columns were added to provide space for summary columns including: Row totals, total employment of each occupation throughout all industries, and the resulting percentage employment of each occupation in the food and fiber system.

METHODOLOGY

Data Collection:

The BLS makes available online their entire collection of employment and industry data. The data can be downloaded from the BLS's public file transfer protocol (FTP) site at this location. From the complete data matrix, available as the file PMBT9808.DAT on the BLS FTP site, the data for the selected industries was copied and placed into several Microsoft Excel files. As shown in the file Matdoc98.txt, the matrix is constructed using both the 9-digit occupational codes and the 6-digit industry codes to identify each employment data entry. A list of all occupational and industry codes can be found in the file codes.txt available on the BLS' FTP site. Using this information, all the information for a particular industry can be copied from the PMBT9808.DAT file by highlighting and copying all entries that have the correct industry code in the record.

For example, the industry "logging" exists in the database. If the records for logging were required for analysis, begin by finding the 6-digit industry code for

"logging" in the Codes.txt file. That code is: 412410. Next, open the data file

PMBT9808.DAT and search for 412410 in positions 13-18 of the file. Once found,

simply highlight all the records that contain the code 412410 in the positions 13-18 and

paste them into another file (Microsoft Excel was used in this project). Using "Record

Layout" information from Matdoc98.txt, the information from the matrix can be

deciphered into its respective columns such as 1998 employment, 2008 employment,

percent change, etc….

Data Manipulations:

After all records of employment by occupation were copied from the

PMBT9808.DAT file into Microsoft Excel files, the data were then manipulated to fit the

requirements of this project. Since our project is only focusing on 78 of the 650 possible

occupations found in each industry, it became necessary to import the data from

Microsoft Excel into Microsoft Access to perform queries to extract the information

needed. In Microsoft Access, we were able to perform a query to extract specifically the

1998 and 2008 employment information for 78 occupations required for each of the 29

industries. After these data were extracted, they were then exported back to Microsoft

Excel in order to build the final table.

In order to address questions concerning the scope and diversity of the industries

selected for our estimation, several multipliers were used to filter the raw data to provide

a better estimate of those positions that could be considered food, agricultural, and fiber

system related. The first multiplier, "Agriculture and Natural Resources as a Percentage

of Gross National Product" (PGNP) was applied to all 29 industries, at varying levels,

according to what extent products of that industry correspond to the agriculture sector.

Six of the 29 industries (Agriculture, Forestry, and Fishing; Lumber and Wood Products; Farm and Garden Machinery; Food and Kindred Products; Tobacco Production; Agriculture Chemicals; Leather and Leather Products; and Lumber and Other Building Materials) were maintained at 100 percent due to their direct relation to agriculture and natural resources. Sixteen additional industries were estimated at 18 percent of their employment total. The 18 percent number was derived from the total contribution of the food and fiber system to the gross national product of the United States[5]. Calculated annually by the ERS-USDA, this percentage provides a reasonable estimate of the output for a specific industry as it relates to agriculture. It is assumed that this same percentile is also a good approximation of the labor employed in the industry that food, agriculture, and natural resource related.

Of the remaining five industries, Food Stores and Groceries and Related Products are considered closely but not completely related to the food and fiber system and were set at 75 percent[6]. The percentage closely resembles the percentage of grocery store purchases that are food related (i.e., excludes non-food expenditures). Retail Nurseries and Garden Stores were calculated at 50 percent. This industry exhibits an obvious relation to the food and fiber system; however, roughly half of the products sold and produced in this industry could be considered non-agricultural. Eating and Drinking Places and Museums, Botanical, and Zoological Gardens were calculated at a higher level than 18 percent based on their use of food and fiber system products; however, much of

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[5] It is important to note that the percentage of the food and fiber system of the United States GNP must be forecasted five periods in the future to complete our projection of demand. A detailed description of the methods used to forecast the percent of US GNP associated with agriculture are found in Appendix B.
[6] This estimate was provided by Dr. Oral Capps, Department of Agricultural Economics, Texas A&M University.

the output of these industries could be considered non-agricultural therefore 25 percent is used in these industries.

The second multiplier found in the table, "Employment Source Adjustment" (ESA), accounts for the percentage of those persons employed in each industry that require some form of agriculture and/or natural resource education background. Set at four different levels, 100%, 50%, 25%, and 10%, this multiplier was based upon the expert judgment and consideration of five College of Agriculture Deans and Directors of Resident Instruction from United States Colleges and Universities.

It should be noted that the BLS data used in this study does not differentiate employees by educational level; therefore, no distinction can be made between baccalaureate and post-baccalaureate educated employment options. As an attempt to introduce the topic of demand for graduate-level educated students into the project, several phone interviews were conducted with graduate deans of leading agriculture and natural resources colleges and universities throughout the United States. Surprisingly, none of the ten institutions interviewed kept placement records for their post-baccalaureate graduates. The only data that seems to be accessible is provided by alumni associations from the institutions interviewed, and these data are highly guarded and available only on a limited basis.

<p style="text-align:center">**BLS PROJECTION RESULTS**</p>

The BLS_{WA} model constructed by the authors provides results that are specifically formatted to follow the same conventions as the earlier demand results by Goecker, *et al* (referred to as the Purdue Model in this document). This tabular format is easily

understandable and offers a summarized listing of the estimated number of agriculture and natural resource graduates as well as a clear insight to future employment openings.

Information in Table 1, Purdue Model Projections vs. BLS$_{wa}$ Model Projections, compares the number of projected agriculture and natural resource graduates to the number of projected positions for the year 2008. This table indicates that in the year 2008, college of agriculture and natural resource graduates will face an extremely open job market, with approximately 21,000 more job openings than expected graduates. With many of the anticipated shortages occurring in the scientific, managerial, and marketing clusters, it can be interpreted that as mentioned earlier, much of the growth in the food and fiber sector is expected to occur in agriculture-support and agribusiness type firms. However, it is interesting to note that the BLS$_{WA}$ model does show a significant shortage in the agriculture production cluster; a cluster that has been in steady decline in the past several years.

To test the viability of these estimates, as analysis was completed to show at what point the estimates would turn from surplus (deficit) graduates to deficit (surplus) compared to the estimated supply. Table 1 also shows these results for the Purdue model and the BLS$_{WA}$ model. The Purdue model shows a total of 67,901 positions projected (a shortage of 10,726) and an overall difference of 15.80 percent error to change the shortage to a surplus. The BLS$_{WA}$ model shows a total of 79,087 positions available (a shortage of 21,912) and an overall difference of 27.70 percent error to change the shortage to a surplus.

Tables 2 through 7 show the specific occupation current employment numbers and future estimates that were used to develop the summary table. Each table, represents

a specific employment cluster (Scientists, Engineers, and Related Specialists (Table 2); Managers and Financial Specialists (Table 3); Marketing, Merchandising, and Sales Representatives (Table 4); Communications and Education Specialists (Table 5); Social Service Professionals (Table 6); and Agriculture Production Specialists (Table 7)) also includes occupation-specific information such as Total Openings due to Growth and Net Replacements, Average Annual Growth Total, and Total Employment with Expertise in Agriculture and Natural Resources. Each of these tables (Tables 2 through 7), show the estimated job openings for the ten-year period 1998-2008 for agriculture and natural resource graduates, as well as total job openings. These employment clusters (reported in each table) consist of the projected employment in the 29 industries and 78 occupations. The estimates include both openings due to growth and to replacements.

Analysis of the six employment clusters reveals two points of interest. First, the BLS$_{WA}$ model estimates a shortage of 7,084 Scientists, Engineers, and Related Specialists while the Purdue model shows a small surplus with a small change causing the shortage to become a small surplus. The authors believe this is due to the increasing technical base required in the food and agriculture sectors since the Purdue model was last estimated.

Secondly, the difference in projected deficit (surplus) in the Purdue (BLS$_{WA}$) model for Social Service Professionals and Communication and Education Specialists is of concern. It is speculated that the authors of the Purdue model may have taken into consideration the large number of food and agriculture graduates who return to rural areas and pursue careers in these job clusters that are rural in nature but not technically considered food and agriculture positions. Estimates of the positions in education and

social services are quite possibly larger than an analysis of the BLS industries and occupations considered an agriculture and natural resource for this effort.

Overall, the BLS_{WA} model shows a larger shortage of graduates of 21,912 to fill potential positions. In addition, the robustness of this model shows that all percent errors to change sign are considerably larger than the Purdue model. This increased robustness is encouraging for the use of the BLS_{WA} model.

CONCLUSIONS

The authors have been able to provide estimates for the employment of agriculture and natural resource graduates for 1998 and for 2008 using the BLS data for selected industries and occupations. The outcome of this effort shows more employment available for agriculture and natural resource graduates than estimated in 1993 for the 1995-2000 period in the Purdue model. The data for each employment cluster uses the summation of the 78 occupations for the 29 industries as presented in Appendix B. The estimates for 2008, which are produced with this methodology, could be updated for a later date (it is anticipated that BLS will update these data before the 2005-2010 supply and demand study is completed). In fact, the estimates for both the AGNR (multiplier for agriculture and natural resources) and Employment source readjustment could be adjusted to make new estimates.

The estimates of the number of jobs available in the six employment clusters seem to be reasonable. This approach to estimating the number of employment opportunities should be used in conjunction with the econometric model to provide the most reliable estimates.

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Table 1. Sensitivity Analysis of BLS$_{WA}$ and Purdue Models

Cluster	Projected Graduates[1]	Purdue Model		
		Projected Positions[2]	Difference	Percent Error to Change Sign[3]
Scientists	18,878	18,538	340	2.63
Managers	5,644	7,311	-1,667	22.80
Education	6,223	10,702	-4,479	41.85
Marketing	14,650	15,946	-1,296	8.13
Social Services	6,570	8,569	-1,999	23.33
Agriculture Production	5,210	6,835	-1,625	23.78
Total	57,175	67,901	-10,726	15.80

Cluster	Projected Graduates[1]	BLS$_{WA}$ Model		
		Projected Positions[4]	Difference	Percent Error to Change Sign[3]
Scientists	18,878	25,962	-7,084	27.29
Managers	5,644	15,132	-9,488	62.70
Education	6,223	2,824	3,399	-120.36
Marketing	14,650	21,020	-6,370	30.30
Social Services	6,570	1,309	5,261	-401.91
Agriculture Production	5,210	12,840	-7,630	59.42
Total	57,175	79,087	-21,912	27.70

1. Projected graduates in 2004.
2. Projected positions in 2006.
3. This indicates the maximum percentage error that con occur without converting a surplus
         projection to a shortage projection or vice-versa.
4. Projected positions for 2008.

Table 2. Summary of 1998-2008 Employment Opportunities for Scientists, Engineers, and Related Specialists[1]									
Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total	Average Annual AG NR Total	Average Annual Total Openings	Total Openings due to Growth and Net Replacements
	Actual	Estimated	Percent[2]	Number		Openings	Openings		
	1998	2008		1998	2008				1998/2008
Engineers									
Chemical engineers	48,363	52,967	1.57	759	831	7	24	1,500	15,000
Civil engineers, including traffic engineers	195,028	235,858	1.14	2,215	2,679	46	89	7,800	78,000
Electrical & electronics engineers	356,954	449,582	0.81	2,881	3,629	75	136	16,900	169,000
Industrial engineers, except safety engineers	126,303	142,427	2.55	3,225	3,637	41	87	3,400	34,000
Mechanical engineers	219,654	255,744	2.00	4,390	5,111	72	158	7,900	79,000
All other engineers (includes Agricultural Engineers)	414,611	508,512	1.71	7,098	8,705	161	356	20,800	208,000
Landscape architects	22,060	25,265	36.99	8,160	9,346	119	222	600	6,000
Life and Physical Scientists									
Agricultural & food scientists	21,468	23,816	10.14	2,177	2,415	24	81	800	8,000
Biological scientists	80,950	109,275	1.10	888	1,199	31	49	4,500	45,000
Chemists	96,372	109,732	5.07	4,881	5,558	68	177	3,500	35,000
Foresters & conservation scientists	38,949	45,918	7.30	2,843	3,352	51	51	700	7,000
Geologists, geophysicists, oceanographers	43,880	50,690	3.01	1,321	1,527	21	54	1,800	18,000
All other life scientists	965	1,125	1.66	16	19	0	0	0	0
Meteorologists	8,419	9,649	2.13	179	205	3	6	300	3,000
Statisticians	16,529	16,910	0.86	142	145	0	3	300	3,000
Surveyors	41,333	41,913	1.10	454	460	1	11	1,000	10,000
Technicians/Technologists									
Clinical laboratory technicians and technologists	313,040	366,377	0.19	610	714	10	18	9,300	93,000
Engineering technicians	771,339	897,227	1.23	9,452	10,994	154	369	30,100	301,000
Forest and conservation workers	32,667	32,884	25.52	8,337	8,392	6	179	700	7,000
Gardeners, nursery workers, and laborers, landscaping and groundskeeping*	1,285,272	1,547,621	32.48	417,434	502,640	8,521	20,331	62,600	626,000
Inspectors, testers, and graders, precision	688,730	666,896	6.44	44,341	42,935	-141	985	15,300	153,000
Pest controllers & assistants	51,865	65,021	3.93	2,039	2,556	52	98	2,500	25,000
Science & mathematics technicians	227,444	243,270	8.40	19,109	20,439	133	571	6,800	68,000
Water & liquid waste treatment plant & system operators	98,267	112,184	1.76	1,727	1,971	24	65	3,700	37,000
All other technicians	20,351	21,194	1.17	239	249	1	7	600	6,000
Other Occupations									
Drafters	283,191	301,199	2.23	6,320	6,722	40	192	8,600	86,000
Veterinarians & veterinary inspectors	57,038	71,126	63.17	36,029	44,927	890	1,642	2,600	26,000
Total	5,561,042	6,404,382		587,265	691,357	10,409	25,962		

Table 3. Summary of 1998-2008 Employment Opportunities for Managers, and Financial Specialists[1]								
Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total	Average Annual AG NR Total	Average Annual Total Openings	Total Openings due to Growth and Net Replacements
	Actual	Estimated		Number					
	1998	2008	Percent[2]	1998	2008	Openings	Openings		1998/2008
Accountants and auditors	1,079,726	1,201,630	3.48	37,621	41,869	425	1,007	28,900	289,000
Administrative services managers	364,259	430,246	2.41	8,790	10,382	159	314	13,000	130,000
Budget analysts	59,173	67,291	1.17	690	785	9	24	2,100	21,000
Communication, transportation, and utilities operations managers	195,951	233,723	1.92	3,764	4,490	73	138	7,200	72,000
Construction managers	270,041	307,817	1.69	4,571	5,210	64	144	8,500	85,000
Cost estimators	151,687	171,394	1.48	2,248	2,540	29	58	3,900	39,000
Credit authorizers	16,906	15,092	2.51	424	378	-5	5	200	2,000
Economists	70,032	82,949	2.71	1,896	2,246	35	73	2,700	27,000
Engineering, science, and computer systems managers*	326,229	467,983	2.43	7,939	11,389	345	484	19,900	199,000
Financial managers	693,291	790,646	2.48	17,213	19,630	242	514	20,700	207,000
Food service & lodging managers	594,642	691,364	5.86	34,865	40,536	567	1,178	20,100	201,000
General managers & top executives	3,362,395	3,913,196	4.43	148,849	173,232	2,438	5,047	114,000	1,140,000
Government chief executives & legislators	79,793	82,042	1.80	1,436	1,477	4	40	2,200	22,000
Industrial production managers	208,345	206,508	10.49	21,865	21,672	-19	378	3,600	36,000
Insurance adjusters, examiners, & investigators	180,112	216,881	2.16	3,895	4,690	80	145	6,700	67,000
Insurance claims clerks	479,015	641,644	3.51	16,823	22,534	571	176	5,000	50,000
Claim examiners, property and casualty insurance	48,746	54,828	1.79	873	982	11	25	1,400	14,000
Loan officers & counselors	227,410	275,572	1.80	4,082	4,947	86	176	9,800	98,000
Management analysts	344,494	442,182	4.50	15,501	19,896	440	562	12,500	125,000
Personnel, training, & labor relations managers	367,370	432,966	2.75	10,098	11,901	180	448	16,300	163,000
Property & real estate managers	315,461	358,698	3.83	12,087	13,744	166	330	8,600	86,000
Underwriters	96,949	99,539	1.87	1,815	1,864	5	56	3,000	30,000
All other managers & administrators	2,114,359	2,419,824	5.62	118,837	136,006	1,717	3,811	67,800	678,000
Total	11,646,386	13,604,015		476,182	552,399	7,622	15,132		

Table 4. Summary of 1998-2008 Employment Opportunities for Marketing, Merchandising, and Sales Representatives[1]

Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total Openings	Average Annual AG NR Total Openings	Average Annual Total Openings	Total Openings due to Growth and Net Replacements
	Actual	Estimated	Percent[2]	Number					
	1998	2008		1998	2008				1998/2008
Customer service representatives (Utilities)									
Insurance sales workers	387,295	395,811	3.85	14,895	15,223	33	373	9,700	97,000
Marketing, advertising, & public relations managers	2,583,772	2,846,839	7.61	196,541	216,552	2,001	4,572	60,100	601,000
Purchasing managers	175,977	188,483	6.58	11,572	12,395	82	342	5,200	52,000
Real estate agents & brokers, and appraisers	347,372	381,539	6.19	21,496	23,610	211	644	10,400	104,000
Salespersons, retail	4,056,472	4,619,676	3.94	160,021	182,239	2,222	7,645	193,800	1,938,000
Security & financial services sales workers	303,053	427,386	3.34	10,123	14,277	415	491	14,700	147,000
Wholesale & retail buyers, except farm products	118,201	117,731	7.12	8,413	8,380	-3	206	2,900	29,000
All other sales & related workers	3,387,590	3,945,308	4.70	159,179	185,386	2,621	6,748	143,600	1,436,000
Total	11,359,732	12,922,773		582,241	658,060	7,582	21,020		

Table 5. Summary of 1998-2008 Employment Opportunities for Communication and Education Specialists[1]

Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total Openings	Average Annual AG NR Total Openings	Average Annual Total Openings	Total Openings due to Growth and Net Replacements
	Actual	Estimated			Number				
	1998	2008	Percent[2]	1998	2008	Openings	Openings		1998/2008
Teachers									
College & university faculty	865,356	1,060,502	0.07	574	703	13	29	43,500	435,000
Postsecondary teachers, agriculture *									
High school teachers, agricultural education **									
Other Communication & Information Personnel									
Computer programmers	647,783	838,902	2.67	17,301	22,406	510	1,047	39,200	392,000
Systems analysts	616,915	1,194,234	2.29	14,146	27,384	1,324	1,412	61,600	616,000
Cooperative Extension Services Personnel***									
Public relations specialists & publicity writers	122,329	152,413	3.00	3,670	4,572	90	186	6,200	62,000
Radio & TV announcers & newscasters	60,182	57,576	1.00	605	578	-3	14	1,400	14,000
Writers & editors, including technical writers									
Other Occupations									
Education administrators	447,158	505,456	0.79	3,550	4,012	46	136	17,100	171,000
Total	2,759,723			39,845	59,656	1,981	2,824		

Table 6. Summary of 1998-2008 Employment Opportunities for Social Services Professionals[1]

Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total	Average Annual AG NR Total	Average Annual Total	Total Openings due to Growth and Net
	Actual	Estimated			Number			Openings	Replacements
	1998	2008	Percent[2]	1998	2008	Openings	Openings		1998/2008
Compliance Officers									
Fire fighting & Prevention Supervisors	59,934	66,325	1.81	1,083	1,198	12	47	2,600	26,000
Inspectors & compliance officers,									
except construction	176,175	194,711	1.81	3,196	3,532	34	93	5,100	51,000
All Other Protective Service Workers	166,335	197,946	0.94	1,560	1,856	30	136	14,500	145,000
Counselors	182,260	227,806	0.23	412	515	10	20	8,700	87,000
Dietitians & Nutritionists	53,972	64,291	2.22	1,198	1,427	23	47	2,100	21,000
Human Services Workers	268,444	409,872	0.57	1,526	2,330	80	120	21,100	211,000
Personnel, training, & labor relations specialists	367,370	432,966	2.75	10,098	11,901	180	448	16,300	163,000
Recreation workers	240,651	286,938	0.88	2,110	2,516	41	96	11,000	110,000
Social workers	604,102	822,148	0.86	5,171	7,037	187	253	29,600	296,000
Urban & regional planners	34,702	40,755	1.46	508	596	9	19	1,300	13,000
All other social scientists	50,108	56,495	1.78	892	1,005	11	30	1,700	17,000
Total	2,204,053	2,800,253		27,752	33,914	616	1,309		

Table 7. Summary of 1998-2008 Employment Opportunities for Agricultural Production Specialists[1]

Occupation	Total U.S. Occupational Employment		Employment with Expertise in Agriculture and Natural Resources			Average Annual Growth Total Openings	Average Annual AG NR Total Openings	Average Annual Total Openings	Total Openings due to Growth and Net Replacements
	Actual	Estimated	Percent[2]	Number					
	1998	2008		1998	2008				1998/2008
Farm managers	175,026	173,686	86.73	151,804	150,642	-116	2,515	2,900	29,000
Farmers	1,307,712	1,135,018	6.76	88,404	76,730	-1,167	1,372	20,300	203,000
Supervisors (Farm, Forestry, & Agricultural related occupations)	91,546	97,250	68.73	62,920	66,840	392	1,237	1,800	18,000
All other agricultural, forestry, fishing, and related workers	373,194	379,396	68.28	254,813	259,048	423	7,716	11,300	113,000
Total	1,947,478	1,785,350		557,941	553,259	-468	12,840		

Appendix A:

Industries and Occupations Selected for BLS$_{WA}$ Methodology

Listing of 29 Industries and 78 Occupations Employing Agriculture and Natural Resource Graduates

Industries	SIC
Agriculture, Forestry, Fishing	01,02,07,08,09
Mining	10,12,13,14
Lumber & Other Building Materials	24
Furniture & Fixtures	25
Farm & Garden Machinery	352
Food & Kindred Products	20
Tobacco Production	21
Textile Mill Products	22
Apparel & Other Textile Products	23
Paper & Allied Products	26
Agriculture Chemicals	287
Petroleum & Coal Products	29
Leather & Leather Products	31
Railroad Transportation	40
Local & Urban Transportation	412,413,414,417
Trucking & Warehousing	42
Water Transportation	44
Freight Transportation	473
Groceries & Related Products	514
Lumber & Other Building Materials	521
Retail Nurseries & Garden Stores	526
Food Stores	54
Eating & Drinking Places	58
Fuel Dealers	598
Finance, Insurance, & Real Estate	60-65,67
Business Services	73
Museums, Botanical & Zoological Gardens	84
Federal, State, & Local Government	91,92,93
Self Employed, Primary Occupation	

BLS Occupational Code	Occupation
Scientists	
	Engineers
221140059	Chemical engineers
221210060	Civil engineers, including traffic engineers
221260061	Electrical & electronics engineers
221280062	Industrial engineers, except safety engineers
221350064	Mechanical engineers
221950068	All other engineers (includes Agricultural Engineers)
223080077	Landscape architects
	Life and Physical Scientists
243050080	Agricultural & food scientists
243080081	Biological scientists
241050103	Chemists
243020082	Foresters & conservation scientists
241110104	Geologists, geophysicists, oceanographers
243980084	All other life scientists
241080102	Meteorologists
253120096	Statisticians
223110078	Surveyors
	Technicians/Technologists
329100245	Clinical laboratory technicians and technologists
351010267	Engineering technicians
790020547	Forest and conservation workers
790010557	Gardeners, nursery workers, and laborers, landscaping and groundskeeping
830000749	Inspectors, testers, and graders, precision
670080441	Pest controllers & assistants
245010278	Science & mathematics technicians
950020831	Water & liquid waste treatment plant & system operators
390990304	All other technicians
	Other Occupations
225120275	Drafters
321140196	Veterinarians & veterinary inspectors
Managers	
211140025	Accountants and auditors
130140004	Administrative services managers
211170029	Budget analysts
150230006	Communication, transportation, and utilities operations managers
150170007	Construction managers
219020035	Cost estimators
531140411	Credit authorizers
271020114	Economists
130170009	Engineering, science, and computer systems managers

130020010	Financial managers
150260011	Food service & lodging managers
190050013	General managers & top executives
190020014	Government chief executives & legislators
150140016	Industrial production managers
533020043	Insurance adjusters, examiners, & investigators
531230334	Insurance claims clerks
219210042	Claim examiners, property and casualty insurance
211080046	Loan officers & counselors
219050047	Management analysts
215110038	Personnel, training, & labor relations managers
150110019	Property & real estate managers
211020045	Underwriters
199980021	All other managers & administrators
Marketing	
*	Customer service representatives (Utilities)*
430020311	Insurance sales workers
410020312	Marketing, advertising, & public relations managers
130080020	Purchasing managers
430100317	Real estate agents & brokers, and appraisers
490110320	Salespersons, retail
430140322	Security & financial services sales workers
213020033	Wholesale & retail buyers, except farm products
499950324	All other sales & related workers
Communication, Education	
	Teachers
311000139	College & university faculty
*	Postsecondary teachers, agriculture *
*	High school teachers, agricultural education *
	Other Communication & Information Personnel
251060291	Computer programmers
251020095	Systems analysts
*	Cooperative Extension Services Personnel*
340080234	Public relations specialists & publicity writers
340160215	Radio & TV announcers & newscasters
*	Writers & editors, including technical writers*
	Other Occupations
150050008	Education administrators
Social Service Professionals	
	Compliance Officers
610020503	Fire fighting & Prevention Supervisors
219110039	Inspectors & compliance officers, except construction
630990526	All Other Protective Service Workers
315140189	Counselors
325210198	Dietitians & Nutritionists
273080123	Human Services Workers
215110038	Personnel, training, & labor relations specialists
273110121	Recreation workers
273100124	Social workers

271050116	Urban & regional planners
271980117	All other social scientists
Ag Production	
710050538	Farm managers
710020537	Farmers
720000563	Supervisors (Farm, Forestry, & Agricultural related occupations)
799980570	All other agricultural, forestry, fishing, and related workers

* Not available from 1998 BLS data.

Appendix B:

Final Master Output Table for BLS$_{WA}$ Methodology

		Industries Covered in the Compilation of Ag-Related Industries:															
		Agriculture, Forestry, Fishing		Mining		Lumber & Wood Products		Furniture & Fixtures		Farm & Garden Machinery		Food & Kindred Products		Tobacco Products		Textile Mill Products		Apparel & Other Textile Products	
	Matrix Code:	100000		200000		412400		412500		413520		422000		422100		422200		422300	
Occupation	SIC:	01 02 07 08 09		10 12 13 14		24		25		352		20		21		22		23	
Code:	Year:	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008
	AGNR as % of GNP Multiplier:	1.00	1.00	0.18	0.18	1.00	1.00	0.18	0.18	1.00	1.00	1.00	1.00	1.00	1.00	0.18	0.18	0.18	0.18
	Employment Source Readjustment:	1	1	0.5	0.5	0.25	0.25	0.5	0.5	0.5	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5
Scientists																		
	Engineers																		
221140059	Chemical engineers	0	0	48	29	0	0	0	0	0	0	139	147	0	0	10	9	0	0
221210060	Civil engineers, including traffic engineers	0	0	64	35	20	20	0	0	0	0	100	101	0	0	0	0	0	0
221260061	Electrical & electronics engineers	0	0	37	30	24	26	16	19	101	100	236	253	74	57	8	7	11	12
221280062	Industrial engineers, except safety engineers	0	0	88	56	140	146	83	92	263	246	1,699	1,716	250	182	101	90	91	83
221350064	Mechanical engineers	0	0	50	40	209	225	72	85	751	732	1,901	1,979	202	153	83	84	46	45
221950068	All other engineers (includes Agricultural Engineers)	2,075	1,924	238	166	76	84	105	123	502	494	1,122	1,202	181	138	38	37	39	40
223080077	Landscape architects	7,336	9,244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Life and Physical Scientists																		
243050080	Agricultural & food scientists	1,295	1,250	0	0	0	0	0	0	0	0	454	452	0	0	0	0	0	0
243080081	Biological scientists	59	63	0	0	0	0	0	0	0	0	178	179	0	0	0	0	0	0
241050103	Chemists	782	703	58	34	0	0	0	0	0	0	2,340	2,312	944	679	46	41	0	0
243020082	Foresters & conservation scientists	1,856	1,650	5	3	381	371	0	0	0	0	0	0	0	0	0	0	0	0
241110104	Geologists, geophysicists, oceanographers	0	0	646	363	0	0	0	0	0	0	71	68	0	0	0	0	0	0
243980084	All other life scientists	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
241080102	Meteorologists	0	0	0	0	0	0	0	0	0	0	118	112	0	0	0	0	0	0
253120096	Statisticians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223110078	Surveyors	62	67	71	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Technicians/Technologists																		
329100245	Clinical laboratory technicians and technologists	207	271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
351010267	Engineering technicians	0	0	319	245	297	303	145	158	635	588	2,638	2,637	545	392	179	162	70	64
790020547	Forest and conservation workers	7,873	7,987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
790010557	Gardeners, nursery workers, and laborers, landscaping and groundskeeping*	388,813	491,241	20	16	0	0	0	0	0	0	0	0	0	0	8	7	0	0
830000749	Inspectors, testers, and graders, precision	1,059	905	305	216	4,072	3,503	617	554	663	532	27,284	24,330	474	295	2,238	1,705	2,119	1,448
670080441	Pest controllers & assistants	873	729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245010278	Science & mathematics technicians	1,386	1,428	784	545	18	17	0	0	0	0	14,189	13,140	190	128	153	127	10	6
950020831	Water & liquid waste treatment plant & system	0	0	0	0	0	0	0	0	0	0	56	58	0	0	0	0	0	0
390990304	All other technicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other Occupations																		
225120275	Drafters	1,816	1,951	93	52	973	836	299	278	520	393	395	312	28	17	10	7	18	15
321140196	Veterinarians & veterinary inspectors	34,411	46,857	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Managers																		
211140025	Accountants and auditors	5,503	4,778	803	473	680	653	184	186	259	225	8,122	7,740	474	321	148	127	122	93
130140004	Administrative services managers	963	979	141	106	223	216	58	59	38	33	3,769	3,546	40	27	71	61	84	65
211170029	Budget analysts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150230006	Communication, transportation, and utilities operations managers	413	422	13	8	13	13	0	0	0	0	115	114	0	0	6	5	0	0
150170007	Construction managers	666	718	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219020035	Cost estimators	305	397	11	10	513	533	107	124	32	30	437	427	0	0	15	14	43	37
531140411	Credit authorizers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
271020114	Economists	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130170009	Engineering, science, and computer systems managers*	610	632	234	190	240	287	97	124	444	481	3,503	4,104	87	74	86	93	67	69
130020010	Financial managers	910	916	402	287	545	523	159	160	363	316	6,138	5,818	226	153	129	109	184	140
150260011	Food service & lodging managers	0	0	0	0	0	0	0	0	0	0	58	49	0	0	0	0	0	0

Code	Occupation																		
190050013	General managers & top executives	33,183	38,449	1,503	1,187	5,487	5,444	1,021	1,067	882	793	25,437	25,117	421	294	667	579	1,270	1,091
190020014	Government chief executives & legislators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150140016	Industrial production managers	362	310	13	8	2,006	1,992	449	469	430	386	16,378	15,805	55	39	536	473	542	455
533020043	Insurance adjusters, examiners, & investigators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
531230334	Insurance claims clerks	213	213	0	0	314	354	188	221	0	0	2,928	3,215	199	157	109	117	144	124
219210042	Claim examiners, property and casualty insurance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
211080046	Loan officers & counselors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219050047	Management analysts	268	277	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215110038	Personnel, training, & labor relations managers	1,000	969	202	128	321	308	64	70	130	120	3,115	3,235	225	162	65	57	64	53
150110019	Property & real estate managers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
211020045	Underwriters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
199980021	All other managers & administrators	2,023	1,833	892	625	445	409	149	144	227	189	7,837	7,047	1,640	1,062	165	133	204	142

Marketing

Code	Occupation																		
*	Customer service representatives (Utilities)																		
430020311	Insurance sales workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
410020312	Marketing, advertising, & public relations managers	6,672	8,752	88	84	416	432	133	142	217	201	13,220	13,171	115	82	120	111	173	142
130080020	Purchasing managers	81	98	60	45	383	397	112	119	140	130	2,879	2,920	26	19	60	53	90	75
430100317	Real estate agents & brokers, and appraisers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
490110320	Salespersons, retail	1,587	2,011	0	0	454	461	133	131	0	0	16,414	15,415	0	0	59	50	431	368
430140322	Security & financial services sales workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
213020033	Wholesale & retail buyers, except farm products	0	0	0	0	0	0	0	0	0	0	62	71	0	0	0	0	0	0
499950324	All other sales & related workers	13,201	15,255	391	353	3,213	3,323	683	749	1,228	1,136	34,492	34,095	133	96	428	401	908	761

Communication, Education

Code	Occupation																		
	Teachers																		
311000139	College & university faculty	550	494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*	Postsecondary teachers, agriculture *																		
*	High school teachers, agricultural education **																		
	Other Communication & Information Personnel																		
251060291	Computer programmers	424	312	162	75	101	81	78	64	0	0	1,812	1,408	171	95	71	50	75	44
251020095	Systems analysts	158	261	245	255	131	193	44	71	182	252	1,940	2,899	0	0	66	96	57	65
*	Cooperative Extension Services Personnel***																		
340080234	Public relations specialists & publicity writers	649	483	13	8	0	0	0	0	0	0	766	750	0	0	0	0	0	0
340160215	Radio & TV announcers & newscasters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*	Writers & editors, including technical writers																		
	Other Occupations																		
150050008	Education administrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Social Service Professionals

Code	Occupation																		
	Compliance Officers																		
610020503	Fire fighting & Prevention Supervisors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219110039	Inspectors & compliance officers, except construction	0	0	110	74	0	0	0	0	0	0	64	68	0	0	0	0	0	0
630990526	All Other Protective Service Workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
315140189	Counselors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
325210198	Dietitians & Nutritionists	400	359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
273080123	Human Services Workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215110038	Personnel, training, & labor relations	1,000	969	202	128	321	308	64	70	130	120	3,115	3,235	225	162	65	57	64	53
273110121	Recreation workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
273100124	Social workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
271050116	Urban & regional planners	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
271980117	All other social scientists	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ag Production

Code	Occupation																		
710050538	Farm managers	151,039	149,122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
710020537	Farmers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
720000563	Supervisors (Farm, Forestry, & Agricultural related occupations)	58,095	61,117	0	0	1,078	1,037	0	0	0	0	2,705	2,762	0	0	0	0	0	0
799980570	All other agricultural, forestry, fishing, and related workers	220,944	206,267	11	9	246	247	0	0	53	49	23,821	25,005	0	0	10	11	0	0

[1] Indicates the difference in actual openings. =(1998%*total openings)-(1996%*total openings)

Paper & Allied Products		Ag Chemicals		Petroleum & Coal Products		Leather & Leather Products		Railroad Transportation		Local & Urban Transportation		Trucking & Warehousing		Water Transportation		Freight Transportation		Groceries & Related Products		Lumber & Other Building Materials		Retail Nurseries & Garden Stores		Food Stores	
422600		422870		422900		423100		514000		514199		514200		514400		514730		615140		625210		625260		625400	
26		287		29		31		40		412,412,414,417		42		44		473		514		521		526		54	
1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008
0.18	0.18	1.00	1.00	0.18	0.18	1.00	1.00	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.75	0.75	1.00	1.00	0.50	0.50	0.75	0.75
0.25	0.25	0.5	0.5	0.25	0.25	0.5	0.5	0.25	0.25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.25	0.25	0.5	0.5	0.5	0.5
74	77	287	276	63	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4	0	0	9	7	0	0	12	9	0	0	2	2	2	3	0	0	0	0	0	0	0	0	40	44
45	45	0	0	9	8	0	0	8	6	0	0	1	2	3	3	0	0	22	26	0	0	0	0	0	0
63	62	0	0	20	16	41	30	7	5	0	0	5	6	4	5	0	0	0	0	0	0	0	0	0	0
81	81	121	117	34	28	28	22	3	2	0	0	2	3	3	3	0	0	44	50	0	0	0	0	73	84
170	184	115	112	54	45	0	0	7	6	0	0	3	4	27	32	0	0	30	36	0	0	0	0	125	145
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4	32	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	38	200	184	44	37	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0
10	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	6	5	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
177	177	209	193	45	37	57	41	107	83	0	0	3	4	3	3	3	5	183	201	23	27	0	0	29	33
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	869	952	740	874	5,341	6,628	63	78
602	526	0	0	98	70	1,137	723	226	152	0	0	37	36	6	6	4	5	1,054	1,001	34	35	0	0	378	360
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	73	990	855	129	98	91	66	0	0	0	0	3	3	0	0	0	0	108	111	0	0	0	0	0	0
44	40	203	187	11	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
26	21	55	41	13	8	0	0	25	16	0	0	1	1	0	0	0	0	25	23	193	186	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	47	0	0	0	0	0	0
155	149	0	0	110	82	111	76	10	7	6	5	97	100	22	23	55	75	2,020	2,079	468	519	82	96	2,001	2,118
70	71	0	0	16	12	46	32	22	16	2	1	50	52	10	11	10	14	544	565	152	170	13	15	276	290
0	0	0	0	22	17	0	0	0	0	0	0	6	6	2	2	0	0	63	69	0	0	0	0	42	46
0	0	0	0	0	0	0	0	286	222	21	22	462	503	56	64	141	204	1,477	1,617	91	108	0	0	168	187
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	62	0	0	15	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	611	721	33	41	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	235	193	65	58	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	111	164	176	38	36	52	46	23	21	0	0	23	30	8	11	0	0	333	427	39	53	0	0	131	169
147	144	84	73	40	31	152	104	17	12	3	3	74	76	13	14	19	25	1,449	1,494	225	251	38	44	366	389
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	163	140	0	0	0	0	750	679

452	462	630	563	146	124	771	553	101	76	44	44	949	1,009	65	71	233	326	12,362	13,137	6,155	7,056	1,667	2,008	34,111	37,374
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
315	317	367	328	70	59	309	220	0	0	0	0	0	0	0	0	0	0	23	24	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	148	0	0	38	32	172	137	0	0	0	0	157	188	0	0	0	0	1,445	1,734	488	631	0	0	6,543	7,872
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	70	50	46	51	39	68	48	3	3	1	1	53	57	6	7	4	6	353	387	127	151	0	0	384	426
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
245	216	322	267	90	66	155	102	80	56	3	3	87	87	23	23	31	40	2,135	2,104	684	727	104	116	1,638	1,634
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	118	182	168	15	13	127	93	7	6	0	0	67	74	12	14	89	128	10,000	10,950	10,032	11,848	1,276	1,584	82,517	94,697
65	66	47	43	11	9	70	51	3	3	0	0	9	10	4	5	2	3	2,046	2,016	771	820	169	189	4,275	4,324
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	0	0	0	0	164	117	0	0	0	0	0	0	0	0	3	4	9,745	10,379	40,626	51,339	5,229	6,313	71,765	82,616
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,517	3,466	577	545	107	120	2,799	2,844
802	859	742	683	93	86	588	436	20	15	17	17	517	563	70	79	226	327	43,008	42,382	6,982	7,450	295	331	7,826	7,834
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	24	34	24	14	9	39	22	0	0	1	1	36	34	7	7	20	25	662	620	0	0	0	0	264	250
0	0	56	77	28	33	42	44	12	14	0	0	0	0	6	10	12	25	257	422	0	0	0	0	153	253
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	359	401
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	29	27	0	0	0	0	8	6	0	0	22	23	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	70	50	46	51	39	68	48	3	3	1	1	53	57	6	7	4	6	353	387	127	151	0	0	384	426
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	77	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	24	0	0	0	0	0	0	0	0	0	0	65	72	2	2	0	0	8,262	9,951	0	0	131	163	227	275

Eating & Drinking Places		Fuel Dealers		Finance, Insurance, & Real Estate		Business Services		Museums & Botanical & Zoological Gardens		Federal, State, & Local Government		Self Employed Primary		Sum		Total in all Industries		Ag as Percentage:		1996 Percentages:	%Δ in Percentages:	Difference in Actual Openings:[1]
625800		625980		700000		807300		808400		909100-300		000005										
58		598		60-65,67		73		84		91,92,93												
1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1996	1996-1998	1996-1998
0.25	0.25	0.18	0.18	0.18	0.18	0.18	0.18	0.25	0.25	0.18	0.18	0.18	0.18									
0.25	0.25	0.1	0.1	0.1	0.1	0.1	0.1	0.25	0.25	0.1	0.1	0.5	0.5									
0	0	0	0	1	1	17	30	0	0	20	17	99	107	759	735	48,363	52,967	1.57	1.39	4	(60.79)	(1,176)
0	0	0	0	12	14	21	35	0	0	1,146	1,182	784	954	2,215	2,409	195,028	235,858	1.14	1.02	5	(77.28)	(7,536)
0	0	0	0	23	29	532	1,115	0	0	577	524	1,155	1,440	2,881	3,700	356,954	449,582	0.81	0.82	2	(59.64)	(4,258)
0	0	0	0	14	17	107	196	0	0	55	50	194	221	3,225	3,217	126,303	142,427	2.55	2.26	4	(36.16)	(1,827)
0	0	0	0	25	31	175	291	0	0	208	199	282	320	4,390	4,571	219,654	255,744	2.00	1.79	4	(50.04)	(4,396)
0	0	0	0	123	153	577	1,109	0	0	708	718	785	961	7,098	7,712	414,611	508,512	1.71	1.52	40	(95.72)	(158,747)
0	0	0	0	1	1	0	0	0	0	15	12	808	914	8,160	10,171	22,060	25,265	36.99	40.26	100	(63.01)	(13,900)
0	0	0	0	5	6	3	5	4	5	125	124	289	328	2,177	2,172	21,468	23,816	10.14	9.12	100	(89.86)	(19,291)
0	0	0	0	2	3	6	9	5	8	548	633	56	84	888	1,011	80,950	109,275	1.10	0.93	20	(94.51)	(15,302)
0	0	0	0	1	1	47	71	0	0	245	243	136	130	4,881	4,478	96,372	109,732	5.07	4.08	5	1.30	63
0	0	0	0	2	3	0	0	0	0	431	481	158	191	2,843	2,708	38,949	45,918	7.30	5.90	100	(92.70)	(36,106)
0	0	0	0	6	8	15	24	0	0	175	169	401	399	1,321	1,037	43,880	50,690	3.01	2.04	2	50.57	444
0	0	0	0	0	0	0	0	0	0	16	18	0	0	16	18	965	1,125	1.66	1.62	23	(92.79)	(206)
0	0	0	0	0	0	9	11	0	0	53	51	0	0	179	174	8,419	9,649	2.13	1.80	4	(46.78)	(158)
0	0	0	0	62	65	3	4	0	0	76	68	0	0	142	137	16,529	16,910	0.86	0.81	9	(90.48)	(1,346)
0	0	0	0	4	4	4	4	0	0	109	93	202	270	454	487	41,333	41,913	1.10	1.16	8	(86.28)	(2,853)
0	0	0	0	4	5	5	7	0	0	324	322	69	104	610	710	313,040	366,377	0.19	0.19	3	(93.51)	(8,782)
0	0	0	0	44	51	1,414	2,433	0	0	1,696	1,651	631	740	9,452	10,225	771,339	897,227	1.23	1.14	4	(69.37)	(21,402)
0	0	0	0	0	0	0	0	0	0	349	362	115	109	8,337	8,458	32,667	32,884	25.52	25.72	50	(48.96)	(7,997)
79	98	6	5	1,392	1,493	650	958	152	229	1,432	1,600	17,867	21,202	417,434	525,383	1,285,272	1,547,621	32.48	33.95	5	549.56	353,170
0	0	0	0	36	36	1,322	1,917	0	0	306	280	270	266	44,341	38,900	688,730	666,896	6.44	5.83	5	28.76	9,904
0	0	0	0	0	0	782	1,005	0	0	46	44	338	412	2,039	2,190	51,865	65,021	3.93	3.37	10	(60.69)	(3,148)
0	0	0	0	46	50	143	204	17	24	515	476	260	326	19,109	17,674	227,444	243,270	8.40	7.27	7	20.02	3,188
0	0	0	0	0	0	0	0	0	0	1,413	1,583	0	0	1,727	1,877	98,267	112,184	1.76	1.67	2	(12.14)	(239)
0	0	0	0	0	0	0	0	0	0	203	210	34	43	239	255	20,351	21,194	1.17	1.20	4	(70.63)	(575)
0	0	0	0	18	17	518	766	0	0	176	158	1,120	1,379	6,320	6,475	283,191	301,199	2.23	2.15	2	11.59	656
0	0	0	0	0	0	0	0	0	0	38	35	1,536	1,656	36,029	48,595	57,038	71,126	63.17	68.32	100	(36.83)	(21,009)
644	746	9	8	2,264	2,594	816	1,245	36	51	2,323	2,126	10,097	11,770	37,621	38,466	1,079,726	1,201,630	3.48	3.20	2	74.22	16,027
126	147	2	2	841	931	534	816	56	79	636	617	0	0	8,790	8,933	364,259	430,246	2.41	2.08	1	141.30	5,147
18	22	0	0	90	103	48	86	0	0	401	431	0	0	690	782	59,173	67,291	1.17	1.16	1	16.63	98
40	50	3	3	9	10	25	40	0	0	425	467	0	0	3,764	4,057	195,951	233,723	1.92	1.74	1	92.09	1,804
0	0	0	0	92	105	31	46	0	0	129	144	3,653	4,118	4,571	5,131	270,041	307,817	1.69	1.67	1	69.27	1,871
0	0	0	0	17	20	51	79	0	0	0	0	0	0	2,248	2,506	151,687	171,394	1.48	1.46	2	(25.91)	(786)
0	0	0	0	92	85	32	36	0	0	0	0	0	0	424	371	16,906	15,092	2.51	2.46	3	(16.48)	(84)
0	0	0	0	192	249	116	201	0	0	198	193	1,390	1,395	1,896	2,038	70,032	82,949	2.71	2.46	5	(45.86)	(1,606)
11	16	0	0	430	578	675	1,535	16	29	534	639	0	0	7,939	9,928	326,229	467,983	2.43	2.12	5	(51.33)	(8,372)
134	156	3	3	3,667	4,184	751	1,086	59	84	470	489	446	644	17,213	17,725	693,291	790,646	2.48	2.24	1	148.28	10,280
16,764	20,155	0	0	111	100	1	1	16	19	1	1	17,000	19,679	34,865	40,823	594,642	691,364	5.86	5.90	2	193.16	22,972

9,443	11,287	132	122	5,897	6,816	4,207	6,457	204	299	1,412	1,509	0	0	148,849	163,312	3,362,395	3,913,196	4.43	4.17	2	121.34	81,601
0	0	0	0	0	0	0	0	0	0	1,436	1,477	0	0	1,436	1,477	79,793	82,042	1.80	1.80	1	80.00	638
0	0	0	0	1	1	9	12	0	0	1	1	0	0	21,865	20,897	208,345	206,508	10.49	10.12	1	949.45	19,781
0	0	0	0	2,930	3,566	10	14	0	0	86	81	870	973	3,895	4,635	180,112	216,881	2.16	2.14	1	116.27	2,094
0	0	14	14	2,595	3,440	1,151	1,920	0	0	0	0	0	0	16,823	20,515	479,015	641,644	3.51	3.20	1	251.20	12,033
0	0	0	0	848	951	5	10	0	0	20	21	0	0	873	982	48,746	54,828	1.79	1.79	2	(10.47)	(102)
0	0	0	0	3,998	4,880	5	9	0	0	79	60	0	0	4,082	4,949	227,410	275,572	1.80	1.80	1	79.52	1,808
0	0	0	0	372	518	211	368	0	0	1,245	1,413	13,399	17,280	15,501	19,859	344,494	442,182	4.50	4.49	1	349.96	12,056
120	148	0	0	718	832	538	898	18	27	1,152	1,254	1,198	1,650	10,098	11,151	367,370	432,966	2.75	2.58	5	(45.03)	(8,270)
0	0	0	0	2,476	2,949	2	3	0	0	346	384	9,264	10,395	12,087	13,731	315,461	358,698	3.83	3.83	1	283.17	8,933
0	0	0	0	1,714	1,763	0	0	0	0	1	1	100	83	1,815	1,847	96,949	99,539	1.87	1.86	2	(6.39)	(124)
367	407	2	2	1,951	2,048	1,375	2,042	141	191	1,825	1,867	94,001	#####	118,837	134,893	2,114,359	2,419,824	5.62	5.57	1	462.05	97,694
0	0	0	0	4,911	5,268	0	0	0	0	0	0	9,984	9,000	14,895	14,268	387,295	395,811	3.85	3.60	2	92.30	7,149
819	1,009	71	67	1,774	2,077	1,216	1,896	127	192	149	156	66,798	63,047	196,541	211,251	2,583,772	2,846,839	7.61	7.42	5	52.14	67,353
22	25	5	4	65	75	73	122	13	20	73	78	18	17	11,572	11,734	175,977	188,483	6.58	6.23	2	228.80	8,053
0	0	0	0	1,480	1,609	0	0	0	0	49	44	19,966	22,030	21,496	23,682	347,372	381,539	6.19	6.21	5	23.76	4,127
2,321	2,780	43	39	12	13	40	59	0	0	183	173	10,812	9,687	160,021	181,955	4,056,472	4,619,676	3.94	3.94	3	31.49	38,327
0	0	0	0	4,037	5,647	1	2	0	0	0	0	6,085	8,881	10,123	14,529	303,053	427,386	3.34	3.40	2	67.02	4,062
8	9	0	0	0	0	4	6	0	0	3	3	1,336	1,145	8,413	8,210	118,201	117,731	7.12	6.97	1	611.78	7,231
722	804	35	30	2,311	2,786	8,915	15,384	195	294	101	111	31,037	29,711	159,179	166,348	3,387,590	3,945,308	4.70	4.22	5	(6.02)	(10,200)
0	0	0	0	0	0	0	0	0	0	24	26	0	0	574	520	865,356	1,060,502	0.07	0.05	2	(96.68)	(16,733)
																				100		
																				100		
0	0	0	0	1,190	1,090	5,071	8,593	8	11	5,071	9,783	1,957	2,704	17,301	25,324	647,783	838,902	2.67	3.02	2	33.54	4,346
62	114	0	0	1,575	2,661	2,780	7,818	10	22	1,627	2,355	4,708	7,650	14,146	25,588	616,915	1,194,234	2.29	2.14	5	(54.14)	(16,700)
150	189	0	0	159	192	159	240	48	73	263	277	1,104	1,440	3,670	4,053	122,329	152,413	3.00	2.66	4	(25.00)	(1,223)
31	35	0	0	0	0	0	0	0	0	0	0	573	572	605	607	60,182	57,576	1.00	1.05	1	0.47	3
																				4		
0	0	0	0	1	2	0	0	4	6	105	115	3,439	3,857	3,550	3,979	447,158	505,456	0.79	0.79	2	(60.31)	(5,394)
0	0	0	0	0	0	0	0	0	0	1,057	1,169	25	26	1,083	1,195	59,934	66,325	1.81	1.80	3	(39.79)	(715)
0	0	0	0	111	129	16	23	0	0	2,451	2,669	386	544	3,196	3,564	176,175	194,711	1.81	1.83	4	(54.65)	(3,851)
10	12	0	0	48	56	431	549	0	0	1,070	1,191	0	0	1,560	1,808	166,335	197,946	0.94	0.91	3	(68.75)	(3,431)
0	0	0	0	0	0	2	2	0	0	323	350	88	139	412	491	182,260	227,806	0.23	0.22	2	(88.70)	(3,233)
90	111	0	0	0	0	0	0	0	0	178	190	503	604	1,198	1,299	53,972	64,291	2.22	2.02	100	(97.78)	(52,774)
0	0	0	0	0	0	0	0	0	0	1,526	1,843	0	0	1,526	1,843	268,444	409,872	0.57	0.45	1	(43.15)	(1,158)
120	148	0	0	718	832	538	898	18	27	1,152	1,254	1,198	1,650	10,098	11,151	367,370	432,966	2.75	2.58	1	174.87	6,424
0	0	0	0	16	19	0	0	0	0	2,019	2,245	75	110	2,110	2,373	240,651	286,938	0.88	0.83	10	(91.23)	(21,955)
0	0	0	0	15	18	4	6	0	0	4,032	5,405	1,119	1,010	5,171	6,440	604,102	822,148	0.86	0.78	2	(57.20)	(6,911)
0	0	0	0	0	0	0	0	0	0	508	584	0	0	508	584	34,702	40,755	1.46	1.43	11	(86.70)	(3,310)
0	0	0	0	17	19	29	44	5	7	394	389	446	543	892	1,001	50,108	56,495	1.78	1.77	2	(11.04)	(111)
0	0	0	0	0	0	0	0	0	0	0	0	765	727	151,804	149,849	175,026	173,686	86.73	86.28	25	246.93	108,048
0	0	0	0	0	0	0	0	0	0	0	0	88,404	77,862	88,404	77,862	1,307,712	1,135,018	6.76	6.86	25	(72.96)	(238,524)
0	0	0	0	112	122	0	0	0	0	55	52	798	958	62,920	66,115	91,546	97,250	68.73	67.98	10	587.30	53,765
0	0	0	0	76	101	108	159	32	49	362	384	437	412	254,813	243,179	373,194	379,396	68.28	64.10	5	1265.58	236,153

Appendix C:

List of Files Used in BLS$_{WA}$ Methodology

List of Data Files Used in BLS_{WA} Methodology

BLS Files Used:

File Name:	File Type:	File Use:
pmbt9808.dat	data file	Contains entire BLS 1998-2008 Employment Matrix
Matdoc98.txt	text file	Contains description of pmbt9808.dat file including column names and character definitions
codes.txt	text file	Titles and 9-digit codes for Occupations and Titles and 6-digit codes for Industries

Proprietary Data Files Used:

File Name:	File Type:	File Use:
matrix.mdb	MS Access file	Contains tables and query results of all 28 industries and 79 occupations used in BLS$_{WA}$ model
9digit_1.xls	MS Excel file	These files contain the results of the MS Access queries performed on the raw BLS data
9digit_2.xls	MS Excel file	
Ag Employment.xls	MS Excel file	This file contains the BLS$_{WA}$ Master Table and individual cluster sheets derived from the Master Table