

Research Documentation

Identifying Regional Skill Shortages
Dayton Metropolitan Statistical Area



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Background

This applied research report reviews different planning models and their indicators of occupational skill shortages. The goal is to improve the economic returns on public training investments. The training investment review process requires labor market information about both the supply and demand conditions of specific occupational labor markets. From that perspective, the following section of this report analyzes current occupational skill shortages in the Dayton MSA.

Occupational Skill Shortages in the Dayton MSA for Possible Training Investments

This analysis focuses upon the sub-baccalaureate occupations in the Dayton MSA that require at least moderate on-the-job training (i.e., one to twelve months combined experience and training). Occupations that require only short-term, on-the-job training (OJT) of less than one month were eliminated, because they involve quick job instruction with little or no formal training. Baccalaureate and above-related occupations were also removed from this analysis for two reasons. First, workforce development training funds are generally restricted to Associate Degree programs and structured training of shorter duration. Secondly, graduates of higher education demonstrate high rates of geographic mobility across state lines, which force the labor market analyst to use the whole nation as the geographic unit of analysis for BA/BS and above-related occupations.¹ This supply/demand analysis of occupational skill shortages is focused upon the Dayton MSA, which results in an emphasis upon sub-baccalaureate jobs.

The foundation for the following analysis is the “high employment prospects” section of the Ohio Bureau of Labor Market Information (BLMI) report, entitled *Dayton MSA Job Outlook to 2014*.² The “high employment” portion of the Dayton MSA projections report listed only occupations that paid at least \$12.00 per hour in 2004 and had at least 25 annual job openings over the projections horizon of 2004-2014, arrayed by education/training levels. The following table (pp. 4-5) refines this information to highlight (in yellow) those 12 occupations within the “high employment” parameters that also pay above average wages within each education/training stratum and have projected rates of employment growth above the average change in employment for all occupations in Ohio, 2004-2014, of 7.3%.³

To these dozen occupations, this analysis applied several different planning models with which to assess both the supply and demand forces impacting upon these occupational labor markets:

- the human resource accounting model with occupational employment projections and training and licensing data
- occupational wage data over time (i.e., longitudinal, albeit not the same cohort, see appendix II) compared to the Consumer Price Index (CPI) over the same time period⁴
- hard-to-fill job order statistics from the Ohio Job Matching System Job Bank, linked to the long-term, Ohio occupational employment projections

- keyword analyses of the 2004 job orders and resumes from America's Job Bank (AJB)
- national supply/demand conclusions about these 12 occupational labor markets by the U.S. Bureau of Labor Statistics (BLS) analysts in the current edition of the *Occupational Outlook Handbook* (OOH) and its statistical supplement, *Occupational Projections and Training Data*, were referenced⁵
- local Dayton job vacancy survey by researchers at Wright State University and the University of Dayton⁶

Throughout this report, the definition of occupational skill shortages refers to an inadequate supply of skilled labor for a specific occupational labor market within the Dayton MSA at prevailing labor market wages with which to meet the hiring demand from employers. These occupational skill shortages lead to upward pressures on occupational wage rates, and the possibility of production bottlenecks developing due to the lack of required, skilled labor at prevailing wages. The skill shortages also represent training investment opportunities and tend to provide the greatest economic returns to human capital investments in terms of job placement rates post training, employment stability, and wage levels.

Dayton MSA

Occupations with High Employment Prospects By Education/Training Level

(Occupations paying at least \$12.00 an hour and having at least 25 annual openings)

Sub-Baccalaureate Occupations Requiring More Than One Month of On-The-Job (OJT) Training

Code	Occupational Title*	Employment		Change in Employment		Total Annual Openings	Average Wage 2004
		2004 Annual	2014 Projected	2004 - 2014	Percent		
Occupations Requiring Moderate-Term On-the-Job Training (one to twelve months combined experience/training)							
41-4011	Sales Rep., Wholesale & Mfg, Tech./Sci. Prod.	1,490	1,740	250	16.8%	64	\$37.40
41-4012	Sales Rep., Wholesale/Mfg, Ex. Tech./Sci. Prod.	4,040	4,400	360	8.9%	142	\$25.65
51-4032	Drilling & Boring Machine Tool Setters, O/T, M/P	1,690	1,340	-350	-20.7%	49	\$21.29
47-2073	Operating Engineers & Other Con. Equip. Op.	740	810	70	9.5%	26	\$18.79
53-3032	Truck Drivers, Heavy and Tractor-Trailer	4,430	4,090	-340	-7.7%	72	\$18.63
51-9061	Inspectors/Testers/Sorters/Samplers/Weighers	2,400	2,210	-190	-7.9%	55	\$18.29
33-3012	Correctional Officers and Jailers	700	810	110	15.7%	26	\$16.75
43-6011	Executive Secretaries & Admin. Assistants	4,280	4,310	30	0.7%	85	\$16.21
49-9042	Maintenance and Repair Workers, General	3,610	3,840	230	6.4%	92	\$15.74
51-2092	Team Assemblers	9,890	8,680	-1,210	-12.2%	256	\$15.60
47-2061	Construction Laborers	1,390	1,530	140	10.1%	32	\$15.45
47-2141	Painters, Construction and Maintenance	1,080	1,230	150	13.9%	31	\$14.66
51-4031	Cutting/Punching/Press Machine S/O/T, M/P	1,500	1,260	-240	-16.0%	35	\$14.15
43-4051	Customer Service Representatives	5,300	6,000	700	13.2%	149	\$14.08
43-3021	Billing & Posting Clerks & Machine Operators	1,590	1,580	-10	-0.6%	27	\$13.43
43-3031	Bookkeeping, Accounting, and Auditing Clerks	5,680	5,560	-120	-2.1%	106	\$13.37
51-4072	Molding/Coremaking/Casting Mach. S/O/T, M/P	1,160	950	-210	-18.1%	29	\$13.25
43-6014	Secretaries, Ex. Legal, Medical, & Executive	6,420	6,080	-340	-5.3%	123	\$12.90
21-1093	Social and Human Service Assistants	550	730	180	32.7%	28	\$12.45
31-9091	Dental Assistants	840	1,100	260	31.0%	49	\$12.43

Interpolated employment median occupational wage=\$15.60; employment weighted average of average occupational wage=\$16.60

Occupations Requiring Long-Term On-the-Job Training (twelve months or more combined experience/training)							
47-2111	Electricians	2,020	2,290	270	13.4%	67	\$23.33
33-3051	Police and Sheriff's Patrol Officers	1,270	1,540	270	21.3%	60	\$22.32
47-2152	Plumbers, Pipefitters, and Steamfitters	1,320	1,470	150	11.4%	45	\$21.37
51-4041	Machinists	2,680	2,340	-340	-12.7%	63	\$18.81
49-9021	Heating, AC, & Refrigeration Mechanics/Installers	730	930	200	27.4%	30	\$18.33
49-9052	Telecommunications Line Installers & Repairers	760	800	40	5.3%	25	\$17.15
47-2031	Carpenters	2,380	2,660	280	11.8%	67	\$16.38
33-2011	Fire Fighters	1,130	1,380	250	22.1%	58	\$14.64
51-4121	Welders, Cutters, Solderers, and Brazers	1,370	1,330	-40	-2.9%	39	\$14.32

Interpolated employment median occupational wage=\$18.81; employment weighted average of average occupational wage=\$18.74

Dayton MSA

Occupations with High Employment Prospects By Education/Training Level

(Occupations paying at least \$12.00 an hour and having at least 25 annual openings)

Sub-Baccalaureate Occupations Requiring More Than One Month of On-The-Job (OJT) Training

Code	Occupational Title*	Employment		Change in Employment		Total Annual Openings	Average Wage 2004
		2004 Annual	2014 Projected	2004 - 2014	Percent		
Occupations Requiring Work Experience in a Related Occupation							
41-1012	First-Line Sup./Mgrs of Non-Retail Sales Workers	1,300	1,380	80	6.2%	33	\$36.89
13-1023	Purchasing Agents, Ex. Whole., Retail, & Farm	1,550	1,590	40	2.6%	43	\$27.45
51-1011	FL Sup/Mgrs of Production/Operating Workers	2,970	2,830	-140	-4.7%	62	\$26.19
49-1011	FL Sup/Mgrs of Mechanics/Installers/Repairers	1,520	1,630	110	7.2%	49	\$25.76
13-1051	Cost Estimators	720	810	90	12.5%	25	\$24.20
47-1011	First-Line Sup/Mgrs of Con. Trades/Extract. Work	1,670	1,930	260	15.6%	54	\$23.98
43-1011	First-Line Sup/Mgrs of Office & Admin. Support	3,430	3,420	-10	-0.3%	74	\$20.22
11-9051	Food Service Managers	1,080	1,220	140	13.0%	32	\$17.46
41-1011	First-Line Superv./Mgrs of Retail Sales Workers	4,390	4,800	410	9.3%	120	\$16.38
35-1012	FL Sup/Mgrs of Food Prep. & Serving Workers	2,070	2,290	220	10.6%	71	\$12.56

Interpolated employment median occupational wage=\$20.22; employment weighted average of average occupational wage=\$21.75

Occupations Requiring Postsecondary Vocational Training							
29-2061	Licensed Practical & Licensed Vocat Nurses	3,100	3,470	370	11.9%	105	\$18.00
49-3031	Bus & Truck Mechanics & Diesel Engine Spec.	1,040	1,070	30	2.9%	30	\$17.27
49-3023	Automotive Service Technicians and Mechanics	2,380	2,700	320	13.4%	95	\$16.32
43-6013	Medical Secretaries	2,370	2,570	200	8.4%	65	\$12.08

Interpolated employment median occupational wage=\$16.32; employment weighted average of average occupational wage=\$15.89

Occupations Requiring an Associate Degree							
29-1111	Registered Nurses**	8,750	10,470	1,720	19.7%	355	\$23.67
29-2034	Radiologic Technologists and Technicians	810	950	140	17.3%	29	\$20.92
15-1041	Computer Support Specialists	1,360	1,600	240	17.6%	41	\$20.04
29-1126	Respiratory Therapists	420	540	120	28.6%	26	\$18.80

Interpolated employment median occupational wage=\$23.67; employment weighted average of average occupational wage=\$22.86

***Abbreviations**

FL Sup/Mgrs = First-Line Supervisors/Managers

M/P = Metal and Plastic

O/T = Operators and Tenders

S/O/T = Setters, Operators and Tenders

**Training is met through a two-year associate degree; a three year diploma; or four year bachelor's program.

+Average Annual Salary

Source: Ohio Department of Job and Family Services, Bureau of Labor Market Information.

Occupations Requiring An Associate Degree

Registered Nurses (RNs)

For occupations that require an Associate Degree within the Dayton MSA over the decade of 2004-2014, only registered nurses potentially meet the high standards of the occupational skill shortage definition noted above. With projected change in employment of 19.7% and an average wage in 2004 of \$23.67, the Dayton area RN occupational labor market warrants careful review of both supply and demand forces.⁷

At the state level, the 4,630 annual job openings for RNs projected by the Ohio Bureau of Labor Market Information (BLMI), 2004-2014, appear greater than available supply. We base this conclusion on the FY 2006 output level of 5,397 trained RN graduates from structured training programs in the Classification of Instructional Programs (CIP) code 51.1601 (RN associate degrees, awards of at least 2 but less than 4 academic years below the bachelor's level, and bachelor's degrees).⁸ Since not all RN training program completers will enter the civilian labor market due to licensing difficulties, family responsibilities, additional education, or military service, only a percentage of the training graduates of registered nursing programs should be compared with the projected RN annual job openings. Even if 85% of the RN training graduates pass their licensing exams and enter the civilian RN labor market in the state, the Ohio projected annual demand for registered nurses to fill available job openings will still exceed the estimated new supply of trained nursing graduates. In CY 2006, the Ohio nursing board reported 5,555 new RN licenses issued by examination.⁹ For many of the reasons noted above, not all recipients of newly issued Ohio RN licenses will enter the Ohio labor market. If 80% or less of the RNs with new Ohio licenses due to examination enter the Ohio RN labor market, demand will continue to exceed supply.

As a result, labor market analysts would expect to see indications of upward pressure on RN wages, which has been the case in Ohio and the Dayton area.

Percent Change, Median Annual Wage for RNs, Ohio, 2002 - 2006 (Occupational Employment Statistics) ¹⁰	18.1%
Percent Change, Hourly Rate for RNs, Dayton-Springfield Area, 2001 - 2005 (National Compensation Surveys) ¹¹	26.3%
Percent Change, Consumer Price Index, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ¹²	10.9%

In the Dayton MSA, the Ohio BLMI projected 355 RN annual job openings, 2004-2014, were exceeded by the output of 567 RN graduates from the associate degree, certificate, and bachelor's degree registered nurse educational programs in FY 2006 from the Dayton area training institutions of Clark State Community College, Community Hospital School of Nursing, Kettering College of Medical Arts, Sinclair Community College, and the main campus of Wright State University.¹³ Even after adjusting the RN training completer totals for graduates that choose not to enter the

local RN labor market after graduation, the above registered nurse training programs in the aggregate appear to be training many Dayton RN graduates for job placement outside of the local labor market area.

The fact that RN wages are increasing much faster than the CPI is an important summary indicator of the dynamics of the local and state RN occupational labor market, which encompasses both the supply and demand actors. Another important set of occupational skill shortage indicators, which incorporate both the supply and demand-side moves and countermoves in the RN labor market, are the statewide “hard-to-fill” job order statistics from the Ohio Job Matching System internet job bank. Occupational wages over time reflect the movement in the equilibrium point between supply and demand in competitive labor markets. As a complementary indicator, the hard-to-fill job order statistics for RN occupations that are projected to have above average growth, which pay at or above the 25th percentile of the Ohio wage distribution for registered nurses, from companies with decent work environments, bring an important time dimension to the analysis of occupational skill shortages.¹⁴

Throughout CY 2006 ($n= 66$ high quality RN job orders), more than 39% of these Ohio Job Matching System job orders from employers in Ohio, that paid satisfactory wages for registered nurses and offered decent working conditions, remained open 62 days or more, with an average of 89 days open for the quality RN job orders.¹⁵ Employers close Ohio Job Matching System job orders when positions are filled to avoid the inconvenience of referrals when no positions are available, or when the employer believes the likelihood of Ohio Job Matching System job referrals is low due to skill shortages. The fact that a large proportion of RN job orders in the Ohio Job Matching System Job Bank from Ohio employers, that paid decent wages and provided good work environments, remained open two months or more in 2006, for an occupation that is projected to experience above average, employment growth rates in the Dayton area, statewide, and nationally, is a significant occupational skill shortage indicator. This skill shortage indicator for registered nurses is reinforced by the increases in the longitudinal RN wage data, which are increasing significantly faster than the rate of increase of the CPI.

The fourth skill shortage indicator for registered nurses comes from another internet job bank, America’s Job Bank (AJB). Transactions data from internet job banks such as Ohio Job Matching System and AJB are especially important to labor market analysts as complements to the employment projections, because of the “real” nature of the job bank data coming from employers. The Caldwell Economic Information Services (CEIS) contractor for the Ohio BLMI analyzed CY 2004 AJB job orders and resumes.¹⁶ CEIS created a ratio of AJB job orders from employers that contained the keyword of *RN* for comparison with AJB resumes that also contained the *RN* keyword. The ratio of RN orders/resumes was 177.15, meaning the employers shouted the need for RN skills through their AJB job orders, but the supply of AJB job seekers with the *RN* keyword in their resumes fell far short of the job order-advertised, employer demand. As a second AJB indicator of employer demand for

registered nurses, fully 90% of the CY 2004 resumes in AJB with the *RN* keyword were viewed by employers, which was the highest proportion of keyword resumes viewed by employers in the sector of healthcare practitioners and technical, Standard Occupational Classification (SOC) Group 29.¹⁷

Both national and local labor market analysts support the preceding conclusions of skill shortages in the registered nurse occupational labor market. The U.S. Bureau of Labor Statistics (BLS) analysts believe the employment opportunities for qualified applicants seeking RN positions will be “excellent” across the country, meaning the RN job openings will be “more numerous” than job seekers, with employment projected to “grow much faster than average for all occupations through 2014, and because the occupation is very large, many new jobs will result.”¹⁸ As BLS emphasized:

“In fact, registered nurses are projected to create the second largest number of new jobs among all occupations. Thousands of job openings also will result from the need to replace experienced nurses who leave the occupation, especially as the median age of the registered nurse population continues to rise.”¹⁹

The centers for urban and public affairs and business research at Wright State University (WSU) and the University of Dayton (UD), in their recent December, 2006, job vacancy survey, found that Dayton area (Montgomery County) employers were “constantly recruiting” for the “hard-to-fill” occupation of registered nurse.²⁰

Furthermore, RN occupational skill shortages have significant economic development implications for the Dayton MSA, as well. The employment of registered nurses is heavily concentrated in Ohio and nationally in the private hospital industry, North American Industrial Classification System (NAICS) code 622. About half of all RNs work in the private hospital industry, and they are projected to continue to do so at approximately the same degree of employment concentration through 2014, by both the BLS nationally and by BLMI in Ohio.²¹ In terms of industry staffing patterns and production functions, more than one-quarter of all private hospital employment in the U.S. and Ohio is composed of the single RN occupational skill category, making registered nurses a critical labor input to the hospital industry production process for medical services. The critical RN labor input is projected to grow in importance and represent about 30% of both the national and Ohio private hospital industry employment in 2014.²²

With respect to the Dayton MSA, the private hospital industry is an export industry, with a 1.5 location quotient (LQ).²³ The LQ statistic for the Dayton MSA private hospital industry indicates this industry exports medical goods, research, and services outside of the local metropolitan area and brings outside capital into the local area in return, as indicated by the above standard concentration of hospital industry employment in the Dayton MSA.²⁴ This LQ statistic is consistent with the 2006 rankings by the *U.S. News and World Report* hospital quality index of the Kettering

Memorial Hospital in the Dayton area as one of the top 176 best hospitals in the U.S. (ranked 40th in the medical specialty of digestive disorders).²⁵

In addition to its status as an export industry, the local private hospital industry, in which the employment of RNs is so heavily concentrated, appears to offer growing employment impervious to economic recessions. The most recent recession occurred between March, 2001, and November, 2001, peak to trough.²⁶ As shown in the following Dayton MSA economic development profile, the local hospital industry appeared not to notice. The number of hospital establishments, hospital total employees and wages, and the hospital industry average annual wage all increased by healthy percentages from 2000-2005 in the Dayton MSA.

Summary Profile for: Dayton MSA²⁷

NAICS Code: 622 – Hospitals								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000-2005	Percent Change 2000-2005
Number of Establishments	17	Economic Recession	20	18	18	18	1	5.9%
All Employees	17,358	Economic Recession	18,521	18,724	19,050	19,507	2,149	12.4%
Total Wages (in thousands)	\$557,443	Economic Recession	\$620,492	\$662,127	\$710,173	\$746,159	\$188,716	33.9%
Average Annual Wage	\$32,114	Economic Recession	\$33,502	\$35,363	\$37,280	\$38,251	\$6,137	19.1%

With regard to the hospital industry in the Dayton area and training investments, both economic development and workforce development indicators support the continued training of relatively high magnitudes of new registered nursing graduates.

Occupations Requiring Postsecondary Vocational Training

Within this category of sub-baccalaureate occupations, the jobs of licensed practical nurses (SOC 29-2061) and automotive service technicians (SOC 49-3023) command wages at or above the 2004 median wage in the Dayton MSA for occupations requiring postsecondary vocational training. These two occupations are projected to experience employment growth rates above average for all occupations in Ohio, 2004-2014. (See p. 5.)

Licensed Practical Nurses (LPNs)

With regard to human resource accounting indicators for LPNs statewide, the Ohio BLMF projects 1,204 annual total job openings, for comparison with 3,436 newly issued state LPN licenses by exam in CY 2006 and 3,510 Ohio structured training graduates from LPN CIP code 51.1613 in FY 2006 (at the award levels of associate degrees and award certificates below the associate degree).²⁸ While not all LPN training program completers and license recipients will enter the labor market and seek LPN employment, the fact that the output of both newly issued LPN licenses and structured training graduates represented more than 285% of projected annual job openings implies a competitive labor market for LPNs statewide. Within the Dayton metropolitan area, 302 FY 2006 LPN graduates from the Miami Valley Career Technology Center competed for a projected 105 LPN job openings in a competitive job market.²⁹

These competitive labor market conditions for LPNs in Ohio and the Dayton area, suggested by the occupational employment projections, licensing and training data for LPNs, were reflected in the small, occupational employment statistics (OES) statewide LPN wage increases, relative to increases in the CPI for the Cincinnati-Hamilton area.

Percent Change, Median Annual Wage for LPNs, Ohio, 2002 - 2006 (Occupational Employment Statistics) ³⁰	13.7%
Percent Change, Median Annual Wage for LPNs, Ohio, 2005 - 2006 (Occupational Employment Statistics) ³¹	3.6%
Percent Change, Hourly Rate for LPNs, Dayton - Springfield Area, 2001 - 2005 (National Compensation Surveys) ³²	23.8%
Percent Change, Hourly Rate for LPNs, Dayton - Springfield Area, 2004 - 2005 (National Compensation Surveys) ³³	6.9%
Percent Change, CPI, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ³⁴	10.9%
Percent Change, CPI, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2005 - 2006, Not Seasonally Adjusted ³⁵	3.9%

In contrast to the competitive labor market conditions for LPNs indicated by the human resource accounts and the small, statewide increases in LPN/OES wages relative to the CPI increases, employer job orders for licensed practical nurses in the Ohio Job Matching System Job Bank could not be filled quickly. After eliminating low wage LPN job orders (that is, below the 25th percentile of the LPN wage distribution for Ohio) and excluding companies with poor work environments (such as private prison companies), 39% of the high quality LPN Ohio Job Matching System job orders remained open 62 days or more during CY 2006 (*n*=59 quality job orders), with these quality LPN job orders in Ohio Job Matching System remaining open an average of 90 days. Because licensed practical nurses are projected to

experience above average employment growth, the Ohio Job Matching System /LPN hard-to-fill job order statistics probably resulted from occupational skill shortages.³⁶

Furthermore, the national AJB for CY 2004 reported a ratio (20.74) of job orders to resumes where both contained the keyword of *LPN*, which implied an employer call for the LPN skill set which the AJB resumes containing the keyword *LPN* could not meet.³⁷ Employers viewed 79% of the CY 2004 AJB resumes in SOC Family 29 (healthcare practitioners and technical) with the keyword, *LPN*.³⁸ At the local level of the Dayton area, the 2006 job vacancy survey by WSU/UD researchers reported licensed practical nurses as a “hard-to-fill” job, but in the category of “recruiting 30-59 days,” which was not as challenging to employers as the other two classifications of hard-to-fill occupations that were characterized by Dayton employers as “recruiting 60+ days” or “constantly recruiting.”³⁹

In the profile of licensed practical nurses contained in the *Occupational Outlook Handbook* (OOH), the labor market analysts of the BLS emphasized LPN replacement needs for job openings, and the average and above average employment growth rates projected for LPNs in different health sectors, plus the decline of LPN employment in hospitals.⁴⁰ But the BLS labor market analysts made no comments concerning the LPN opportunities and competition for jobs and the supply/demand balances or imbalances.⁴¹

In summary, the occupational skill shortage indicators relied upon in this analysis gave contradictory indicators for the LPN labor market in the Dayton MSA, possibly because the LPN market may be in the process of changing from shortage to balance or surplus.

Indicators of LPN skill shortages in the Dayton MSA:

- (a) longitudinal occupational (NCS) wage data compared to CPI (local);
- (b) Ohio Job Matching System hard-to-fill job order statistics (statewide);
- (c) AJB keyword research (national);
- (d) WSU/UD 2006 job vacancy survey (local).

Indicators of Rough Balance or Surplus in the Dayton Area LPN Labor Market:

- (e) human resource accounting model, i.e., occupational projections and training and licensing data (state and local);
- (f) longitudinal occupational (OES) wage data compared to CPI (statewide).

Inconclusive Indicator about LPN skill shortages in the Dayton Area:

- (g) The OOH/BLS analysts made no comments about possible LPN skill shortages and supply/demand imbalances.

The key factor in this dynamic labor market may be the substantial increases in newly issued LPN licenses and training graduates statewide during the recent past, 2003-2006.

				Percent Change '03-'04 to '05-'06
	<u>'03 - '04</u>	<u>'04 - '05</u>	<u>'05 - '06</u>	
Ohio LPN Training Completers ⁴²	2,354	3,098	3,510	49%
				Percent Change CY '04-'06
	<u>CY '04</u>	<u>CY '05</u>	<u>CY '06</u>	
Ohio LPN Newly Issued Licenses ⁴³	2,604	3,073	3,436	32%

Hence, dislocated workers making retraining investments or educational program planners may wish to review recent and rigorous follow-up data about LPN training programs, before enrolling and investing in this career field.

With regard to related economic development issues, the employment of licensed practical nurses in Ohio and nationally is concentrated most heavily in the nursing and residential care facilities industry (NAICS 623), an industry which was able to ignore the 2001 recession in terms of employment growth (see table below). About a third of all LPNs at both the national and Ohio levels work in the nursing and residential care facilities industry.⁴⁴ Nursing and residential care facilities also are an export industry, with a high location quotient (LQ) in the Dayton MSA (that is, 1.3 LQ).⁴⁵ Consequently, economic developers may wish to support the nursing care facilities industry through workforce development policies which emphasize training and placement of LPNs. Licensed practical nurses are a critical labor input in the staffing pattern for the nursing care facilities industry, representing 11%-13% of the total industry employment for both the state and national industry/occupational employment distributions.⁴⁶

Summary Profile for: Dayton MSA⁴⁷

NAICS Code: 623 - Nursing and residential care facilities								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000- 2005	Percent Change 2000- 2005
Number of Establishments	172	185	184	189	196	199	27	15.7%
All Employees	10,224	10,543	10,117	10,634	11,001	10,945	721	7.1%
Total Wages (in thousands)	\$204,520	\$220,065	\$222,554	\$232,265	\$246,149	\$244,505	\$39,985	19.6%
Average Annual Wage	\$20,005	\$20,873	\$21,997	\$21,842	\$22,376	\$22,340	\$2,335	11.7%

(Note: 2001 recession, peak to trough, March, 2001, through November, 2001, NBER)

Automotive Service Technicians and Mechanics

Labor market information predominately signaled no pressing skill shortages. The Ohio BLMI projected the statewide demand for auto service technicians and mechanics at 1,211 annual job openings, 2004-2014.⁴⁸ The structured training graduates from the postsecondary, related educational programs in Ohio (i.e., CIP 15.0803, automotive engineering technology/technician; and CIP 47.0604, automobile/automotive mechanics technology/technician) totaled 730 completers in FY 2006 – not all of whom entered the Ohio auto mechanic labor market.⁴⁹ Training data for this occupation provide incomplete proxies for supply information, as documented by the BLS analysts in the training section of the OOH profile about automotive service technicians and mechanics.⁵⁰ In the Dayton MSA, for the decade of 2004-2014, the Ohio BLMI labor market analysts projected 95 total annual job openings for auto mechanics and technicians.⁵¹ The Sinclair Community College in downtown Dayton produced 73 certificate automotive engineering technology/technician program completers in FY 2006, and 85 associate degree graduates from the same instructional program category during the same time period.⁵² As a result, several of the Sinclair graduates from the postsecondary automotive engineering technician programs may seek and find favorable employment opportunities outside the Dayton labor market area, in addition to more competitive local employment prospects.

Over the 5-year period of 2002-2006, the Ohio occupational employment statistics (OES) wages for automobile mechanics increased by 5.8%,⁵³ while the CPI for the Cincinnati-Hamilton area for the same time period (all items, all urban consumers, annual, not seasonally adjusted) increased by 10.9%, almost twice as much as the wage increases.⁵⁴ Also, the transactional data from the Ohio Job Matching System and AJB did not indicate occupational skill shortages.

During CY 2006, one quarter of the high quality statewide Ohio Job Matching System job orders ($n=48$), with Ohio wages above the 25th percentile with companies that provided decent work environments, for automotive service technicians and mechanics remained unfilled 62 days or more after posting, with the average 58 days open for the Ohio Job Matching System auto technicians and mechanics job orders.⁵⁵ In contrast, skill shortage occupations, such as registered nurses, were marked by hard-to-fill job order statistics for quality job orders with significantly higher percentages of unfilled job orders after 62 days than the Ohio Job Matching System statistics for auto mechanics (i.e., RN=39% versus auto mechanic=25%); and the statistic for average days open was also much higher for RNs than for auto service technicians and mechanics (RN=89 average days open versus auto mechanics=58 average days open).⁵⁶ The Ohio Job Matching System hard-to-fill job order statistics for SOC 49-3023 more closely resembled a “surplus” occupation such as hand packers, rather than a shortage occupation such as registered nurses.⁵⁷

For the national transactions data (that is, real job orders from real employers), AJB job order and resume data in CY 2004 showed no indication of skill shortages for auto service technicians and mechanics, based on keyword analysis. While

employers in CY 2004 were interested in AJB resumes with the primary keyword of *engine* and the secondary keyword of *mechanic* (and viewed 78% of those resumes), the ratio of AJB job orders to resumes where both had the keyword of *engine* was only 0.78.⁵⁸ The other, related primary keyword of *technician* also provided no indicator of skill shortages for automobile service technicians and mechanics, with a ratio of job orders to resumes with this primary keyword of 0.79.⁵⁹ In 2004, AJB had enough relevant resumes on file to meet the job order demand for auto mechanics.

The labor market for automobile service technicians and mechanics, suggested by the state's job matching system and national AJB job bank data, is not the labor market projected for this occupation by the national labor market analysts of BLS. In the current edition of the OOH, these BLS analysts described the labor market for auto mechanics as one where, "Opportunities should be very good for automotive service technicians and mechanics with diagnostic and problem-solving skills, knowledge of electronics and mathematics, and mechanical aptitude."⁶⁰ By this phrasing, the BLS analysts meant that U.S. job openings for auto technicians and mechanics with the aforementioned skills are expected to be more numerous than job seekers across the nation.⁶¹

Contradicting the national BLS analysis, local employers in the Dayton area reported no skill shortages for auto service technicians and mechanics in 2006. It was not a Montgomery County (Dayton area) hard-to-fill job, according to the 2006 job vacancy survey of the university researchers.⁶²

In summary, the Dayton area occupational labor market for automotive service technicians and mechanics probably does not suffer from skill shortages. Both local planning models - the Dayton area job vacancy survey and the human resource model of occupational projections of job openings and training data do not indicate skill shortages for auto mechanics. Neither do the state and national transactions data from the Ohio Job Matching System and AJB job banks. However, the statewide projections of job openings and training graduates in the auto mechanics cluster give limited support to the strong, national BLS conclusion of job openings for auto mechanics "more numerous" than job seekers, for auto service technicians and mechanics with diagnostic and problem-solving skills.⁶³

Automotive service technicians and mechanics meet the standard of a high employment prospect in the Dayton MSA with 95 projected annual job openings, 2004-2014, and a 2004 average wage of \$16.32 (see p. 5). It is doubtful that this occupation also meets the more restrictive standard of an occupational skill shortage.

Skill Shortage Indicators for Auto Service Technicians & Mechanics	
Human Resource Accounting Model (statewide)	Yes
Human Resource Accounting Model, Dayton MSA (local)	No
OES Longitudinal Occupational Wage Data compared to CPI (statewide)	No
Transactional Data, Ohio Job Bank, hard-to-fill statistics (statewide)	No
Transactional Dta, America's Job Bank, keyword analysis (national)	No
U.S. Bureau of Labor Stateistics analysts, OOH (national)	Yes
Job Vacancy Survey, WSU/UD (local)	No

From a combined workforce and economic development perspective, the automotive service technicians and mechanics are crucial labor inputs into the production functions of two local industries – the North American Industrial Classification System (NAICS) 4411 (automobile dealers) industry, and NAICS 8111 (automotive repair and maintenance) industry. Auto technicians and mechanics represent 18%-19% of the total industry employment for NAICS 4411 in Ohio and the nation, and they are a quarter of the staffing pattern for NAICS 8111 statewide and nationally.⁶⁴ At both the national and Ohio levels, almost 30% of all auto technicians and mechanics worked in 2004, and are expected to work through 2014, for auto dealers. More than a quarter of all auto service technicians and mechanics are estimated and projected to work for the automotive repair and maintenance industry.⁶⁵ Significantly more than half (almost 60%) of all auto techs and mechanics worked in these two industries and are projected to continue working there through the next decade. Consequently, these two industries become the foci for efficient job placement efforts regarding this occupation.

Both of the industries of employment concentration for SOC 49-3023 (auto service technicians and mechanics) experienced some economic stress in the years following the 2001 recession, as reflected in the declines in the number of establishments, employment, and total wages in NAICS 4111 and 8111 in the Dayton area. Nonetheless, persons seeking employment as automotive service technicians and mechanics in the Dayton region have over 400 establishments in these two industries as potential employers.

Summary Profile for :Dayton MSA⁶⁶

NAICS Code: 4411 – Automobile Dealers								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000-2005	Percent Change 2000-2005
Number of Establishments	131	126	124	125	125	126	-5	-3.8%
All Employees	4,072	3,987	4,049	4,045	3,998	3,805	-267	-6.6%
Total Wages (in thousands)	\$149,356	\$154,752	\$159,063	\$159,038	\$154,977	\$148,839	\$-517	-.3%
Average Annual Wage	\$36,683	\$38,811	\$39,289	\$39,313	\$38,769	\$39,118	\$2,435	6.6%

Summary Profile for: Montgomery County (Dayton)⁶⁷

NAICS Code: 8111 - Automotive repair and maintenance								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000-2005	Percent Change 2000-2005
Number of Establishments	308	309	318	314	294	287	-21	-6.8%
All Employees	2,129	2,133	2,214	2,172	1,866	1,777	-352	-16.5%
Total Wages (in thousands)	\$53,912	\$53,833	\$54,511	\$53,816	\$51,364	\$50,666	\$-3,246	-6.0%
Average Annual Wage	\$25,323	\$25,235	\$24,621	\$24,775	\$27,524	\$28,515	\$3,192	12.6%

The location quotients for automobile dealers and automotive repair and maintenance businesses categorize these industries as local ones, which do not bring new, outside capital into the local region as export industries would.⁶⁸ Consequently, workforce development exigencies, rather than economic development priorities, will probably dominate the supporting rationales for training and placement in this occupation of auto technicians and mechanics.

Occupations Requiring Work Experience in a Related Occupation

Cost Estimators

First Line Supervisors/Managers

Among occupations in this category that require work experience in a related occupation, the two jobs of cost estimators (SOC 13-1051) and first line supervisors/managers of construction trades/extraction workers (SOC 47-1011) have sufficient, projected job growth and high wages to justify a review as possible skill shortages. The projected change in employment, 2004-2014, for cost estimators in the Dayton MSA is 12.5%, with a 2004 average hourly wage of \$24.20. The job growth and wage levels are similar for supervisors and managers of the construction trades. These first line supervisors (SOC 47-1011) are expected to experience a 15.6% percent change increase in employment over the projections period, 2004-2014, with average hourly wages in 2004 in the Dayton area of \$23.98. (See p. 5.)

Because these occupations place a heavy emphasis upon work experience and on-the-job training, coupled with baccalaureate level training in a related field for cost estimators, the traditional human resource accounting model for training investments of occupational employment projections and training and licensing data will not provide insightful information for these occupational labor markets in the Dayton area. There are no clear correlations between specific sub-baccalaureate, instructional training programs and these two occupations. Neither cost estimators nor first line construction supervisors are licensed occupations.⁶⁹

However, the longitudinal occupational wage data were instructive. As shown in the table below, both occupations of cost estimators and construction supervisors in Ohio enjoyed wage increases appreciably higher than the increases in the cost-of-living (that is, the Consumer Price Index).

Percent Change, Median Annual Wage, Ohio, 2002 - 2006, OES ⁷⁰	
Cost Estimators	15.9%
First-Line Supervisors/Managers	15.6%
Percent Change, CPI, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ⁷¹	10.9%

With the transactions data from AJB by keyword within the major occupational group 47 of construction and extraction, the ratios of 2004 job orders to resumes with the same primary keyword of *estimator* or *manager* or *project* indicated a rough balance between employer job order skill demands and resume skill supply for cost estimators and construction managers.⁷² AJB employers were interested in the cost estimator and construction manager skill sets in 2004, and viewed 86.9% of the resumes containing the primary keyword of *estimator*, 72.6% of the resumes with the primary keyword of *manager*, and 79.8% of the AJB resumes with the primary keyword of *project*.⁷³ But the ratio of job orders to resumes, both with the keyword of *estimator*, was only 2.25; and the similar ratio of job orders with the keyword of *manager*,

compared to AJB resumes also with the keyword of *manager*, was 1.21; while the ratio of AJB job orders to AJB resumes both with the keyword of *project* was 2.09.⁷⁴

In the OOH, the labor market analysts of the U.S. BLS did not assess the balances or imbalances in the occupational labor markets for cost estimators and first-line construction managers.⁷⁵ In the Dayton area of Montgomery County, the 2006 job vacancy survey of the Wright State University and University of Dayton researchers reported that local employers did not classify either cost estimators or first-line construction supervisors as hard-to-fill jobs.⁷⁶

Although the OES wage data, 2002-2006, increased at a higher rate than the CPI, neither the AJB transactions data keyword analysis, the BLS/OOH profiles, nor the Dayton area job vacancy survey indicated skill shortages for cost estimators or first-line supervisors/managers of construction trades/extraction workers. These two occupations are high employment prospects, but may not be occupational skill shortages. In addition, both occupations are important contributors to economic development projects through their construction work.

Cost estimators and first-line managers of construction and extraction workers are heavily concentrated in terms of employment in the construction division, at approximately 60% occupational employment levels of concentration in the construction supersector at both the national and Ohio levels.⁷⁷ The construction division in the Dayton MSA is categorized as a *local* industry for economic development purposes, with a .66 location quotient.⁷⁸ Cost estimators and construction managers are not critical labor inputs for *export* industries in the Dayton area, which bring outside capital into the local community.

Summary Profile for: Dayton MSA⁷⁹

NAICS Code: 23 – Construction								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000-2005	Percent Change 2000-2005
Number of Establishments	1,734	1,686	1,716	1,733	1,697	1,702	-32	-1.8%
All Employees	15,933	14,950	14,855	14,741	15,139	14,945	-988	-6.2%
Total Wages (in thousands)	\$577,814	\$546,358	\$544,466	\$550,113	\$568,094	\$575,583	-\$2,232	-.4%
Average Annual Wage	\$36,266	\$36,545	\$36,652	\$37,319	\$37,525	\$38,514	\$2,248	6.2%

Following the 2001 recession, the construction supersector in the Dayton metropolitan statistical area suffered small declines in employment, number of establishments, and total wages, as shown in the above economic development profile for NAICS code 23 (construction). However, the large base number of potential Dayton area employers in the construction division (that is, about 1700 construction firms) provides substantial opportunities for job placements of cost estimators and first-line construction managers.

Occupations Requiring Long-Term On-the-Job Training (twelve months or more combined experience/training)

Electricians

Plumbers, Pipefitters, & Steamfitters

The occupations which require long-term, on-the-job training (OJT) include three jobs (i.e., electricians; police and sheriff's patrol officers; and plumbers, pipefitters, and steamfitters) that enjoyed above average wages for this stratum of sub-baccalaureate occupations. These three occupations have projected employment growth rates above the statewide average for all occupations (see p. 4), thus meeting the prerequisites for consideration as possible occupational skill shortages. Two of these occupations – electricians (SOC 47-2111) and plumbers (SOC 47-2152) – rely heavily upon apprenticeship job placement and training, which prohibits the application of the human resource accounting model about occupational employment projections and training and licensing data for these jobs. Apprenticeship training operates on the principal of “hiring first,” with skill training following on-the-job and in related classroom training. As a result, apprentices already hired are included on the demand-side of the human resource accounting model, even though they may be awaiting OJT and/or classroom training or licensure.⁸⁰

Consequently, occupational wage data over time, compared to the CPI, provided better estimates of supply and demand conditions in the labor markets for electricians and plumbers. The Ohio OES wage data indicated median annual wage increases of only 3.8% and 6.8% for electricians and plumbers, respectively, from 2002-2006. Over the same time period, the CPI increased by 10.9% in the Cincinnati-Hamilton area (annual, all urban consumers, all items, not seasonally adjusted), suggesting that Ohio electricians and plumbers lost real purchasing power over those five years and showing no upward pressure on wages from occupational skill shortages.⁸¹

For these two occupations, the signals from the job bank transactions data were mixed. The plumbers occupation had too few, high quality job orders in the Ohio Job Matching System job bank for analysis in 2006. But the electrician classification in the Ohio Job Matching System had a reasonable number of quality job orders ($n=50$) in CY 2006 that paid at or above the 25th percentile of statewide wages for electricians with companies that offered decent working environments.⁸² Some 32% of these job orders for electricians remained open 62 days or more, with an average of 74 days open.⁸³ These hard-to-fill job order statistics for electricians were not as strong as the comparable hard-to-fill job order statistics for the skill shortage,

registered nurse occupation, where 39.4% of the high quality job orders ($n=66$) remained open for two months or more. The average number of days open for RN/Ohio Job Matching System quality job orders was 89 days.⁸⁴

The data from AJB by keyword for the SOC major occupational group 47 (construction and extraction) in CY 2004 gave no indication of occupational skill shortages for either electricians or plumbers, pipefitters, and steamfitters. The ratio of AJB job orders to resumes, both with the keywords of either *electrical*, *journeymen*, *pipe*, or *plumbing*, was about 1-2, signifying rough balance in the labor markets for electricians and plumbers.⁸⁵ Employers viewed 62%-69% of the AJB resumes with one of the four keywords of *electrical*, *journeymen*, *pipe*, or *plumbing*; but the construction and extraction employers were more interested in the keyword of *estimator* and viewed 87% of the 2004 AJB resumes which contained that preferred keyword.⁸⁶

Similarly, the local job vacancy survey in 2006 reported that Dayton area employers did not consider electricians or plumbers as hard-to-fill occupations.⁸⁷ However, the labor market analysts of the BLS forecast a rough balance in the occupational labor market for electricians, and a shortage of plumbers because of the relative lack of training graduates in the plumbing field.⁸⁸ Because the local job vacancy survey, the state OES longitudinal wage data compared to the CPI, and the AJB keyword analysis showed no indications of skill shortages for either electricians or plumbers, these two occupations do not qualify as occupational skill shortages. While representing high employment prospects on the demand side, when assessed with the complement of demand and supply information for their respective occupational labor markets, neither electricians nor plumbers appear to be strong candidates for classification as Dayton area occupational skill shortages.

Both of the occupations of electricians and plumbers were heavily concentrated in the construction supersector, with over half of electricians and plumbers in the U.S. and Ohio working for building equipment contractors (NAICS 2382).⁸⁹ Within the staffing pattern for the building equipment contractors industry, which defines the array of labor inputs into the production function for NAICS industry 2382 in terms of skill level and the magnitude of the specific occupational labor inputs, both electricians and plumbers were critical labor inputs for that industry. These two occupations alone represented approximately 40% of the total industry employment in the nation and Ohio for building equipment contractors.⁹⁰ Whatever happens economically to NAICS industry 2382, such as the recent surfeit of housing, will affect the occupations of electricians and plumbers.

In the Dayton metropolitan statistical area, the building equipment contractors are numerous, with an estimated 460 establishments that might offer employment opportunities. However, this industry lost 10% of its employees and total wages as a result of the 2001 recession, which it had not recovered by CY 2005.

Summary Profile for: Dayton MSA⁹¹

NAICS Code: 2382 - Building equipment contractors								
Item Type	2000	2001	2002	2003	2004	2005	Absolute Change 2000-2005	Percent Change 2000-2005
Number of Establishments	444	431	443	452	455	460	16	3.6%
All Employees	5,678	5,173	5,070	5,036	5,193	5,096	-582	-10.3%
Total Wages (in thousands)	\$234,543	\$207,380	\$204,738	\$205,698	\$214,042	\$211,795	\$-22,748	-9.7%
Average Annual Wage	\$41,310	\$40,092	\$40,380	\$40,844	\$41,218	\$41,562	\$252	.6%

The building equipment contractors industry in the Dayton MSA is a local industry, with a location quotient of .87.⁹² Economic development incentives to attract export industries would not involve training for electricians or plumbers, because of the heavy employment concentration of these two occupations in NAICS 2382.

Police and Sheriff’s Patrol Officers

The third occupation within the category of jobs requiring long-term, OJT training, among the larger group of Dayton area high employment prospects, that possibly meet the stringent requirements for an occupational skill shortage is SOC code 33-3051, police and sheriff’s patrol officers. This occupation has a projected employment growth rate (i.e., 21.3% percent change employment, 2004-2014, Dayton MSA) above the statewide average for all occupations (that is, 7.3% percent change employment, 2004-2014). The jobs for police and sheriff’s patrol officers pay above the median wage in the Dayton area for occupations that require long-term OJT.⁹³

The police officer labor market in the Dayton area, Ohio, and the nation looks to remain in rough balance or surplus over the planning period of this analysis, 2004-2014, with no indications of skill shortages. With respect to the statewide human resource accounting model, the 1,675 FY 2006 training graduates from related postsecondary law enforcement programs such as the CIP code 43.0104 (criminal justice/safety studies with 1,026 completers) and CIP 43.0107 (criminal justice/police science with 649 completers) met the demand for the projected 873 annual job openings for police and sheriff’s patrol officers statewide. In the Dayton MSA, the Ohio BLMI projected 60 total annual job openings due to growth and replacement needs for police officers. The local postsecondary training institutions of Miami Valley Career Technology Center and the Sinclair Community College, respectively in FY 2006, produced 18 certificate police science graduates and 28 associate degree

police science graduates.⁹⁴ BLS analysts report that, “Law enforcement agencies are encouraging applicants to take postsecondary school training in law enforcement-related subjects.”⁹⁵ However, it is not a requirement for entry into careers as police officers. Hence, training data are only one of several sources of supply to fill police officer job openings.

These structured training completers in police science, plus the other sources of supply (i.e., unemployed workers, returning veterans, immigration, college graduates in non-law enforcement fields, and net geographic and occupational mobility) met adequately the local and state demand for police and sheriff patrol officers, as reflected in the recent, average wage increases for police officers in both the Dayton area and Ohio.

Percent Change, Median Annual Wage, Police Officers, Ohio, 2002 - 2006 (Occupational Employment Statistics) ⁹⁶	12.4%
Percent Change, Hourly Rate, Police Officers, Dayton-Springfield Area, 2001 - 2005 (National Compensation Surveys) ⁹⁷	14.1%
Percent Change, Consumer Price Index, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ⁹⁸	10.9%

In a consistent fashion, the transactions data from AJB in 2004 showed no indicators of skill shortages, according to the keyword analysis. The AJB ratios of job orders to AJB resumes, both with the keywords of either *deputy* or *police*, reflected a rough balance in the police officer national labor market.⁹⁹ Only about half of the AJB resumes with either of the preceding keywords were viewed by employers – a much smaller percentage of resumes viewed by employers than was the case for skill shortage occupations.¹⁰⁰

Other national assessments of the labor market for police officers, such as the analysis of BLS, reached a similar conclusion of balance or surplus. As remarked by the BLS labor market analysts, “Competition should remain keen for higher paying jobs with State and Federal agencies and police departments in affluent areas”¹⁰¹ These BLS analysts believe the police officer labor market for higher paying positions should be characterized as “fewer job openings compared with job seekers”¹⁰²

At the other end of the spectrum from the national police labor market data and analysis, the 2006 Dayton area job vacancy survey also received no indications from employers that they considered police officers to be a skill shortage occupation.¹⁰³ All of the available economic data and planning models support the conclusion that the occupational labor market for police officers and sheriff’s patrol officers in the Dayton MSA is not a skill shortage labor market, although there are high employment prospects for this occupation. In other words, police officer job applicants in the Dayton area will probably experience a high demand, competitive labor market, with many job openings and many more job seekers.

With more than 95% of police and sheriff's patrol officers employed in local and state government at both the Ohio and national levels, this occupation provides the critical labor input into the production of public safety services.¹⁰⁴ Training investments in this occupational career field would not normally be linked to economic development efforts, because of the government concentration of employment.

Occupations Requiring Moderate-Term On-the-Job Training (one to twelve months combined experience/training)

Correctional Officers and Jailers

Operating Engineers & other Construction Equipment Operators

Sales Representatives, Wholesale & Manufacturing, Technical/Scientific Products

Sales Representatives, Wholesale & Manufacturing, except Technical/Scientific Products

For the final category of sub-baccalaureate occupations centered in the Dayton labor market area with high employment prospects, the four occupations of correctional officers and jailers (SOC 33-3012); operating engineers and other construction equipment operators (SOC 47-2073); sales representatives wholesale and manufacturing, technical/ scientific products (SOC 41-4011); and sales representatives wholesale and manufacturing, except technical/scientific products (SOC 41-4012) all have above average, projected employment growth rates (i.e., greater than 7.3 % change, 2004-2014, see p. 4). These four occupations also had wage rates in 2004 greater than the median occupational wage for occupations in the Dayton metropolitan area that require moderate OJT, with 1-12 months of combined experience and training (see p. 4). Hence, these jobs represent potential, skilled labor shortage occupations, which require further review.

The human resource accounting model at the state level is indeterminate with regard to the skill shortages for correctional officers and jailers. The statewide projected demand by the Ohio BLMi of 326 annual job openings, 2004-2014, looks favorable when compared to the 312 statewide FY 2006 postsecondary structured training graduates from the CIP 43.0102, Corrections, and CIP 43.0199, Corrections and Criminal Justice, Other. However, these postsecondary training data are incomplete and poor proxies for supply information, since the applicants for positions as jailers or correctional officers at state prisons or local detention centers are only required to have graduated from high school. The position of correctional officer is not a licensed occupation.¹⁰⁵ At the local level, the Ohio BLMi projected 26 annual job openings for jailers and correctional officers each year between 2004 and 2014.¹⁰⁶ In FY 2006, in the Dayton metropolitan area, the Greene County Career Center produced 32 certificate graduates from CIP 43.0199, Corrections and Criminal Justice, Other.¹⁰⁷ During the same FY 2006, Sinclair Community College in downtown Dayton reported 16 Associate Degree and 1 Certificate completers from CIP 43.0102, Corrections.¹⁰⁸ Within the Dayton MSA, structured training and other sources of supply created a competitive labor market for correctional officers and jailers.

The longitudinal occupational wage data compared to the CPI confirmed the competitive nature of the labor market for jailers and correctional officers in Ohio, with wage increases for this occupation falling behind increases in the CPI. Between 2001 and 2005, the Ohio OES wages for correctional officers and jailers increased by 5.1%; while the CPI for the Cincinnati-Hamilton area over the same time period increased by 8.2% (annual index, all urban consumers, all items, not seasonally adjusted), indicating that Ohio correctional officers and jailers lost real purchasing power.¹⁰⁹

The keyword transactions data from AJB in CY 2004 told a similar story. The ratio of AJB job orders to resumes, where both the job orders and resumes shared the same keywords, for the occupational family of SOC 33, Protective Service, showed a rough balance (ratio .66).¹¹⁰ The terms, *corrections* or *jailers*, did not even qualify as primary keywords based on employer interest as reflected in the number and type of viewed resumes within SOC 33.¹¹¹

To reinforce the conclusion that correctional officers and jailers are not a shortage occupation, the Dayton area (Montgomery County) job vacancy survey by researchers at Wright State University and the University of Dayton reported that local employers did not classify correctional officers as a hard-to-fill occupation.¹¹² Yet, contrary to the Ohio and local data, the labor market analysts of the BLS believe the “job opportunities are expected to be excellent” for correctional officers, meaning that job openings for the occupation will be “more numerous” than job seekers.¹¹³ The BLS analysts forecast employment for correctional officers to grow “more slowly than the average,” but they believe the replacement needs will create a favorable job market for this occupation nationally.¹¹⁴

Notwithstanding the BLS assessment of the U.S. labor market for correctional officers, within Ohio and the Dayton area, correctional officers and jailers are not in short supply. Nor does this occupation play a significant role with economic development projects to attract export industries, because the employment of jailers and correctional officers is heavily concentrated in the government sector.¹¹⁵

Another high employment prospect occupation that requires moderate OJT, but is not a labor skill shortage, is the position of operating engineers (SOC 47-2073). Because training for positions as construction equipment operators is generally provided on-the-job or through apprenticeship programs, the human resources accounting model cannot be applied to this occupational labor market to assess balances or imbalances (see footnote #80 for further explication). The occupational wage data for operating engineers over time indicated wage increases which did not keep pace with increases in the CPI.

Percent Change, Median Annual Wage, Operating Engineers, Ohio, 2002 - 2006 (Occupational Employment Statistics) ¹¹⁶	7.0%
Percent Change, Consumer Price Index (CPI), Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ¹¹⁷	10.9%

The transactions data from AJB in 2004 suggested no shortages in the labor market for operating engineers. The primary keywords in SOC Family 47 (construction and extraction) which were closely related to operating engineers – that is, *CDL*, *equipment*, *heavy*, and *loader* – indicated a rough balance in the labor market, i.e., ratios of .5 to 1 of AJB job orders to AJB resumes where both had the same keyword of either *CDL*, *equipment*, *heavy*, or *loader*.¹¹⁸ Employers viewed only 56% to 61% of the AJB resumes with these keywords in 2004 for SOC 47.¹¹⁹

The conclusion of rough balance in the labor market for operating engineers was also endorsed by the BLS analysts at the national level. BLS projects “good” job opportunities for construction equipment operators, with “employment growing about as fast as the average for all occupations.”¹²⁰ A BLS assessment for an occupational labor market of “good” job opportunities signifies a judgment of rough balance in the labor market between job openings and job seekers.¹²¹ At the local level, Montgomery County (Dayton area) employers did not report operating engineers as a hard-to-fill job in response to the 2006 job vacancy survey of the Wright State University and University of Dayton researchers.¹²² From an economic development perspective, with about 60% of the employment of operating engineers concentrated in the construction supersector at both the national and state levels, training for construction equipment operators would not be part of economic development efforts to attract export industries into the Dayton area.¹²³

The last two occupations for consideration as possible skill shortages among the high employment prospect jobs in the category requiring moderate OJT (that is, 1-12 months of combined experience/training) are closely related – namely, the sales representatives wholesale and manufacturing, technical/scientific products (SOC 41-4011), and sales representatives wholesale and manufacturing, except technical/scientific products (SOC 41-4012). Because of the heavy reliance upon OJT, the labor markets for these two sales occupations must be assessed with planning models other than the human resource accounting model (which attempts to estimate separately the demand and supply-side forces in the occupational labor market with employment projections, structured training data, and licensing data). There are no licensure requirements for these sales representative occupations.¹²⁴

Fortunately, longitudinal occupational wage data for Ohio, 2002-2006, when compared to the CPI for the same time period, summarize the effects of both the supply and demand forces in this labor market and provide good indicators of upward pressures on wages for sales representatives in the wholesale and manufacturing divisions, probably due to skill shortages.

Percent Change, Median Annual Wage, Ohio, 2002 - 2006, OES ¹²⁵	
Sales Representatives, Wholesale & Manufacturing, Technical/Scientific Products	16.9%
Sales Representatives, Wholesale & Manufacturing, Except Technical/Scientific Products	25.1%
Percent Change, CPI, Annual, All Urban Consumers, All Items, Cincinnati - Hamilton Area, 2002 - 2006, Not Seasonally Adjusted ¹²⁶	10.9%

The transactions data from the Ohio Job Matching System job bank were not sufficiently large for analysis (please see appendix I). However, America’s Job Bank (AJB) keyword analysis of 2004 showed a ratio of AJB job orders to AJB resumes (with each containing the keyword of *call*, referring to calls to prospective clients) of 13.3 – a clear shortage indicator. Three-fourths of the resumes with this keyword were viewed by employers.¹²⁷ The 2006 local job vacancy survey of Dayton area employers also found sales representatives, wholesale and manufacturing, except technical and scientific products (SOC 41-4012), to be a hard-to-fill job that required “recruiting 60+ days.”¹²⁸ While noting that the employment of sales representatives, wholesale and manufacturing, nationally is projected to “grow as fast as average” for all occupations, the BLS analysts did not assess the balances or imbalances in the labor market for these sales representative occupations.¹²⁹ Although sales representatives, wholesale and manufacturing, both “technical/scientific” and “except technical/scientific,” are employed by export industries, the nature, travel, and location of the sales work make it unlikely that economic developers will request training for these occupations as a means to attract export industries.

Conclusion

The findings about potential, occupational skill shortages in the Dayton metropolitan area for sub-baccalaureate, “high employment prospect” occupations are summarized in the following table for quick reference. Each of these planning models with their different analytic techniques added perspective about the occupational labor markets under review.

For example, the human resource accounting model was the only planning model which attempted to disaggregate the occupational labor market supply and demand forces and separately analyze each one. (For a full discussion of the strengths and limitations of the human resource accounting approach for labor market analysis, please see the Occupational Supply/Demand System planning models at <http://occsupplydemand.org>.) The summary indicators of the longitudinal occupational wage data – both the Occupational Employment Statistics (OES) and National Compensation Surveys (NCS) occupational wages – showed the effects (equilibrium point) after both the supply and demand-side actors and reactors made their moves and counter-moves in the labor market. These wage trend indicators benefited from the precision of the occupational wage estimates as reflected in their small, relative standard errors (please see the methodological appendix section about longitudinal occupational wage data). Transactional data reports, based on the Ohio’s Job Matching System Job Bank and AJB,

gave information about real job orders from real employers to complement the employment projections of job openings. The Ohio Job Matching System’s hard-to-fill job order statistics provided an important time dimension to the labor market analysis, after eliminating low-paying jobs in bad work environments and linking the findings to projected, high employment growth occupations. The AJB keyword analysis showed the ratio of AJB job orders to AJB resumes, where both shared the same keyword, as a proxy for occupational labor market balances or imbalances. The recent, local area job vacancy survey by researchers at Dayton area universities aggregated the opinions of local employers about hard-to-fill jobs. Further, the national labor market assessments of the analysts of the BLS noted in this report are generally considered among the most rigorous.

Economic Indications of Occupational Skill Shortages

Planning Models	RN's (29-1111)	LPN's (29-2061)	Auto. Techn. & Mech. (49-3023)	Cost Estimator (13-1051)	1st-Line S./Mgrs. Constr.Tr. (47-1011)	Electric. (47-2111)	Plumbers (47-2152)	Police Officers (33-3051)	Correct. Officers (33-3012)	Operating Engineers (47-2073)	Sales Rep. Tech./Sci. (41-4011)	Sales Rep. Except Tech./Sci. (41-4012)
High Employment Prospect Occup. (Dayton MSA, 2004-14)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Human Resource Accounting: Dayton MSA (2005-2006)	No	No	No	NA	NA	NA	NA	No	No	NA	NA	NA
Ohio (2005-2006)	Yes	No	Yes	NA	NA	NA	NA	No	Indeterm.	NA	NA	NA
Longitudinal Occup. Wage Data Compared to CPI: NCS Data (Dayton MSA, 2001-05)	Yes	Yes	NA	NA	NA	NA	NA	No	NA	NA	NA	NA
OES Data (Ohio, 2002-06)	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes
Ohio Job Matching System Job Order Statistics (Oh., 2006)	Yes	Yes	No	NA	NA	Yes	NA	NA	NA	NA	NA	NA
America's Job Bank (AJB) Keyword Analysis (U.S., 2004)	Yes	Yes	No	No	No	No	No	No	No	No	Yes	Yes
Job Vacancy Survey Dayton Area (Montgomery Cty., 2006)	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes
BLS Labor Market Analysts (OOH, & Occup. Projections & Training Data, 2006-07 ed.), (national)	Yes	NA	Yes	NA	NA	No*	Yes	No	Yes	No*	NA	NA
*As reported in the 2006-07 edition of the OOH, the BLS analysts found "good employment opportunities" for electricians and operating engineers resulting from a rough balance in their respective labor markets, not occupational skill shortages.												
MSA= Metropolitan Statistical Area	NCS=National Compensation Surveys			BLS=Bureau of Labor Statistics			NA=Not Addressed or Not Available					
CPI=Consumer Price Index	OES=Occupational Employment Statistics			OOH=Occupational Outlook Handbook			Indeterm.=Indeterminate					

All of the preceding, sub-baccalaureate occupations have above (statewide) average, projected employment growth rates, and at least 25 projected total annual job openings in the Dayton MSA, and pay in the upper half of the wage distribution for their respective educational stratum in the Dayton area.

Of these 12 occupations, 4 had a majority of affirmative indicators for occupational skill shortages – that is, registered nurses (SOC 29-1111); licensed practical nurses (SOC 29-2061); and sales representatives, wholesale and manufacturing, technical/scientific (SOC 41-4011) and except technical/scientific (SOC 41-4012). The analytical support for the designation of occupational skill shortages was especially strong with respect to two occupations. For RNs, 8 out of 9 indicators pointed to an occupational skill shortage in the Dayton area labor market for RNs, resulting in upward pressure on the wages for

registered nurses. Also, the Dayton area sales representatives, wholesale and manufacturing, except technical/scientific, had all affirmative indications of occupational skill shortages for which data were available for analysis (that is, for 4 out of the 9 occupational skill indicators). In the cases of two of the above “high employment prospect occupations” – that is, cost estimators (SOC 13-1051) and first-line supervisors/managers of construction trades and extraction workers (SOC 47-1011) – the occupational skill shortage indicators were evenly split between affirmative and negative indications among the 4 indicators for which we had sufficient data.

In the special Ohio occupational labor market for LPNs, the skill shortage indicators require a caveat. Because of rapid growth in statewide, supply-side responses to employer demand for licensed practical nursing workers, shown in the recent increases of LPN structured training completers and newly issued LPN licenses, the authors expect this Ohio occupational labor market to become increasingly competitive in the near future. (Please see the appended, methodological statement concerning the licensed practical nurse forecast of a competitive labor market, and the following Ohio LPN training completions table).

State/Territory: Ohio

Program of Study and Training: 51.1613 Licensed Practical /Vocational Nurse Training (LPN, LVN, Cert, Dipl, AAS)

Market Share		Completers														
		2001-02			2002-03			2003-04			2004-05			2005-06		
School		M	W	Total	M	W	Total	M	W	Total	M	W	Total	M	W	Total
Awards of less than one academic year																
1	Adult and Community Education-Hudson	0	0	0	0	0	0	0	0	0	3	8	11	0	0	0
2	Choffin Career and Technical Center	0	0	0	5	43	48	5	43	48	4	52	56	7	25	32
3	Hannah E Mullins School of Practical Nursing	0	0	0	0	0	0	5	40	45	2	34	36	6	34	40
4	James A Rhodes State College	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4
5	Pike County Joint Vocational School District	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Tri-Rivers Career Center	0	0	0	9	29	38	4	37	41	5	37	42	6	58	64
	Subtotal	0	0	0	14	72	86	14	120	134	14	131	145	20	120	140
Awards at least 1 but less than 2 academic years																
1	Adult and Community Education-Hudson	10	56	66	16	84	100	6	85	91	20	100	120	11	104	115
2	Adult Center for Education	7	54	61	9	70	79	8	56	64	5	64	69	8	70	78
3	Akron School of Practical Nursing	4	47	51	2	58	60	3	49	52	4	47	51	4	67	71
4	Apollo Career Center	1	26	27	4	37	41	4	68	72	4	61	65	8	51	59
5	Belmont Technical College	3	21	24	1	22	23	0	25	25	11	47	58	7	58	65

Market Share		Completers														
		2001-02			2002-03			2003-04			2004-05			2005-06		
School		M	W	Total	M	W	Total	M	W	Total	M	W	Total	M	W	Total
6	Brown Mackie College-Findlay	0	0	0	0	0	0	0	0	0	16	138	154	20	149	169
7	Buckeye Joint Vocational School	0	0	0	0	0	0	4	19	23	7	40	47	1	19	20
8	Butler Tech-D Russel Lee Career Center	10	73	83	11	111	122	12	126	138	7	148	155	12	123	135
9	Central Ohio Technical College	0	17	17	2	17	19	3	38	41	2	29	31	7	66	73
10	Central School of Practical Nursing	4	35	39	10	44	54	13	74	87	9	79	88	7	71	78
11	Choffin Career and Technical Center	5	72	77	0	0	0	0	0	0	0	0	0	0	0	0
12	Clark State Community College	3	21	24	1	23	24	1	27	28	4	30	34	0	28	28
13	Community Services Division-Alliance City	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Cuyahoga Community College District	0	16	16	2	29	31	4	27	31	6	59	65	7	74	81
15	Ehove Career Center	1	39	40	0	40	40	4	69	73	6	72	78	3	67	70
16	Gallia Jackson Vinton Joint Vocational School District	2	31	33	2	24	26	4	30	34	2	15	17	1	10	11
17	Great Oaks Institute of Technology and Career Development	5	93	98	6	110	116	9	116	125	10	130	140	24	178	202
18	Hannah E Mullins School of Practical Nursing	2	37	39	2	36	38	0	0	0	0	0	0	0	0	0
19	Hocking College	13	126	139	15	149	164	12	147	159	16	176	192	17	138	155
20	James A Rhodes State College	0	0	0	0	17	17	2	18	20	1	29	30	5	51	56
21	Jefferson Community College	2	22	24	2	30	32	5	26	31	1	22	23	0	19	19
22	Knox County Career Center	1	26	27	3	29	32	2	27	29	2	27	29	1	43	44
23	Lorain County Community College	1	46	47	5	45	50	4	69	73	6	58	64	5	96	101
24	Miami Valley Career Technology Center	9	72	81	18	119	137	1	80	81	9	166	175	15	287	302
25	North Central State College	1	55	56	5	45	50	2	53	55	4	52	56	5	48	53
26	Northwest State Community College	2	25	27	1	35	36	3	36	39	4	31	35	5	73	78
27	O C Collins Career Center	7	38	45	5	28	33	9	60	69	18	96	114	18	67	85
28	Ohio Hi Point Joint Vocational School District	0	21	21	1	19	20	1	36	37	0	43	43	2	39	41
29	Owens Community College	0	0	0	0	0	0	1	25	26	3	34	37	7	84	91
30	Pickaway Ross Joint Vocational School District	3	25	28	7	25	32	7	19	26	7	15	22	2	36	38

Market Share		Completers														
		2001-02			2002-03			2003-04			2004-05			2005-06		
School		M	W	Total	M	W	Total	M	W	Total	M	W	Total	M	W	Total
31	Portage Lakes Career Center	0	28	28	0	22	22	2	24	26	0	22	22	2	24	26
32	Practical Nurse Program Canton City Schools	4	49	53	3	43	46	10	70	80	7	77	84	3	62	65
33	Professional Skills Institute	0	0	0	1	7	8	4	56	60	4	74	78	7	83	90
34	School of Nursing at Cuyahoga Valley Career Center	3	40	43	2	38	40	2	46	48	6	63	69	9	64	73
35	Scioto County Joint Vocational School District	3	31	34	2	29	31	2	29	31	7	34	41	5	34	39
36	Southern State Community College	3	26	29	1	28	29	3	42	45	2	51	53	1	39	40
37	TCTC Adult Training Center	0	26	26	0	20	20	2	37	39	4	34	38	5	57	62
38	Toledo School of Practical Nursing	15	153	168	14	150	164	13	144	157	17	142	159	26	198	224
39	Tri-Rivers Career Center	3	35	38	0	0	0	2	16	18	0	0	0	0	0	0
40	Upper Valley Joint Vocational School	5	97	102	4	56	60	2	29	31	8	64	72	3	53	56
41	W Howard Nicol School of Practical Nursing	0	27	27	0	22	22	0	24	24	1	21	22	1	29	30
42	Washington State Community College	5	21	26	2	25	27	5	20	25	4	45	49	2	38	40
43	Wayne County Schools Career Center	1	23	24	3	53	56	0	0	0	6	102	108	9	58	67
44	Willoughby-Eastlake School of Practical Nursing	0	23	23	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		138	1,673	1,811	162	1,739	1,901	171	1,942	2,113	250	2,537	2,787	275	2,855	3,130
Associates degrees																
1	North Central State College	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
2	Ohio University- Chillicothe Campus	0	0	0	0	0	0	2	23	25	3	43	46	10	62	72
3	Ohio University- Southern Campus	0	0	0	0	0	0	0	0	0	6	22	28	6	31	37
4	Ohio University- Zanesville Campus	0	0	0	0	0	0	8	74	82	12	75	87	21	110	131
5	University of Rio Grande	6	54	60	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		6	54	60	0	2	2	10	97	107	21	140	161	37	203	240
Bachelors degrees																
1	University of Akron Main Campus	0	0	0	0	0	0	0	0	0	1	4	5	1	8	9
Program Completer Total		144	1,727	1,871	176	1,813	1,989	195	2,159	2,354	286	2,812	3,098	333	3,186	3,519

Source: National Center for Education Statistics, Awards and Degrees Conferred 2001-06, OSDS at <http://occsupplydemand.org>.

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Appendix I:

**Hard-to-Fill Job Order Statistics from
the Ohio Job Matching System***

O*NET Code: 13-1051.00 -- Cost Estimators

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	3	116	0.0%	0.0%	33.3%	0.0%	66.7%	100.0%
2005	5	53	20.0%	60.0%	0.0%	20.0%	0.0%	20.0%
2006	7	34	28.6%	57.1%	14.3%	0.0%	0.0%	14.3%

O*NET Code: 29-1111.00 -- Registered Nurses

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	26	76	42.3%	15.4%	19.2%	7.7%	15.4%	42.3%
2005	38	51	42.1%	31.6%	13.2%	5.3%	7.9%	26.4%
2006	66	89	24.2%	36.4%	13.6%	7.6%	18.2%	39.4%

O*NET Code: 29-2061.00 -- Licensed Practical & Licensed Vocat. Nurses

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	21	120	38.1%	14.3%	9.5%	0.0%	38.1%	47.6%
2005	35	95	20.0%	20.0%	20.0%	14.3%	25.7%	60.0%
2006	59	90	32.2%	28.8%	6.8%	8.5%	23.7%	39.0%

O*Net Code: 33-3012.00 -- Correctional Officers and Jailers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	2	19	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%
2005	8	129	25.0%	25.0%	0.0%	12.5%	37.5%	50.0%
2006	7	32	85.7%	0.0%	0.0%	0.0%	14.3%	14.3%

O*NET Code: 33-3051.00 -- Police and Sheriff's Patrol Officers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	0							0.0%
2005	1	50	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
2006	3	8	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%

O*NET Code: 41-1012.00 -- First-Line Sup./Mgrs of Non-Retail Sales Workers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	1	142	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
2005	2	54	0.0%	50.0%	50.0%	0.0%	0.0%	50.0%
2006	2	147	50.0%	0.0%	0.0%	0.0%	50.0%	50.0%

O*NET Code: 41-4011.00 -- Sales Rep., Wholesale & Mfg, Tech./Sci. Prod

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	1	43	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
2005	8	62	25.0%	37.5%	12.5%	25.0%	0.0%	37.5%
2006	2	238	50.0%	0.0%	0.0%	0.0%	50.0%	50.0%

O*NET Code: 41-4012.00: Sales Rep., Wholesale/Mfg, Ex. Tech./Sci. Prod.

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	4	21	75.0%	25.0%	0.0%	0.0%	0.0%	0.0%
2005	8	45	37.5%	37.5%	25.0%	0.0%	0.0%	25.0%
2006	10	209	20.0%	10.0%	0.0%	10.0%	60.0%	70.0%

O*NET Code: 43-6012.00 -- Legal Secretaries

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 1 month	1 month	2 months	3 months	4+ months	
2004	4	30	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%
2005	5	33	60.0%	20.0%	20.0%	0.0%	0.0%	20.0%
2006	6	23	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%

O*NET Code: 47-1011.00 -- First-Line Sup/Mgrs of Con. Trades/Extract. Work

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	0							0.0%
2005	3	67	33.3%	33.3%	0.0%	0.0%	33.3%	33.3%
2006	2	54	50.0%	0.0%	0.0%	50.0%	0.0%	50.0%

O*NET Code: 47-2031.00 -- Carpenters

Year	Annual Openings	Average days open	Percent open:					net
			< 1 month	1 month	2 months	3 months	4+ months	≥ 62 days
2004	25	91	32.0%	12.0%	16.0%	12.0%	28.0%	56.0%
2005	21	39	52.4%	23.8%	19.0%	0.0%	4.8%	23.8%
2006	22	65	27.3%	27.3%	18.2%	9.1%	18.2%	45.5%

O*NET Code: 47-2051.00 -- Cement Masons and Concrete Finishers

Year	Annual Openings	Average days open	Percent open:					net
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	≥ 62 days
2004	7	38	42.9%	28.6%	28.6%	0.0%	0.0%	28.6%
2005	6	45	50.0%	16.7%	33.3%	0.0%	0.0%	33.3%
2006	9	25	66.7%	22.2%	11.1%	0.0%	0.0%	11.1%

O*NET Code: 47-2061.00 -- Construction Laborers

Year	Annual Openings	Average days open	Percent open:					net
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	≥ 62 days
2004	39	53	46.2%	10.3%	28.2%	7.7%	7.7%	43.6%
2005	49	68	51.0%	18.4%	14.3%	4.1%	12.2%	30.6%
2006	49	43	59.2%	20.4%	12.2%	0.0%	8.2%	20.4%

O*NET Code: 47-2073.00 -- Operating Engineers & Other Construction Equipment Operators

Year	Annual Openings	Average days open	Percent open:					net
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	≥ 62 days
2004	5	88	20.0%	0.0%	60.0%	0.0%	20.0%	80.0%
2005	6	107	0.0%	0.0%	66.7%	16.7%	16.7%	100.1%
2006	13	81	38.5%	23.1%	23.1%	0.0%	15.4%	38.5%

O*NET code: 47-2111.00 -- Electricians

Year	Annual Openings	Average days open	Percent open:					net
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	≥ 62 days
2004	27	80	40.7%	18.5%	11.1%	11.1%	18.5%	40.7%
2005	53	70	37.7%	17.0%	26.4%	3.8%	15.1%	45.3%
2006	50	74	46.0%	22.0%	6.0%	2.0%	24.0%	32.0%

O*NET Code: 47-2141.00 -- Painters, Construction and Maintenance

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
			2004	11	40	54.5%	9.1%	
2005	24	38	70.8%	20.8%	0.0%	0.0%	8.3%	8.3%
2006	14	40	35.7%	42.9%	21.4%	0.0%	0.0%	21.4%

O*NET Code: 47-2152.00 -- Plumbers, Pipefitters, and Steamfitters

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
			2004	5	174	40.0%	0.0%	
2005	4	105	25.0%	25.0%	0.0%	0.0%	50.0%	50.0%
2006	6	30	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%

O*NET Code: 47-2181.00 -- Roofers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
			2004	5	54	40.0%	0.0%	
2005	6	54	16.7%	50.0%	16.7%	16.7%	0.0%	33.4%
2006	2	50	50.0%	0.0%	50.0%	0.0%	0.0%	50.0%

O*NET code: 47-2211.00 -- Sheet Metal Workers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
			2004	3	124	33.3%	0.0%	
2005	4	41	75.0%	0.0%	25.0%	0.0%	0.0%	25.0%
2006	9	62	33.3%	55.6%	0.0%	0.0%	11.1%	11.1%

O*NET Code: 49-1011.00 -- First-Line Supervisors/Managers of Mechanics, Installers, and Repairers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
			2004	17	82	35.3%	29.4%	
2005	14	57	42.9%	21.4%	21.4%	0.0%	14.3%	35.7%
2006	13	107	30.8%	30.8%	15.4%	0.0%	23.1%	38.5%

O*NET Code: 49-3023.00 -- Automotive Service Technicians and Mechanics

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	45	69	40.0%	11.1%	26.7%	2.2%	20.0%	48.9%
2005	60	53	36.7%	35.0%	16.7%	0.0%	11.7%	28.4%
2006	48	58	56.3%	18.8%	12.5%	2.1%	10.4%	25.0%

O*NET Code: 49-9021.00 -- Heating, AC, & Refrigeration Mechanics/Installers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 1 month	1 month	2 months	3 months	4+ months	
2004	14	77	64.3%	7.1%	7.1%	7.1%	14.3%	28.5%
2005	9	122	33.3%	22.2%	11.1%	11.1%	22.2%	44.4%
2006	12	95	41.7%	25.0%	8.3%	0.0%	25.0%	33.3%

O*NET Code: 49-9042.00 -- Maintenance and Repair Workers, General

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	97	53	41.2%	26.8%	12.4%	9.3%	10.3%	32.0%
2005	138	73	36.2%	27.5%	15.2%	6.5%	14.5%	36.2%
2006	152	80	41.4%	22.4%	11.8%	2.6%	21.7%	36.1%

O*NET Code: 51-2092.00 -- Team Assemblers

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	5	147	40.0%	0.0%	0.0%	0.0%	60.0%	60.0%
2005	11	37	54.5%	27.3%	0.0%	9.1%	9.1%	18.2%
2006	41	54	73.2%	4.9%	7.3%	0.0%	14.6%	21.9%

O*NET code: 53-7062.00 -- Laborers and Freight, Stock, and Material Movers, Hand

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	197	71	42.6%	21.8%	12.7%	6.1%	16.8%	35.6%
2005	225	49	55.6%	16.9%	12.0%	6.2%	9.3%	27.5%
2006	231	58	59.3%	16.9%	5.6%	3.5%	14.7%	23.8%

O*NET code: 53-7064.00 -- Packers, Packagers, Hand

Year	Annual Openings	Average days open	Percent open:					net ≥ 62 days
			< 31 days	≥ 31 days < 62 days	≥ 62 days < 93 days	≥ 93 days < 124 days	≥ 124 days	
2004	63	61	49.2%	12.7%	11.1%	9.5%	17.5%	38.1%
2005	72	77	27.8%	31.9%	15.3%	8.3%	16.7%	40.3%
2006	100	51	60.0%	18.0%	5.0%	5.0%	12.0%	22.0%

*Wages ≥ the Ohio 25th percentile for the occupation, minus all default 90 day job orders and job orders from firms with obviously unattractive work environments (e.g., private prison companies) and obvious miscodings of occupation

(Note: “default, 90-day job orders” refer to job orders entered into the Ohio Job Matching System Job Bank with automatic closing dates, regardless of the date when the job is actually filled or if the position remained open. These job orders with mechanical, arbitrary closing dates are not sensitive to labor market conditions; and, thus, they had to be removed from the universe of Ohio Job Matching System hard-to-fill job order statistics for this analysis.)

Appendix II: METHODOLOGICAL STATEMENT

Licensed Practical Nurse (LPN) Forecast of a Competitive Labor Market

In projecting an increasingly competitive labor market for licensed practical nurses in Ohio, the authors relied heavily upon the accuracy of the demand projections of LPN job openings developed by the BLMI, coupled with census data about LPN training graduates and newly issued licensing data for LPNs in Ohio. The complete coverage of the LPN structured training data and licensing data as universe information gave these supply trends high accuracy and credibility. With the employment projections of the Ohio BLMI, evaluation of the accuracy of prior Ohio BLMI industry employment projections for nursing care facilities and hospitals engendered confidence in the demand estimates of annual job openings for licensed practical nurses referenced in this report. Nationally, the U.S. Bureau of Labor Statistics estimated that 45% of all LPNs worked in either nursing care facilities or hospitals in 2004.¹³⁰

For the LPN industries of employment concentration, the small mean absolute percent errors (MAPEs) of the recent industry employment forecasts support the application of these employment projections in the human resource accounting model.¹³¹

MAPE	1995	2000	2005
SIC 805, Nursing and Personal Care Facilities	14.4%	4.2%	
SIC 806, Private Hospitals	3.6%	15.1%	
NAICS 623, Nursing and Residential Care Facilities			7.5%
NAICS 622, Private Hospitals			0.4%
Weighted MAPE*	1995	2000	2005
SIC 805, Nursing and Personal Care Facilities	0.31%	0.08%	
SIC 806, Private Hospitals	0.15%	0.53%	
NAICS 623, Nursing and Residential Care Facilities			0.22%
NAICS 622, Hospitals			0.02%

(SIC = Standard Industrial Classification Code)

(NAICS = North American Industrial Classification System)

(*Weights = specific industry employment relative to total, all industry employment)

Occupational Wage Data Trends

The OES wage data resulted from cross-sectional surveys of employers 2002-2006; but the small, relative standard errors of the occupational wage estimates permitted longitudinal applications of these cross-sectional data compared to the CPI, because of the precision of the occupational wage estimates. The U.S. Bureau of Labor Statistics (BLS) notes that these data were not designed for over-time comparisons. The BLS made several methodological changes to the OES that affect comparisons before 2002. These changes should have little effect on this study, because we rely

on OES wage data from 2002 and later. The BLS also notes that sample design issues lead the OES to register changes in employment levels and wages more gradually than they actually occur. This means that our use of the OES wage data is more likely to underestimate skill shortage conditions.¹³²

Precision of Occupational Employment Statistics (OES) Wage Estimates, May 2006, Ohio

Occupations	Annual Mean Wage	Mean Relative Standard Error
Registered Nurses (29-1111)	\$55,130	0.5%
Licensed Practical & Licensed Vocational Nurses (29-2061)	\$37,610	0.4%
Automotive Service Technicians & Mechanics (49-3023)	\$34,580	1.2%
Cost Estimators (13-1051)	\$54,720	1.3%
First-Line Sup/Mgrs of Con. Trades/Extract Work (47-1011)	\$59,160	1.1%
Electricians (47-2111)	\$46,600	1.2%
Plumbers, Pipefitters, and Steamfitters (47-2152)	\$46,490	1.3%
Police and Sheriff's Patrol Officers (33-3051)	\$44,410	2.5%
Correctional Officers and Jailers (33-3012)	\$35,080*	0.9%*
Operating Engineers & Other Construction Equipment Operators (47-2073)	\$44,450	1.1%
Sales Rep., Wholesale & Mfg, Tech./Sci. Prod (41-4011)	\$68,880	2.8%
Sales Rep., Wholesale & Mfg, Except Tech./Sci. Prod (41-4012)	\$61,000	1.1%

(*May, 2005, Ohio annual mean wage estimate and mean RSE)

Source: U.S. Department of Labor, Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES), at http://www.bls.gov/oes/oes_dl.htm.

Job Bank Transactional Data and Labor Market Search-Matching Theory

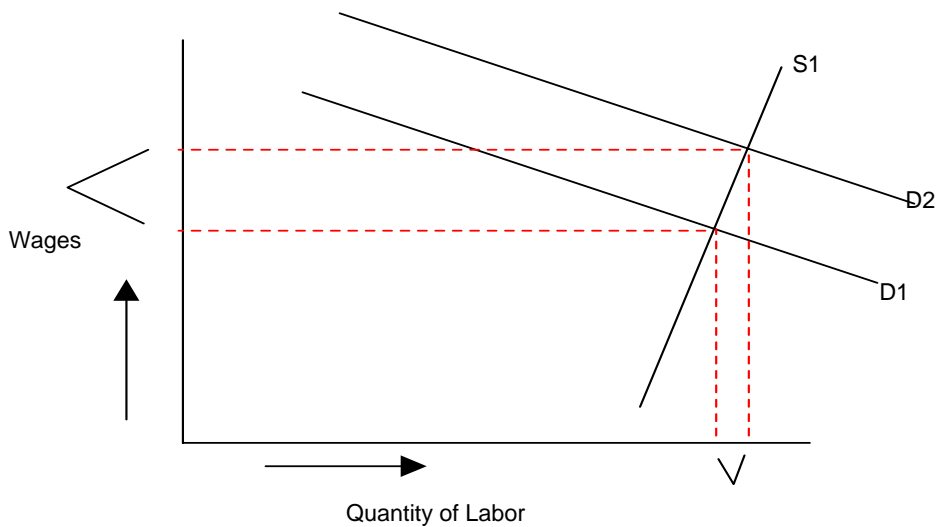
The Ohio Job Matching System Job Bank and AJB transactions data analyzed in this report supplement the employment projections of the BLMI and the BLS with actual job order data from real employers. The job bank data also help to tie this analysis to the prevailing labor market job search-matching theory of unemployment, as described by Economist Guillaume Rocheteau of the Federal Reserve Bank of Cleveland in his Oct. 15, 2006, paper entitled, "Understanding Unemployment."¹³³ As Economist Rocheteau noted, "Countries with similar policies can have different unemployment rates because they use different technologies to match workers and firms. The Internet or employment agencies, for example, might improve the matching process, and firms in countries where they are available will have higher incentives to open vacancies."¹³⁴

Occupational Wage Elasticities

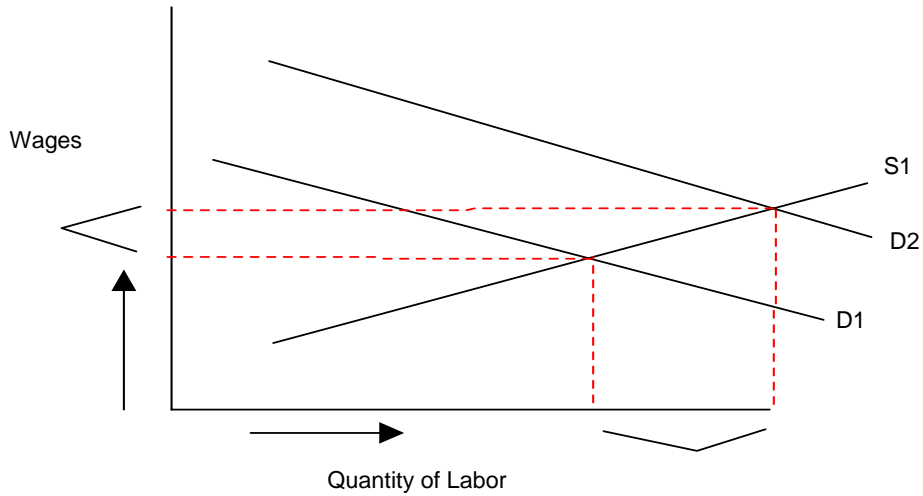
Future applied research about balances and imbalances in occupational labor markets will benefit from estimates of wage elasticities in the labor market. The labor supply wage elasticities refer to the percent change in the occupational labor supply relative to the percent change in occupational wages. If this wage elasticity for the

occupational labor supply is less than 1, the occupational labor market would be considered inelastic. In other words, if the percentage change in wages does not stimulate a greater percent change in the labor supply, then the occupational labor market can be characterized as one in which traditional market signals of increasing occupational wages may not be adequate to quickly increase the labor supply. The identification of an inelastic occupational labor market may help to rationalize government intervention to increase labor supply through increased training programs or expanding the output capacity of trained graduates from existing training programs. (Occupational Labor Supply Wage Elasticity = $\% \Delta$ Quantity of Occupational Labor / $\% \Delta$ of Occupational Wages.)

Inelastic occupational labor markets, *ceteris paribus*, imply steep supply curves, where large wage increases are required to bring about small increases in the quantity of labor supplied, because of lengthy training time requirements, licensing requirements, and other institutional and administrative factors outside of the competitive market forces (see below).



In contrast, elastic occupational labor markets (see following supply/demand curves) require gently sloping supply curves, where small increases in wages result in relatively large increases in the supply of labor provided, *ceteris paribus*. For elastic occupational labor markets, the market signals of wage changes (and the magnitude of these wage changes) are generally sufficient to bring about balances between labor supply and demand in a reasonable period of time.



Footnotes

1. *Performance Report for Ohio's Colleges and Universities, 2006*, Ohio Board of Regents, at <http://regents.ohio.gov/perfrpt/index.php>.
2. Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014*, pp.14-16, at <http://lmi.state.oh.us/proj/OhioJobOutlook.htm>.
3. *Ibid.*, p. 5; and *Ohio Job Outlook 2014, Ibid.*, p 4.
4. The BLS advises that data from the OES Survey have limited value for over-time comparisons. The OES cross-sectional wage data, reviewed over time between 2002-2006 in this report, do not come from the same cohort. However, when used in conjunction with other information and planning models, these occupational wage trends provide an analytical tool for evaluating skill shortages because of their low relative standard errors. We use these data cautiously and in combination with other data. Please refer to appendix II (Occupational Wage Data Trends) for a discussion of these data.
5. *Occupational Outlook Handbook*, 2006-07 edition, U. S. Bureau of Labor Statistics (BLS), at <http://www.bls.gov/oco/home.htm>; and the *Occupational Projections and Training Data*, 2006-07 edition, statistical and research supplement to the OOH, U.S. BLS, at <http://www.bls.gov/emp/optd/home.htm>.
6. Dockery, Jane, Center for Urban and Public Affairs, Wright State University, and Stock, Richard, the Business Research Group, University of Dayton, *Job Vacancy Survey Report for the Greater Montgomery County Labor Market*, December, 2006, at <http://www.thejobcenter.org/jvsreport.php>.
7. Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014, op. cit.*, p. 15.
8. Newman, Sandy, and Less, Larry, *Ohio Job Outlook, 2004-2014*, at <http://lmi.state.oh.us/proj/OhioJobOutlook.htm>, p. 26; and the Occupational Supply/Demand System (OSDS), Supply Indicators, Nursing Cluster, at <http://occsupplydemand.org>; plus unpublished Ohio FY 2006 final, adjudicated completions training data table from the National Center for Education Statistics (NCES) for selected, detailed 6-digit Classification of Instructional Program (CIP) codes. Registered Nurse (RN) = Standard Occupational Classification (SOC) Code 29-1111.
9. Ohio Board of Nursing, unpublished licensing data. Because recent RN licensing data with endorsements from other states included "First Responder" data and did not net out the endorsements into and out of Ohio, the Ohio RN licensing totals by exam fit the human resource accounting model better and are reported here for comparison against projected RN annual total job openings. In CY 2006, the Ohio Board of Nursing issued 7,300 new RN licenses through examination and endorsement from other states.
10. OSDS, Demand Indicators, Nursing Cluster, *op. cit.*
11. National Compensation Surveys (NCS) at <http://data.bls.gov/PDQ/outside.jsp?survey=nc>.
12. CPI at <http://data.bls.gov/PDQ/outside.jsp?survey=cu>. Comparable % change in Cincinnati-Hamilton CPI, 2001-2005, = 8.2%.
13. College Navigator at <http://nces.ed.gov/ipeds/cool/SearchResults.aspx>.
14. Medvin, Norman, "Occupational Job Requirements: A Short-Cut Approach to Long-Range Forecasting," reprinted from the *Employment Service Review*, January-February, 1967; Ohio Workforce Informer at <http://ohioworkforceinformer.org>; and the Ohio Job Matching System at https://scoti.ohio.gov/scoti_lexs. 90-day closing default, Ohio Job Matching System job orders were excluded from the hard-to-fill job order analysis.

15. *Ibid.*
16. Caldwell Economic Information Services (CEIS), *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, pp. 56-57, at <http://lmi.state.oh.us/research/Research.htm>.
17. *Ibid.*
18. Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2006-07 Edition*, Registered Nurses, at <http://www.bls.gov/oco/ocos083.htm>.
19. *Ibid.*
20. Dockery, Jane, Wright State University (WSU), and Stock, Richard, University of Dayton (UD), *Job Vacancy Survey Report for the Greater Montgomery County Labor Market*, December, 2006, p. 26, *op. cit.*
21. BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, at <http://www.ohioworkforceinformer.org>; and U.S. Bureau of Labor Statistics (BLS), Industry-Occupation Employment Matrix, at <http://www.bls.gov>, and the Employment Projections, National Employment Matrix, detailed occupation by industry, at <http://www.bls.gov/emp/empoids.htm>.
22. *Ibid.*
23. BLS, Location Quotient Calculator, at http://data.bls.gov/LOCATION_QUOTIENT/servlet/lqc.ControllerServlet.
24. *Ibid.*
25. "Best Hospitals 2006," *U.S. News & World Report*, at <http://www.usnews.com/usnews/health/best-hospitals/tophosp.htm>.
26. National Bureau of Economic Research, U.S. Business Cycle Expansions and Contractions, at <http://www.nber.org/cycles.html>.
27. Ohio BLMI, Economic Development Profile of Quarterly Census of Employment and Wages, Labor Market Information (LMI) Classic web site, at <http://lmi.state.oh.us/asp/edeps/EdepsDisplay.asp>.
28. Newman, Sandy, and Less, Larry, *Ohio Job Outlook, 2004-2014*, p. 30, *op. cit.*; Ohio occupational licensing data, *op. cit.*; the Ohio nursing board unpublished licensing data; and the OSDS, Supply Indicators, LPN Cluster, *op. cit.*; plus unpublished NCES table.
29. College Navigator, *op. cit.*; and Newman and Less, *Dayton MSA Job Outlook to 2014*, *op. cit.*, p. 15.
30. OSDS, Demand Indicators, LPN Cluster, *op. cit.*
31. *Ibid.*
32. National Compensation Surveys (NCS), *op. cit.*
33. *Ibid.* Because the NCS sampling design places greater emphasis upon the selection of larger employment firms with labor/management collective bargaining agreements, the NCS data may be less sensitive than the OES data to downward pressures on wages.
34. CPI, *op. cit.*; comparable % change in Cincinnati-Hamilton CPI, 2001-05 = 8.2%.
35. *Ibid.*; comparable % change in Cincinnati-Hamilton CPI, 2004-2005 = 2.9%.
36. Ohio Job Matching System, *op. cit.* (Excluded 90-day closing default, Ohio Job Matching System job orders.)
37. CEIS, *Keywords Found on AJB Resumes and Job Orders 2004*, *op. cit.*, pp. 57 & 60.
38. *Ibid.*, p. 57.
39. Dockery, Jane, WSU, and Stock, Richard, UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, p. 26, *op. cit.*

40. BLS, U.S. Department of Labor, *Occupational Outlook Handbook, op. cit.*, Licensed Practical Nurses.
41. *Ibid.*
42. OSDS, Supply Indicators, LPN Cluster, *op. cit.*
43. Ohio occupational licensing data, *op. cit.*; and unpublished Ohio nursing board data about newly issued LPN licenses by examination.
44. Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and BLS, Employment Projections, National Employment Matrix, detailed occupation by industry, *op. cit.*
45. BLS, Location Quotient Calculator, *op. cit.*
46. Ohio BLMI, Ohio Workforce Informer, Staffing Patterns, *op. cit.*; and U.S. BLS, Industry-Occupation Employment Matrix, *op. cit.*
47. Ohio BLMI, Economic Development Profile of Quarterly Census of Employment and Wages, Labor Market Information Classic web site, *op. cit.*
48. Newman, Sandy, and Less, Larry, *Ohio Job Outlook, 2004-2014, op. cit.*
49. OSDS, Supply Indicators, Automobile Mechanics Cluster, *op. cit.*
50. *Occupational Outlook Handbook, 2006-07 edition, U.S. BLS, op. cit.*
51. Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014, op. cit.*
52. College Opportunities Online Locator, *op. cit.*
53. OSDS, Demand Indicators, Automobile Mechanics Cluster, *op. cit.*
54. Consumer Price Index (CPI), *op. cit.*
55. Ohio's Job Matching System's Job Bank, *op. cit.* Excluded all default 90-day job orders, and job orders from firms with obviously unattractive work environments (e.g., private prison companies), and obvious miscodings of occupations.
56. *Ibid.* The difference in average days open between registered nurses and auto service technicians in 2006 was statistically significant at the 20% significance level.
57. See the appendix I for complete Ohio Job Bank hard-to-fill job order statistics.
58. Caldwell Economic Information Services (CEIS), *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004, op. cit.*, pp. 97-102.
59. *Ibid.*
60. BLS, U.S. Department of Labor, *Occupational Outlook Handbook, 2006-07 Edition, Automotive Service Technicians and Mechanics, op. cit.*
61. *Ibid.*, "How to Interpret Occupational Information Included in the *Handbook*."
62. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Survey Report for the Greater Montgomery County Labor Market, op. cit.*
63. BLS, U.S. Department of Labor, *Occupational Outlook Handbook, 2006-07 Edition, Automotive Service Technicians and Mechanics, op. cit.*
64. OSDS, Demand Indicators, Automobile Mechanics Cluster, *op. cit.*; the Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and the U.S. BLS, Industry-Occupation Employment Matrix, *op. cit.*
65. *Ibid.*
66. Ohio BLMI, Economic Development Profile of Quarterly Census of Employment and Wages, Labor Market Information Classic web site, *op. cit.*
67. *Ibid.*
68. BLS, Location Quotient Calculator, *op. cit.*
69. BLS, OOH, *op. cit.*

70. OSDS, Demand Indicators, Miscellaneous Professional Occupations Cluster, *op. cit.*; and OSDS, Demand Indicators, Line Supervision Cluster, *op. cit.*
71. CPI, *op. cit.*
72. CEIS, *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.*, pp. 92-96.
73. *Ibid.*
74. *Ibid.* For these two occupations, the Ohio's job bank provided insufficient numbers of quality job orders with which to draw conclusions about possible skill shortages (see appendix).
75. BLS/USDOL, OOH, Cost Estimators and First-Line Construction Managers, *op. cit.*
76. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
77. OSDS, Demand Indicators, Miscellaneous Professional Occupations and Line Supervision Clusters, *op. cit.*; the Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and the U.S. BLS, Industry-Occupation Employment Matrix, *op. cit.*
78. U.S. BLS, Location Quotient Calculator, *op. cit.*
79. Ohio BLMI, Economic Development Profile of Quarterly Census of Employment and Wages, Labor Market Information Classic web site, *op. cit.*
80. The human resource accounting approach is the only planning model which attempts to disaggregate and separately estimate the supply and demand forces in an occupational labor market. Since apprentices are hired first, and thereby counted in the workforce estimates on the demand side, the same apprenticeship training graduates or newly issued, construction license recipients cannot also and simultaneously be counted on the supply side.
81. OSDS, Demand Indicators, Electrical and Plumbing Clusters, at <http://occsupplydemand.org>. Current national compensation survey (NCS) wage data are not available for electricians and plumbers in the Dayton metropolitan area (see <http://data.bls.gov/PDQ/outside.jsp?survey=nc>).
82. Ohio Job Matching System Job Bank, *op. cit.* Excludes 90-day default Ohio Job Matching System job orders.
83. *Ibid.*
84. *Ibid.*
85. CEIS, *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.*, pp. 92-96.
86. *Ibid.*
87. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
88. BLS, OOH, *op. cit.*
89. OSDS, Demand Indicators, Electrical and Plumbing Clusters, *op. cit.*
90. Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and the U.S. BLS, Industry-Occupation Employment Matrix, *op. cit.*
91. Ohio BLMI, Economic Development Profile of Quarterly Census of Employment and Wages, Labor Market Information Classic web site, *op. cit.*
92. U.S. BLS, Location Quotient Calculator, *op. cit.*

93. Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014*, *op. cit.*; and *Ohio Job Outlook 2014*, *op. cit.*
94. Newman, Sandy, and Less, Larry, *Ohio Job Outlook, 2004-2014*, *op. cit.*; the OSDS, Law Enforcement Cluster, *op. cit.*; Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014*, *op. cit.*; and College Opportunities Online Locator, *op. cit.*
95. BLS, OOH, Police and Detectives, Training, Other Qualifications, and Advancement, *op. cit.*
96. OSDS, Demand Indicators, Law Enforcement Cluster, *op. cit.*
97. NCS, *op. cit.*
98. CPI, *op. cit.* The percent change in the CPI (annual, all urban consumers, all items, not seasonally adjusted) for the Cincinnati-Hamilton area, 2001-2005, was 8.2%.
99. CEIS, *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.*, pp. 62-65.
100. *Ibid.* The second source of job bank transactions data, the Ohio Job Matching System hard-to-fill job order statistics, were too few in number in 2006 for police officers to permit analysis.
101. BLS, OOH, Police and Detectives Profile, 2006-07 edition, *op. cit.*
102. BLS, OOH, "How to Interpret Occupational Information Included in the *Handbook*," 2006-07 edition, *op. cit.*
103. Dockery, Jane, WSU, and Stock, Richard, UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
104. Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and the BLS, National Employment Matrix, Industry-Occupation Employment Matrix, *op. cit.*
105. Newman, Sandy, and Less, Larry, *Ohio Job Outlook, 2004-2014*, *op. cit.*; OSDS, Supply Indicators, Law Enforcement Cluster, *op. cit.*; and OOH, Correctional Officers, *op. cit.*
106. Newman, Sandy, and Less, Larry, *Dayton MSA Job Outlook to 2014*, *op. cit.*
107. College Navigator, *op. cit.*
108. *Ibid.*
109. OSDS, Demand Indicators, Law Enforcement Cluster, *op. cit.*; and CPI, *op. cit.*
110. CEIS, *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.*, p. 63.
111. *Ibid.* The Ohio's job bank listed insufficient numbers of quality job orders for correctional officers and jailers in 2006 to permit analysis of hard-to-fill job order statistics.
112. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
113. BLS/USDOL, OOH, 2006-07 edition, Correctional Officers, and "How to Interpret Occupational Information Included in the *Handbook*," *op. cit.*
114. *Ibid.*
115. Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*
116. OSDS, Demand Indicators, Construction Equipment Operation Cluster, *op. cit.*
117. CPI, *op. cit.*
118. CEIS, *Keywords Found on America's Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.*, pp. 92-96.

119. *Ibid.* Insufficient numbers of quality Ohio Job Matching System hard-to-fill job order statistics prohibited analysis of this source of real-time, transactions data.
120. BLS, OOH, Construction Equipment Operators Profile, 2006-07 edition, *op.cit.*
121. BLS, OOH, “How to Interpret Occupational Information Included in the *Handbook*,” 2006-07 edition, *op. cit.*
122. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
123. Ohio BLMI, Ohio Workforce Informer, Occupation by Industry & Staffing Patterns, *op. cit.*; and U.S. BLS, National Employment Matrix, *op. cit.*
124. *Occupational Outlook Handbook* (OOH), 2006-07 edition, Sales Representatives, Wholesale and Manufacturing, *op. cit.*
125. OSDS, Demand Indicators, Sales Cluster, *op. cit.*
126. CPI, *op. cit.*
127. CEIS, *Keywords Found on America’s Job Bank (AJB) Resumes and Job Orders 2004*, *op. cit.* p. 79-80. As noted by the CEIS author, Chuck Caldwell, “The ratio may be inflated somewhat by orders that direct applicants to call a contact phone number.”(p. 79)
128. Dockery, Jane, and Stock, Richard, WSU/UD, *Job Vacancy Report for the Greater Montgomery County Labor Market*, *op. cit.*
129. BLS/USDOL, OOH, 2006-07 edition, Sales Representatives, Wholesale and Manufacturing.
130. OSDS, Demand Indicators, LPN Cluster, *op. cit.*
131. Less, Larry, *Ohio Industry Employment Projections for 1995: An Evaluation*, Long-Term Industry Projections and Census Tools Consortium, ALMIS (America’s Labor Market Information System), Employment and Training Administration, U.S. Department of Labor, October, 1997, p. 3 and Appendix Table 3; and Less, Larry, *An Evaluation of Ohio Industry Employment Projections for 2000*, Ohio BLMI, December, 2002, p. 5 and Appendix Table 3, at <http://lmi.state.oh.us/proj/projections.htm>; Less, Larry, and Newman, Sandy, *Ohio Job Outlook: 1994-2005*, June, 1996; and Ohio BLMI, Current Employment Statistics (CES) annual averages 2005, at <http://lmi.state.oh.us/ces/lmr.htm>. The mean absolute percent error (MAPE) refers to the industry employment forecast error as a percentage of the actual industry employment. (Please note that in this discussion, the terms, *forecast* and *projections*, are used interchangeably.)
132. See *Frequently Asked Questions*, “Can OES data be used to compare changes in employment or wages over time,” BLS/USDOL, at http://www.bls.gov/oes/oes_ques.htm.
133. Rocheteau, Guillaume, “Understanding Unemployment,” Federal Reserve Bank of Cleveland, at <http://www.clevelandfed.org/research/economists/rocheteau/index.cfm>.
134. *Ibid.*, p. 3.

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