incontext

Mar-Apr 2009, Vol. 10, No. 2

Earnings of a Lifetime: Comparing Women and Men with College and Graduate Degrees

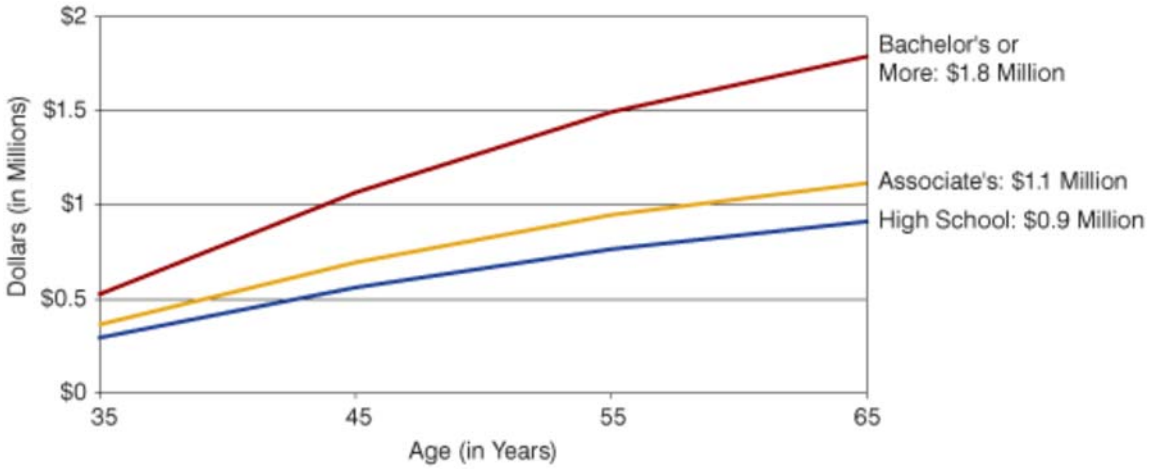
While women are now more likely to complete four-year college degrees than men,[1] it is less clear whether their higher levels of education will translate into closing the wage gap. Using synthetic lifetime earnings calculations, this article underscores the fact that men still earn considerably more than women at all levels of education. We also see that, while women seem more likely to complete degrees in fields that are associated with relatively low lifetime earnings (such as education), men still receive substantially higher incomes than women with similar educational backgrounds.

To meet the challenge of calculating lifetime earnings, this study follows a similar synthetic estimation strategy used by the Census Bureau[2] but with one important difference—future earnings are discounted at a rate of 3 percent per year to reflect the time value of money. More details are available in the methodology section at the end of this report.

All Degrees

Overall, bachelor's, master's, professional and doctoral degrees allow graduates the opportunity to greatly enhance their wage-earning potential beyond what they might have earned with merely an associate's degree or less—especially in the long run. **Figure 1** provides a rough illustration of the differences in the cumulative lifetime earnings for full-time year-round workers with different terminal degree levels, assuming a 40-year career from age 25 through 64. We see that associate's degree graduates can expect to earn a total of $361,000 or about 22 percent more than high school graduates between the ages of 25 and 34. Three decades later, we expect that associate's degree graduates would now have earned a total of $1.1 million, compared to $910,000 for high school graduates—still roughly a 22 percent increment.

Figure 1: Estimated Cumulative Lifetime Earnings by Sex in the United States

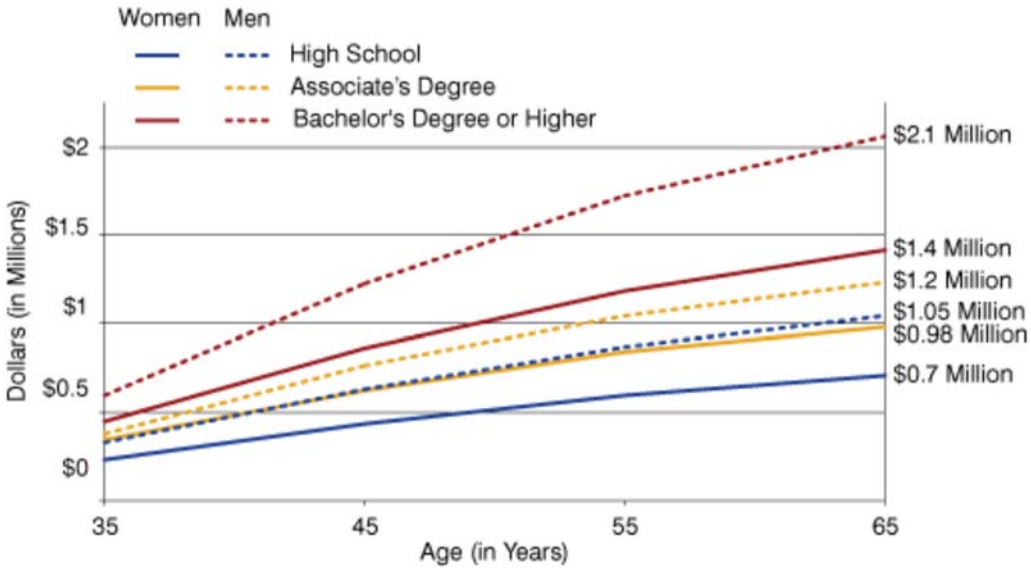


Note: This chart uses census data based on the average wages of 10-year cohorts by degree level. Figures use 2006 dollars and future earnings have been discounted at 3 percent.
Source: IBRC, using U.S. Census Bureau income data

However, when comparing graduates with a bachelor's degree or higher to associate's degree graduates, we see a 45 percent advantage in cumulative earnings by age 35—$524,000 compared to $361,000—and this gap in earnings widens considerably more over the life course. By retirement, graduates with bachelor's and advanced degrees can expect to have earned an average total of $1.8 million while associate's degree graduates only reach $1.1 million—a 61 percent advantage.

The increased lifetime earnings by degree level are remarkably different for women compared to men. **Figure 2** suggests that women have an important financial incentive to achieving higher levels of education: only women with a bachelor's degree or higher are likely to earn more over their careers ($1.4 million) than men with a high school degree ($1 million). Men earn far more than women across the life course at all degree levels: 48 percent more at the high school level, 26 percent more at the associate degree level and 45 percent more among those with a bachelor's degree or more.

Figure 2: Estimated Cumulative Lifetime Earnings by Sex and Degree Level in the United States



Note: This chart uses census data based on the average wages of 10-year cohorts by degree level. Figures use 2006 dollars and future earnings have been discounted at 3 percent.
Source: IBRC, using U.S. Census Bureau income data

Bachelor's Degrees by Field

Table 1 shows the estimated lifetime earnings associated with the 10 most popular degree fields of women and men earning bachelor's degrees at Indiana's public universities, assuming that graduates do not earn an additional advanced degree. Among women, the most popular degree fields are in education, business, arts and humanities, and social sciences, which together account for 57 percent of all bachelor's degrees received by women at these institutions. While arts and humanities and social sciences are also popular fields among men, the most popular field by far is business, which accounts for 22 percent of all male graduates. Most notably, education is only the fifth most popular field for men while engineering—which is not even among the top 10 fields for women—ranks third.

Table 1: Estimated Lifetime Earnings for Popular Bachelor's Degrees of Women and Men at Indiana Public Universities, 2002 to 2007

Women				Men			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)		Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Education (except Administration)	2,381	$964	1	Business Administration, Sales and Marketing	2,483	$1,910
2	Business Administration, Sales and Marketing	1,824	$1,355	2	Arts and Humanities (except Music, Visual and Performing Arts)	1,271	$1,553
3	Arts and Humanities (except Music,	1,617	$1,303	3	Engineering	1,073	$2,036

	Visual and Performing Arts)						
4	Social Sciences	1,578	$1,216	4	Social Sciences	1,016	$1,845
5	Communications and Journalism	972	$1,425	5	Education (except Administration)	852	$1,261
6	Nursing	667	$1,368	6	Technology/ Technical Fields (Includes Computer Programming)	825	$1,731
7	Allied Health Fields (except Nursing)	660	$1,370	7	Computer and Information Science (not programming)	626	$1,965
8	Biological, Agricultural and Environmental Sciences	626	$1,253	8	Communications and Journalism	552	$1,575
9	Music/Fine, Visual and Performing Arts	601	$1,210	9	Biological, Agricultural and Environmental Sciences	547	$1,536
10	Social Work	544	$979	10	Music / Fine, Visual and Performing Arts	355	$1,359

Note: There were 64,731 female graduates and 55,782 male graduates over this five-year period for an average of 12,946 and 11,156 per year, respectively. Data for 772 graduates over this period did not indicate gender. Lifetime earnings are synthetic estimates based on average wages for graduates by five-year age cohort, degree level and field. Figures have been adjusted to 2006 dollars and future earnings have been discounted at 3 percent.
Source: IBRC, using data from the Indiana Commission for Higher Education and the National Survey of College Graduates

Even though graduates of any field can choose a wide variety of occupations, we see substantial differences in the earnings of these graduates who work full-time. Among popular women's fields, graduates of business, communications, nursing and allied health all earn over $1.3 million while graduates of education and social work earn less than $1 million. Men with engineering degrees earn an estimated $2 million over the course of their careers whereas education majors are expected to earn $1.3 million.

However, the difference in lifetime earnings between men and women cannot be simply attributed to differences in the popularity of certain degree fields since men receive higher earnings in every field. For example, while business degrees were popular and their graduates relatively well paid among both sexes, men earn an estimated $1.9 million compared to $1.4 million for women—about 41 percent more. Even male graduates in fields associated with relatively low earnings among men still earn amounts comparable to the highest earnings of female graduates. Take men who complete bachelor's degrees in the music, fine and visual arts

field: they earn roughly $1.4 million—the same as women earning degrees in business.

Master's Degrees by Field

The most popular master's degree fields for women and men at Indiana's public institutions are again notably different (see **Table 2**). The most popular field for women is education (30 percent of all graduates) followed by business (13 percent). In contrast, over a third of all men's master's degrees are in business, followed by education (16 percent). Engineering is again the third most popular field among men (13 percent of all graduates) but only the 11th most popular field among women. Allied health fields and nursing are popular among female master's degree graduates but do not rank among the top 10 for men.

Table 2: Estimated Lifetime Earnings for Popular Master's Degrees of Women and Men at Indiana Public Universities, 2002-2007

Women				Men			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)		Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Education (except Administration)	1,124	$1,245	1	Business Administration, Sales and Marketing	1,110	$2,414
2	Business Administration, Sales and Marketing	489	$1,853	2	Education (except Administration)	531	$1,373
3	Public and Educational Administration and Management	282	$1,388	3	Engineering	413	$2,188
4	Allied Health Fields (except Nursing)	267	$1,588	4	Public and Educational Administration and Management	140	$1,634
5	Social Sciences	222	$1,303	5	Biological, Agricultural and Environmental Sciences	139	$1,475
6	Nursing	187	$1,626	6	Social Sciences	134	$1,800
7	Arts and Humanities (except Music, Visual and Performing Arts)	182	$1,201	7	Music/Fine, Visual and Performing Arts	118	$1,282

8	Library Science	175	$1,150	8	Mathematics and Physical Sciences	118	$1,920
9	Music/Fine, Visual and Performing Arts	147	$1,084	9	Arts and Humanities (except Music, Visual and Performing Arts)	118	$1,264
10	Biological, Agricultural and Environmental Sciences	144	$1,304	10	Computer and Information Science (not programming)	94	$2,085

Note: There were 18,422 female graduates and 16,303 male graduates over this five-year period for an average of 3,696 and 3,261 per year, respectively. Data for 626 graduates over this period did not indicate gender. Lifetime earnings are synthetic estimates based on average wages for graduates by five-year age cohort, degree level and field. Figures have been adjusted to 2006 dollars and future earnings have been discounted at 3 percent.
Source: IBRC, using data from the Indiana Commission for Higher Education and the National Survey of College Graduates

We would expect that the more specialized skills of master's degree graduates make them more likely to hold occupations aligned to their fields. It is, therefore, no surprise that women with master's degrees in business and nursing are expected to earn the most over their careers—$1.8 million and $1.6 million, respectively. Men with business degrees earn an estimated $2.4 million and engineering majors are expected to earn $2.1 million.

Again, men with master's degrees have far larger earning potentials than their female counterparts in almost all popular fields, with one notable exception among graduates in the arts and humanities field. Overall, while seven of the 10 most popular degree fields among men allow their graduates over $1.4 million in lifetime earnings, only female graduates in three popular fields earn this amount or more. Interestingly, men with master's degrees in arts and humanities have estimated lifetime earnings that are only marginally more ($63,000 or 5 percent) than their female counterparts—the smallest earnings gap observed in this study.

Professional and Doctoral Degrees by Field

There are similar numbers of female and male graduates of professional degree programs,[3] such as those in medicine and law, and these graduates are among the highest paid in the U.S. labor market. **Table 3** shows that both women and men are expected to earn around $2.5 million or higher as graduates with popular professional degrees though men still earn substantially more. In particular, men with medical, dental, optometry and veterinary degrees have massive earning potentials slightly less than $3.5 million, while their female counterparts earn roughly $2.8 million (21 percent less).

Table 3: Estimated Lifetime Earnings for Popular Professional Degrees of Women and Men at Indiana Public Universities, 2002 to 2007

Women			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Medicine/ Dentistry/ Optometry/ Veterinary Sciences	244	$2,759
2	Law/Legal Studies	209	$2,453

Men			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Law/Legal Studies	256	$2,903
2	Medicine/ Dentistry/ Optometry/ Veterinary Sciences	250	$3,488

Note: Besides the programs listed above, there are also professional degrees available in nursing, pharmacy and other allied health sciences. There were 2,825 female graduates and 2,767 male graduates over this five-year period for an average of 565 and 553 per year, respectively. Lifetime earnings are synthetic estimates based on average wages for graduates by five-year age cohort, degree level and field. Figures have been adjusted to 2006 dollars and future earnings have been discounted at 3 percent.

Source: IBRC, using data from the Indiana Commission for Higher Education and the National Survey of College Graduates

While women outnumber men at most degree levels, Indiana's public universities still produce more male graduates than female graduates at the doctoral level—approximately 598 compared to 426 each year (see **Table 4**). The field of choice among women is once again education (23 percent) followed by the social sciences (14 percent) and arts and humanities (12 percent), which together account for half of all female graduates' doctoral degrees. In contrast, half of all men complete doctoral degrees in engineering (24 percent), mathematics and physical sciences (14 percent), and the biological, agricultural and environmental sciences (12 percent).

Table 4 : Estimated Lifetime Earnings for Popular Doctoral Degrees of Women and Men at Indiana Public Universities, 2002 to 2007

Women			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Education (except Administration)	99	$1,520
2	Social Sciences	61	$1,657

Men			
	Field of Study	Average Annual Graduates	Lifetime Earnings (in Thousands)
1	Engineering	144	$2,513
2	Mathematics and Physical Sciences	83	$2,327

3	Arts and Humanities (except Music, Visual and Performing Arts)	51	$1,246	3	Biological, Agricultural and Environmental Sciences	69	$2,022
4	Biological, Agricultural and Environmental Sciences	46	$1,719	4	Education (except Administration)	67	$1,681
5	Mathematics and Physical Sciences	40	$2,003	5	Arts and Humanities (except Music, Visual and Performing Arts)	57	$1,573
6	Allied Health Fields (except Nursing)	37	$1,765	6	Social Sciences	55	$2,053

Note: There were 2,132 female graduates and 2,988 male graduates over this five-year period for an average of 426 and 598 per year, respectively. Data for 173 graduates over this period did not indicate gender. Lifetime earnings are synthetic estimates based on average wages for graduates by five-year age cohort, degree level and field. Figures have been adjusted to 2006 dollars and future earnings have been discounted at 3 percent.
Source: IBRC, using data from the Indiana Commission for Higher Education and the National Survey of College Graduates

There is a wide range of lifetime earnings associated with the six most popular doctoral degree programs. Men with engineering doctorates earn an estimated $2.5 million over the course of their careers—almost 60 percent more than graduates with doctoral degrees in the arts and humanities field ($1.6 million). Similarly, female doctoral graduates in mathematics and physical sciences ($2 million) are expected to earn 60 percent more than their counterparts in arts and humanities (only $1.2 million).

For popular doctoral fields, men again have substantially higher lifetime earnings than women. Four out of the six most popular doctoral degree fields for men have graduates who are expected to earn over $2 million over the course of their careers whereas only female graduates in the popular mathematics and physical sciences field earn that amount. The earnings gap is narrowest in the education field where female graduates are expected to earn about $161,000 (or 11 percent) less than their male counterparts.

Does Higher Learning Equal Higher Earning?

Overall, both men and women earn more over their careers for obtaining higher levels of education, but tremendous differences remain based on gender and field. Higher levels of education allow women greater earnings but these earnings are still far lower than the wages of men. Just because women are now more likely to complete bachelor's degrees than men does not mean that they will necessarily earn higher wages. This is especially true given that graduates of women's most popular field of study (education) earn substantially less than most

other fields. Another field that has more female graduates than men is the arts and humanities field, and this is one of the rare fields whose graduates may actually earn *less* at higher degree levels, perhaps since advanced degree holders are more likely to specialize in lower-paying occupations specific to their training. Female bachelor's degree graduates in arts and humanities typically earn an estimated $1.3 million while master's and doctoral degree graduates in this field earn an estimated $1.2 million. Meanwhile, male arts and humanities graduates make estimated lifetime earnings of $1.5 million with bachelor's degrees but those with master's and doctoral degrees make $1.3 and $1.5 million, respectively.

Women and men do not gain the same returns in wages through higher education, and complex challenges remain to solve this nagging social problem. For starters, we need to examine whether—for each degree and level—the occupations available to both women and men have similar compensation. Higher earning potential is not the only reason women and men choose particular fields of study, but perhaps important occupations related to degrees popular among women—such as teaching jobs for education majors—would become more popular if they were given more value through higher wages.

Methodology

In the most recent National Study of College Graduates (NSCG) survey in 2003, a nationally representative sample of college graduates (bachelor's degree and above) were asked detailed questions about their educational history, wages and work status, along with demographic information (such as sex and age).[4] This information was then used to determine the average annual wages (adjusted to 2006 dollars) of each five-year age cohort of graduates (male and female) based on the degree level (bachelor's, master's, etc.) and field of study of their terminal degree. Data for full-time, year-round workers were used—that is, only the earnings of persons who worked 35 hours or more per week (or were on paid leave) during at least 50 weeks of the year.

To reflect a typical 40-year career, this research uses eight five-year cohorts: 25-29 through 60-64. The average wage of each age cohort was multiplied by five to produce the five-year cumulative real earnings. Earnings for each subsequent age cohort were then used as synthetic "future earnings" by discounting them at an annual rate of 3 percent.[5] After all cohort calculations were made for the cumulative real earnings of each five-year period, the earnings were summed to produce estimated lifetime earnings for each combination of sex, degree level and field.[6] The only exception is that U.S. Census Bureau data based on 10-year age cohorts was used to compare the synthetic lifetime earnings for high school graduates, associate degree graduates and those with bachelor's degrees or higher (for **Figure 1** and **Figure 2**).[7]

This study also used data from the Indiana Commission for Higher Education (CHE), to determine the most popular degree programs by field for graduates of Indiana public universities that offer four-year and advanced degrees.[8]All degrees conferred during the five academic years starting in 2002 and ending in 2007 were compiled to produce the average annual number of degrees by field for both men and women. In all, calculations were made for 24 fields at four degree levels—bachelor's, master's, professional and doctoral.

Notes

1. Rachel Justis, "Higher Education: Women Take Lead." *InContext*, November-December

2008. Available online at: www.incontext.indiana.edu/2008/nov-dec/1.asp.

2. More information is contained within the Census report "The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings" issued in July 2002. Available online at: www.census.gov/prod/2002pubs/p23-210.pdf.
3. Professional degrees include doctoral degrees in medicine, dentistry, law, optometry, pharmacy and veterinary sciences.
4. While the National Survey of College Graduates is administered by the National Science Foundation which focuses on the careers of science and engineering degree graduates, the NSCG is designed to collect data on a representative of college graduates in all fields. Detailed information is available at: https://sestat.nsf.gov/flex/sestat.jsp.
5. CHE data reveal that almost all of these degrees are granted by all the campuses of the following five public universities: Ball State University, Indiana State University, Indiana University, Purdue University and the University of Southern Indiana. Since CHE categorizes majors based on the U.S. Department of Education's Classification of Instructional Programs (CIP) system, these majors were first re-classified into fields that were compatible with the National Science Foundation system used by NSCG data.
6. The formula used is 1/(1+0.03)^y—where y reflects the number of years between the "present" and the mid-point of the particular five-year period in the "future."
7. Estimated lifetime earnings =
   $$\sum_{a=1}^{8} (5 * \widehat{realearn}_a) * \left(\frac{1}{(1+d)^{((5*a)-2.5)}}\right)$$
   where a is the cohort numbered one through eight (representing 25 to 29, 30 to 34, ... , 60 to 64); $\widehat{realearn}$ is the average annual wage of the cohort in 2006 dollars; and d is the discount rate (set at 0.03 for this analysis).
8. The NSCG survey only reports the wages of graduates of four-year college degrees or higher. The U.S. Census Bureau releases historical income tables for a wide range of demographic groups, using the Current Population Surveys. Data relevant to this research are available at: www.census.gov/hhes/www/income/histinc/histinctb.html.

Michael F. Thompson, Economic Research Analyst
Indiana Business Research Center, Kelley School of Business, Indiana University

Mar-Apr 2009, Vol. 10, No. 2

Manufacturing Drove Indiana Compensation in 2007

Compensation for Indiana workers grew 3.1 percent in 2007, slightly outpacing inflation. This compares to growth of 3.4 percent in the Great Lakes region[1] and 5.2 percent growth in the United States as a whole.

Manufacturing Led the Pack in 2007

Despite Indiana's diversification away from manufacturing, that sector still ranked number one in share of total compensation (see **Table 1**) in 2007 (the latest year for which federal data are available). More than one-quarter of all Indiana's nonfarm compensation flowed out of that sector, followed by government at 15 percent. The fastest growing sector, however, was professional and technical services, with an 8.2 percent growth.

Table 1: Indiana's Compensation by Industry, 2007

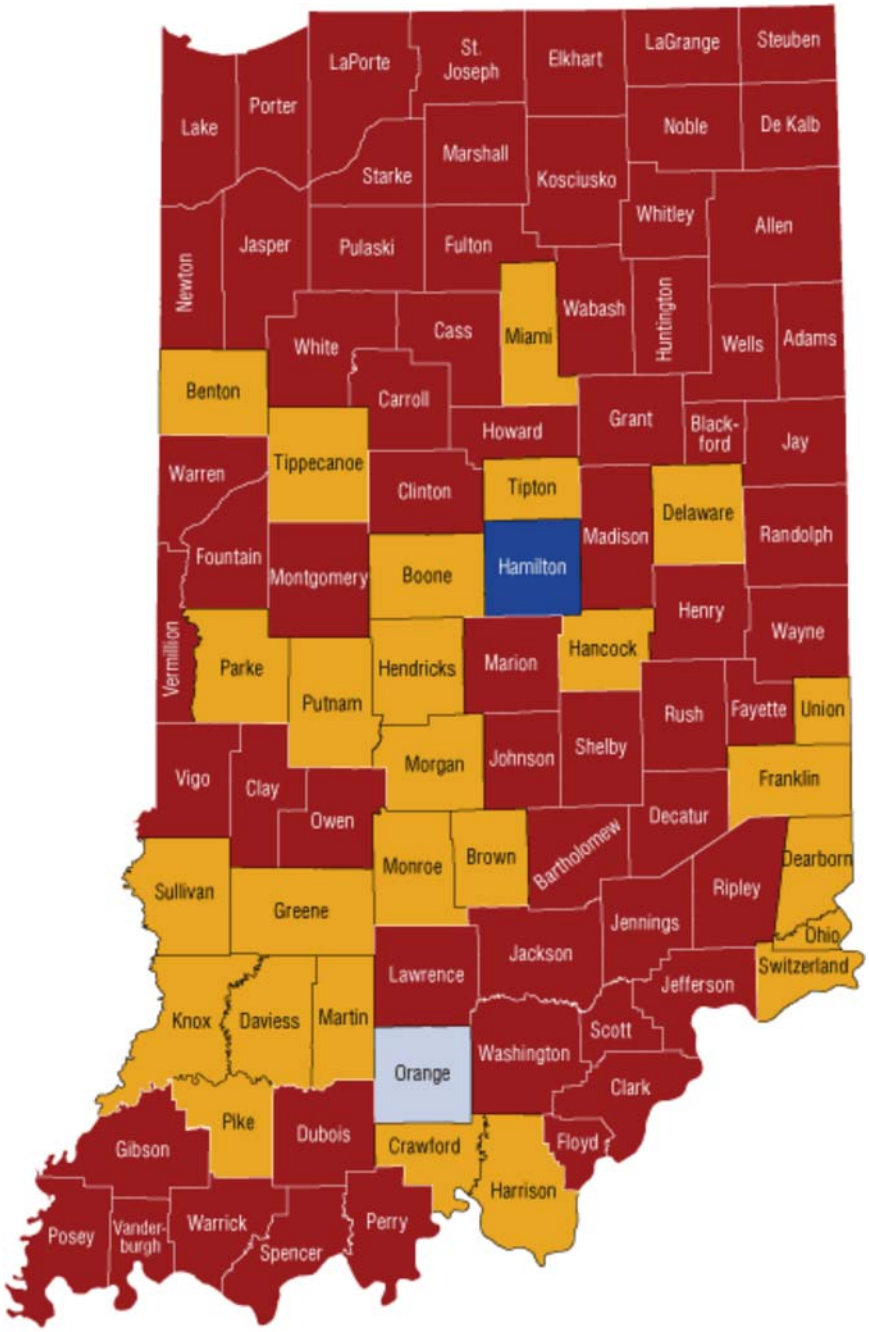
Rank	Industry	Compensation (in Thousands)	Share of Total Nonfarm Compensation	Percent Change, 2006-2007
1	Manufacturing	36,962,044	26.1%	0.1%
2	Government and Government Enterprises	21,780,476	15.4%	3.8%
3	Health Care and Social Assistance	14,909,046	10.5%	5.1%
4	Retail Trade	8,962,439	6.3%	1.2%
5	Construction	8,348,004	5.9%	6.6%
6	Wholesale Trade	7,778,635	5.5%	5.0%
7	Finance and Insurance	6,557,105	4.6%	0.9%
8	Professional and Technical Services	6,156,494	4.4%	8.2%
9	Transportation and Warehousing	5,701,462	4.0%	3.0%
10	Administrative and Waste Services	4,757,514	3.4%	5.5%
11	Other Services (except Public Administration)	4,351,255	3.1%	4.6%

12	Accommodation and Food Services	3,759,700	2.7%	3.3%
13	Management of Companies and Enterprises	2,420,466	1.7%	3.9%
14	Information	2,299,441	1.6%	4.4%
15	Educational Services	1,779,146	1.3%	5.9%
16	Arts, Entertainment and Recreation	1,635,884	1.2%	3.9%
17	Real Estate, Rental and Leasing	1,407,856	1.0%	0.8%
18	Utilities	1,323,473	0.9%	2.2%
19	Mining	475,037	0.3%	5.4%
20	Forestry, Fishing, Related Activities and Other	102,239	0.1%	7.7%

Source: Bureau of Economic Analysis

Figure 1 shows the sector with the largest share of total compensation by county. Manufacturing had the largest share in 64 of Indiana's 92 counties. Government ranked first in 26 counties, bearing in mind that this sector includes compensation at public schools, public hospitals and the like.

Figure 1: Industry Sector with the Largest Share of Total Compensation by County, 2007

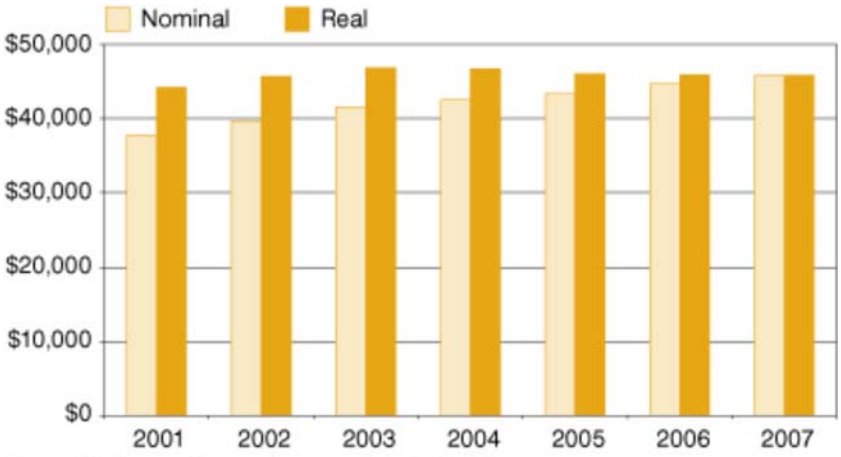


Source: IBRC, using Bureau of Economic Analysis data

Average Compensation per Job

Average compensation per job helps explain these figures at the individual worker level. **Figure 2** shows average compensation for the state in both nominal (actual) and real (adjusted for inflation) terms since 2001. While Indiana has experienced a steady increase in compensation in nominal terms, average compensation per job remained relatively stable after adjusting for inflation, with a slight peak in 2003.

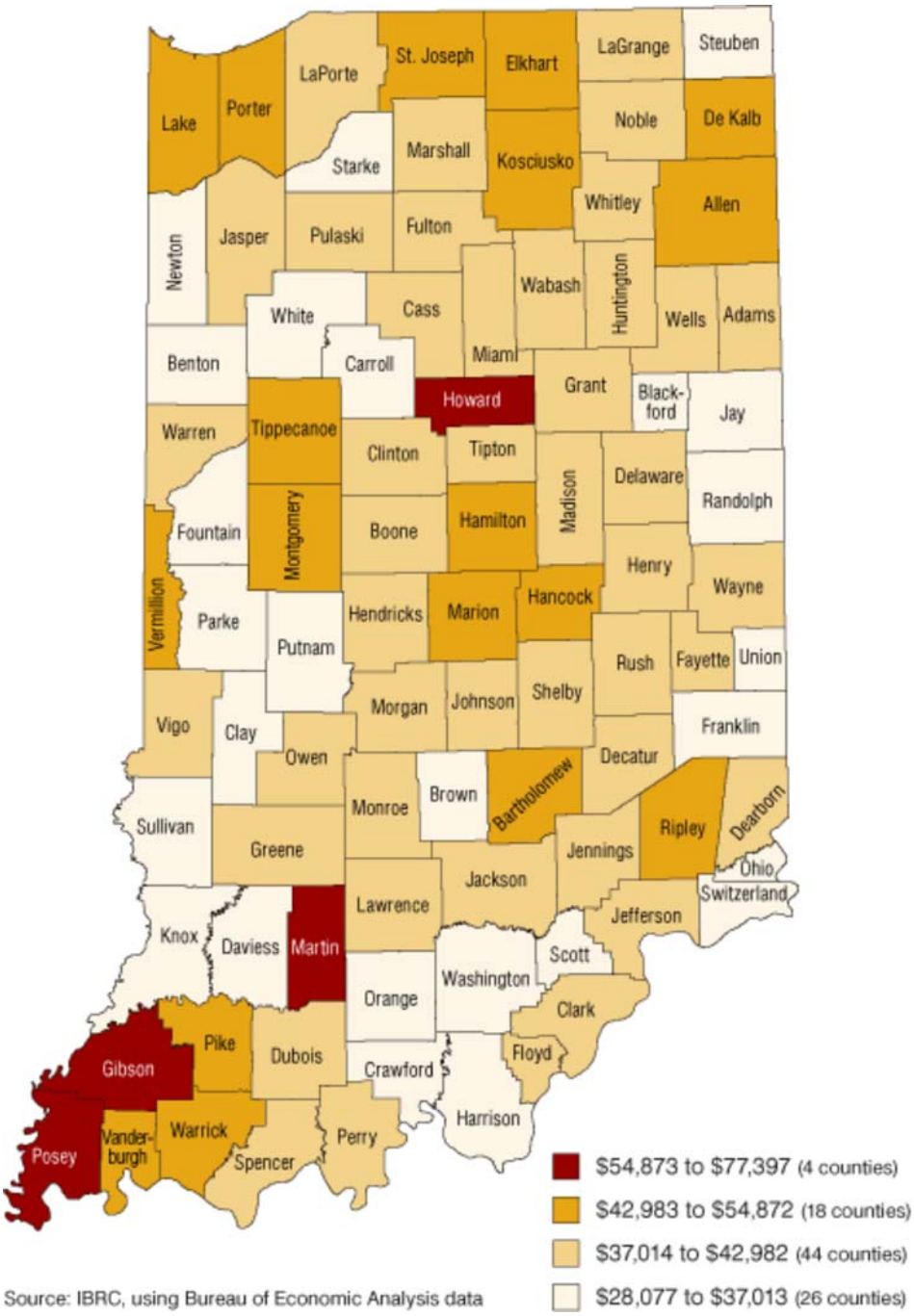
Figure 2: Average Compensation in Indiana, 2001 to 2007



Source: IBRC, using Bureau of Economic Analysis data

While the statewide average job compensation was $45,849, average compensation per job ranged from $28,077 in Brown County to $77,397 in Martin County (see **Figure 3**). With the presence of the Crane naval base, Martin County had the highest average compensation in the entire Great Lakes region.

Figure 3: Average Compensation per Job by Indiana County, 2007



Source: IBRC, using Bureau of Economic Analysis data

Conclusion

The manufacturing sector will continue to be a vital source of jobs and wages in Indiana, as it has weathered significant business cycles over the past 60 years or more. Despite a very small nominal growth rate of 0.1 percent since 2006, manufacturing still accounts for more than 25 percent of nonfarm compensation in the state. Manufacturing is currently the dominant sector in 64 of 92 counties. Given the current recession and manufacturing's shifting fortunes, that reliance on manufacturing will pose significant challenges to our economies across the state.

Note

1. The Great Lakes region includes Illinois, Indiana, Michigan, Ohio and Wisconsin.

Rachel Justis, Geodemographic Analyst

Indiana Business Research Center, Kelley School of Business, Indiana University

incontext

Mar-Apr 2009, Vol. 10, No. 2

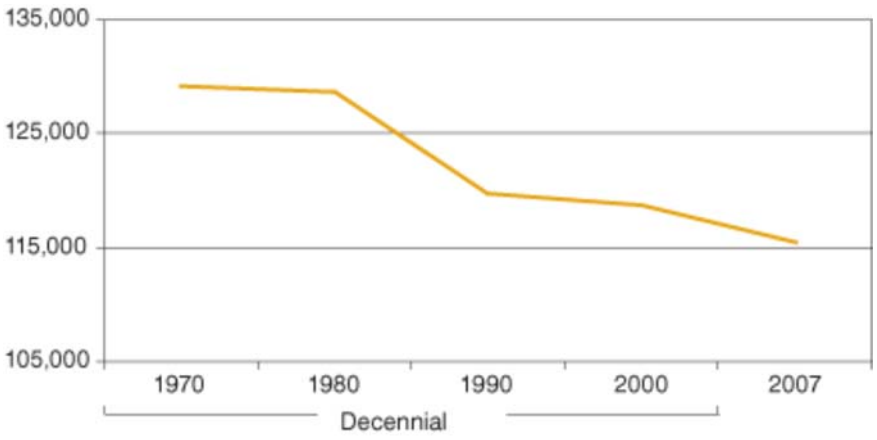
The Muncie Metro Story: Told by STATS Indiana

This is the 10th article in a series about Indiana's metropolitan statistical areas (metros). All of the data used in this article can be found using the USA Counties and Metros Side-by-Side feature on STATS Indiana (www.stats.indiana.edu).

The Area

With 115,419 people in 2007, the Muncie metro area is much more densely populated than the state or the nation with 294 people per square mile, compared to 177 people per square mile in Indiana and 85 people per square mile in the United States. (To put that into perspective, however, the Indianpolis metro had 439 people per square mile and the Cincinnati-Middletown metro had 485 people per square mile.) Since 1970, Muncie's population has continued to decline (see **Figure 1**).

Figure 1: Muncie Metro Population, 1970 to 2007

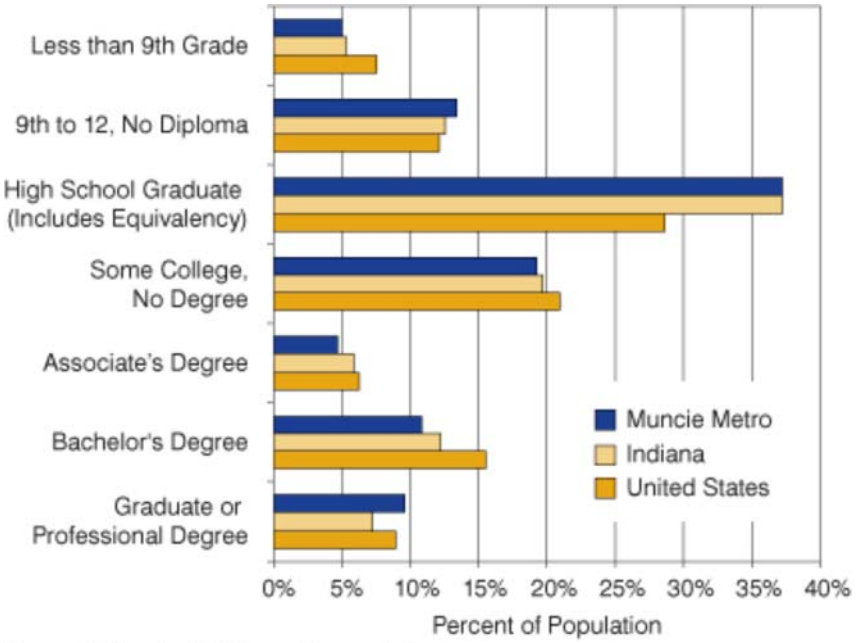


Source: IBRC, using U.S. Census Bureau data

Ball State University is the major campus in the Muncie area, so it is not surprising that the population of college-age adults is much higher in the metro (16.8 percent of the total population) than in the state (9.5 percent) and nation (9.8 percent). A look at educational data from Census 2000, however, shows a mixed picture. Only 5 percent of the total population in the Muncie metro age 25 and older had less than a ninth grade education, compared to 7.5 percent in the United States. That said, the metro also has a higher proportion of adults 25 and older with some high school but no diploma (13.4 percent, compared to 12.1 percent nationally). The metro had a lower percent of its population with some college, an associate's degree and bachelor's degree, but a higher percent with a graduate or professional degree (see **Figure 2**).

Figure 2: Educational Attainment in the Muncie Metro, Indiana and the

United States, 2000

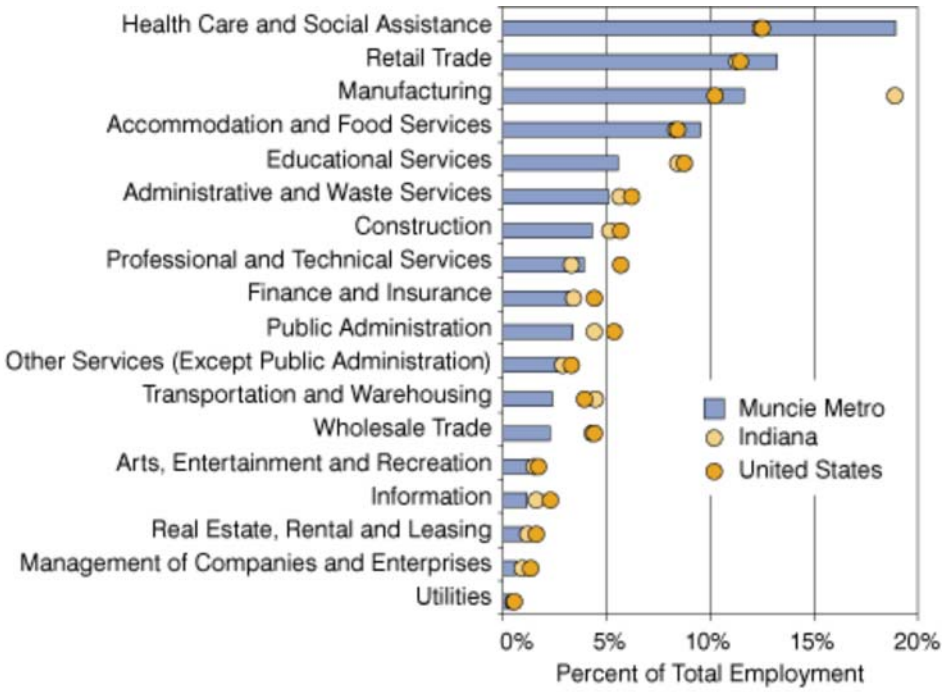


Source: IBRC, using U.S. Census Bureau data

Jobs and Wages

There were fewer jobs in the Muncie metro in 2007 than there were 10 years prior, but jobs have rebounded slightly since the low point in 2005. The health care industry employed more than any other industry in the metro in 2007, providing more than 9,100 jobs. This industry also had a higher proportion of jobs in Muncie than it did in the state or nation (see **Figure 3**). Retail trade and accommodation and food services were the only other industries where the metro had a higher percentage of employment than both the state and nation—quite common for university counties.

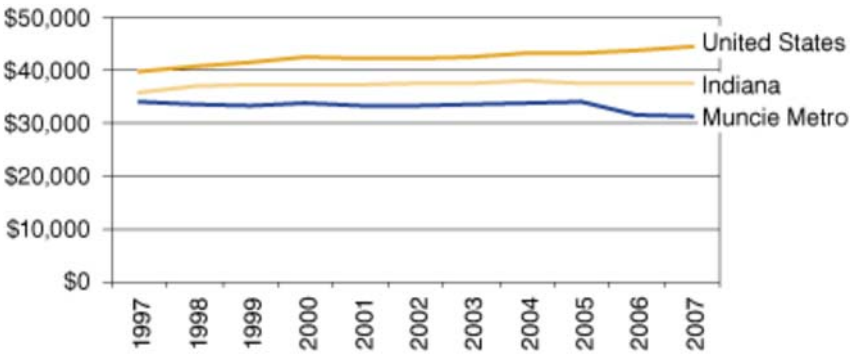
Figure 3: Percent of Employment by Industry in the Muncie Metro, Indiana and the United States, 2007



Source: IBRC, using Bureau of Labor Statistics data

The Muncie metro saw a decline in wages following the bottoming out of jobs in 2005. After adjusting for inflation, the average wage per job fell from an average of $34,149 in 2005 to $31,559 in 2006. Unfortunately for the metro, that number dropped again, albeit more slowly, in 2007 (see **Figure 4**).

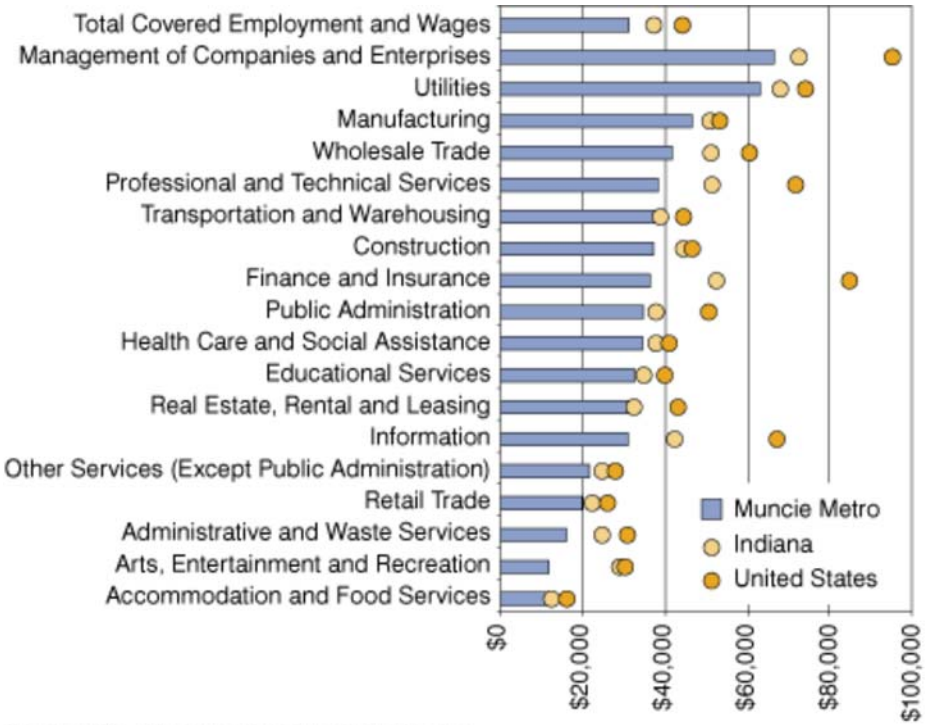
Figure 4: Average Wage per Job in the Muncie Metro, Indiana and the United States, 2007



Source: IBRC, using Bureau of Labor Statistics data

Wages in the metro and Indiana were lower than wages in the United States across each of the major industry sectors (see **Figure 5**).[1] Management of companies and enterprises paid the most in 2007, averaging $66,504 for the year. Utilities closely followed at $62,941 on average. The three industries with the most employees were scattered across the gamut when it came to wages: health care and social assistance paid $34,498 in the metro, manufacturing paid $46,429, and retail trade averaged $19,715.

Figure 5: Wages by Industry in the Muncie Metro, Indiana and the United States, 2007



Source: IBRC, using Bureau of Labor Statistics data

The biggest gap in wages between the metro and the United States was in the finance and insurance industry, where the U.S. average was more than double Muncie's average annual wage of $36,338. The smallest gap was in the low-paying accommodation and food services industry, where the U.S. paid about $5,300 more than the metro over the year.

Conclusion

After a longer delay in recovery than most areas experienced from the 2001 recession, the most current data show Muncie pulling through. However, these data do not capture any of the current recession-related news. For example, Borg Warner's Muncie plant is scheduled to close in 2009,[2] as is Graphic Packaging International. Meanwhile, Brevini is supposed to build a facility that will create 450 jobs.[3] Like much of Indiana, Muncie is being forced to adapt to a tough economy that isn't as reliant on auto manufacturing as it used to be.

Notes

1. Data for agriculture, forestry and hunting as well as data for mining were not disclosable for the Muncie metro.
2. Dagney Faulk, “Muncie Forecast 2009,” *Indiana Business Review*, 83 (4), www.ibrc.indiana.edu/ibr/2008/outlook/muncie.html. Keith Roysdon, "Muncie box plant to close, ending 154 jobs," The Star Press, February 10, 2009. Available online at www.thestarpress.com/article/20090210/NEWS06/90210020.
3. Dagney Faulk, “Muncie Forecast 2009,” *Indiana Business Review*, 83 (4), www.ibrc.indiana.edu/ibr/2008/outlook/muncie.html.

Molly Manns, Associate Editor
Indiana Business Research Center, Kelley School of Business, Indiana University

incontext

Mar-Apr 2009, Vol. 10, No. 2

Expanding Indiana's Monthly Employment Data

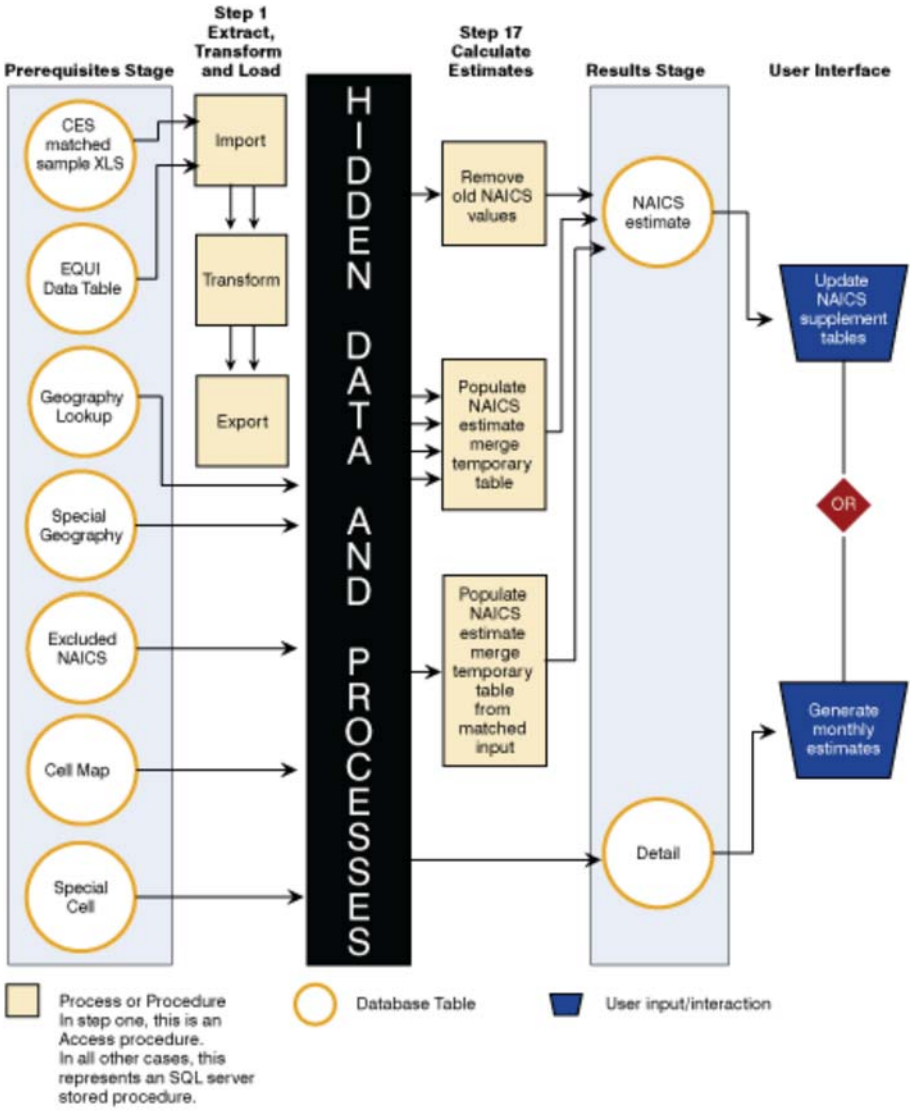
This research brief summarizes efforts to further expand Indiana's Current Employment Statistics (CES) program to produce monthly super-sector employment estimates at the county-level. Currently, such detailed figures are only available quarterly with a six-month lag through the Quarterly Census of Employment and Wages (QCEW) through its comprehensive survey of employers throughout the state. It is a challenging task to make monthly projections of local super-sector employment given the small size of many counties and the rapidly changing labor market. However, over the past year, the project team from the Research and Analysis Division of the Indiana Department of Workforce Development (DWD) and the Indiana Business Research Center (IBRC) have been working to adapt the strategy used by the State of Illinois—the only other state to produce such estimates.[1] These efforts to form the Indiana County Estimator (ICE) stand to produce an "early intelligence" tool that would greatly assist government officials and local economic developers in their efforts to rapidly address changes in the labor market.

The Methodology in Brief

In developing ICE, the research team modified the strategy used by the Economic Information and Analysis Division of the Illinois Department of Employment Security and their collaborators at the University of Chicago's National Opinion Research Center (NORC). These Illinois researchers were kind enough to share their documentation and even offer some initial advice by phone.

The overall technique is to use the change in "current" employment for firms in the relatively small sample surveyed monthly through the CES program to project the employment of all Indiana firms using data reported previously through quarterly tax filings. Of course, there are many intermediate tasks to successfully and securely implement such a procedure given the millions of confidential employment records. Extensive coding in Microsoft SQL Server Integration Services (SSIS) is used to assemble, parse and match data from multiple secure servers hosted by state government as well as to run statistical estimation procedures.[2] Ultimately, a user-friendly computer interface will be created that will allow DWD analysts to automate and make adjustments to the entire procedure whenever new data are available. **Figure 1** summarizes the beginning and end stages of the process by showcasing some of the procedures and types of data involved.

Figure 1: Data Flow Diagram Summarizing the Beginning and End Stages of the Indiana County Estimator (ICE) Process



Source: IBRC and IDWD, adapting strategies of the Illinois Department of Employment Security

Click for larger image

Key Steps in the ICE process

1. CES employment for sample establishments for the current month (e.g. March 2009) are matched with QCEW employment for the same establishments one year earlier (March 2008).[3]
2. The sample establishments' employment is then aggregated in two key ways:
   - By industry based on the 96 sectors classified through the three-digit codes of the North American Industrial Classification System (NAICS)
   - By whether or not they are located within a Metropolitan Statistical Area (metro)
3. Beta estimates (β) are obtained as the factor by which QCEW employment for each industry are multiplied to accurately reflect aggregate CES employment for the sample (or "certainty") units. This estimation is made using ordinary least squares (OLS) regression and is loosely based on the following formula:
   $$CES_{ALL}^{2009} = \beta_{n211} * \sum QCEW_{n211}^{2008} + \beta_{n212} * \sum QCEW_{n212}^{2008} + \ldots + \beta_{n999} * \sum QCEW_{n999}^{2008}$$
   where *n*211, *n*212, etc. represent each three-digit NAICS industry.
4. Beta estimates are then refined in three key ways:

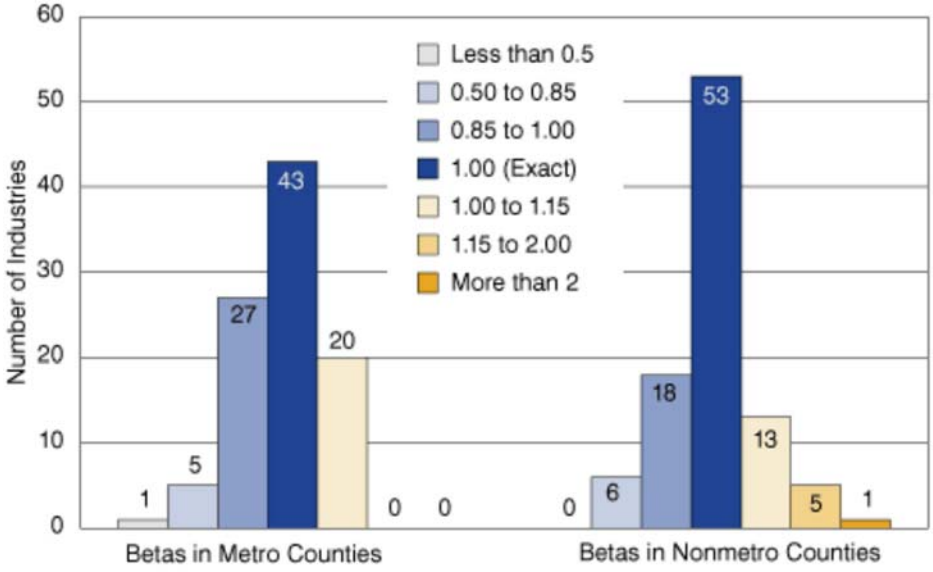
- Beta coefficients that are not statistically significant (i.e., have a likelihood of error higher than 5 percent) are replaced with the value of "1." This means they essentially default to a 1-to-1 ratio.
- Beta coefficients that are based on a sample of firms fewer than four for a particular industry are also replaced with a value of "1."

5. Employment estimates by county for each three-digit NAICS industry (96 industries in all) are created as the sum of the following:
   - The actual employment for each establishment that is reported by the CES sample (certainty units).
   - The estimated employment (using the beta estimates for each industry) for establishments that are not in the CES sample (non-certainty units).
   - The supplemental employment figures for "presumed non-covered" workers. These are workers that are not counted by the QCEW, including elected officials, railroad workers and student workers at colleges and universities. DWD already creates regular estimates of these workers based on supplemental data it requests from relevant employers.
6. To reduce the volatility of the estimates, employment figures are then produced for 11 super-sectors by aggregating employment estimates of the 96 NAICS sectors to the super-sector structure used for Current Employment Statistics reporting.

Results of Initial Testing

To test the reliability of ICE results, the research team produced estimates for historical periods to see how well projections matched actual reported employment. Specifically, the research team made employment estimates for every month of 2007 using data from 2006. **Figure 2** summarizes the ranges of the Beta coefficients produced for November 2007. Many estimates had the conservative value of 1 meaning no change in employment between 2006 and 2007 for that industry. However, slightly more coefficients were between 0.85 and 1.00 rather than between 1.00 and 1.15—indicating that more industries had a modest decline in employment rather than a modest incline.

Figure 2: Beta Coefficient Ranges for Projected Employment Change for Nonfarm Industries in Indiana's Metro and Nonmetro Counties, November 2006 to November 2007



Note: These estimates are for 96 nonfarm industries of the three-digit North American Industrial Classification System. Beta values can be interpreted as ratios such that values lower than 1 indicate a decline in employment and those above 1 indicate an increase in employment.
Source: IBRC, using ICE results based on analysis of Current Employment Statistics and Quarterly Census of Employment and Wages data

Figure 2 also reveals the increased challenge of projecting employment in nonmetro counties. ICE projections not only assigned more industries in these regions with the default beta value of 1 (meaning no change in employment) but more industries were assigned extremely low (less than 0.85) or high beta values (greater than 1.15)—indicating unusually large shifts in employment.

Overall, the ICE estimates are highly accurate in projecting total employment. November 2007 test results show that, on average, ICE total employment estimates were within 2.5 percent of the actual employment figures confirmed by QCEW establishment reporting. However there are still several counties, mostly outside of metros, with fairly large differences between the estimates and actual employment figures. For example, estimates for Newton, Ripley and Union counties were off the mark by more than 8 percent.

To improve ICE estimates for industrial sectors, the research team is working on ways to allow labor market analysts the chance to investigate large shifts in employment within counties. This is crucial to ensuring that employment shifts reflect the actual changes of particularly influential establishments that may be major employers within small counties. Data error is possible since administrators at establishments with multiple locations sometimes mistakenly provide combined employment figures instead of separately reporting data for each operation by county location. Furthermore, if shifts in employment within a particular county are valid yet particularly unusual and non-representative of other metro or nonmetro counties, the ICE modeling procedure should be adjusted accordingly.

Conclusion and Future Plans

Currently, the research team is doing a final round of testing by projecting 2008 employment figures before beginning employment projections for 2009. Additionally, important work is needed in order to automate the entire process with a user-friendly interface, along with editing capabilities that state analysts could use on a monthly basis. While employment projections are never perfect and need to be used with caution, ICE can lend important insight for leaders required to make urgent workforce investment decisions.

Notes

1. More information about Illinois's small area employment estimates can be found in: Joseph Malcolm's "Nonfarm Employment Estimates for Smaller Areas (Part 2)" *Illinois Labor Market Review*: 8 (3), available online at http://lmi.ides.state.il.us/lmr/fall_2002/Non-farm.htm.
2. Currently, the research team is in the process of automating the statistical estimation process using either Stata or SPSS software.
3. While the Illinois strategy called for matching CES employment with the most recent benchmarked QCEW figures, the research team decided it was better to use the same month in the prior year to avoid the need for seasonal adjustments.

Michael F. Thompson, Economic Research Analyst
Indiana Business Research Center, Kelley School of Business, Indiana University

Jackie V. Turner, Database Analyst/Programmer
Indiana Business Research Center, Kelley School of Business, Indiana University