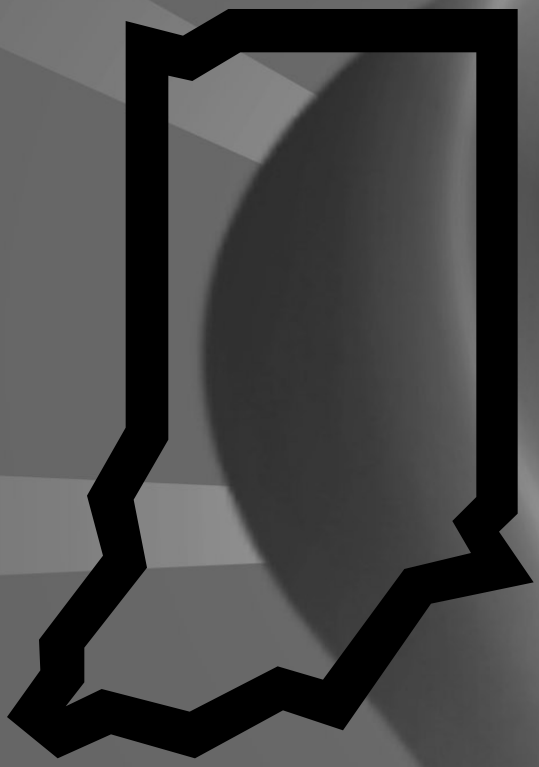
Spring 2000



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High-tech. High technology. These terms are bandied about today to describe stocks and states. A recent article in the *Indianapolis Star* branded Indiana as a low-tech state, but without defining the term. What does high-tech mean exactly? Is it specific to computers, as in hardware or software? Or is it the use or application of high-tech processes in manufacturing? The American Heritage Dictionary defines high-tech as "that which involves highly advanced or specialized systems or devices." A rather broad definition that doesn't necessarily answer the question are you high-tech if you make high-tech or use high-tech?

This issue of the *Indiana Business Review* won't answer that question for Indiana, but Professor Kirk, author of our lead article, looks at patent issuance as one indicator of Indiana's entrepreneurial environment, be it high-tech, bio-medical or otherwise. Thousands of patents, issued to both individuals and companies, have been filed within the state of Indiana over the past ten years. Millions of dollars are spent in Indiana on research and development. A new fund, the 21st Century Technology Fund, was created to foster a climate of technology, which, in turn, may breed more entrepreneurs--those inventors and creators who take a great idea and find others to help bring it to the marketplace. Edison comes to mind as one of the great entrepreneurs of the past two centuries, filing thousands of patents just in his own name. And just fifteen years ago, then President Reagan announced to a gathering of Nobel winning scientists, that "you who are on the cutting edge of technology have already made yesterday's impossibilities the commonplace realities of today."

Comments? Questions? Concerns? Please e-mail them to rogersc@indiana.edu.

Indiana: Land of Entrepreneurial Opportunity

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...clusters of high-technology firms have been shown to generate benefits in terms of employment, income, and economic development

Gary S. Becker, the 1992 Nobel laureate from the University of Chicago, wrote recently in *Business Week*: "A successful entrepreneurial environment features continual 'creative destruction,' to use (Austrian economist Joseph) Schumpeter's apt term. New companies prosper and help the economy in part by destroying the markets of established competitors."

In Indiana, there have been recent local and state initiatives to develop a successful entrepreneurial environment. In 1997, Stephen Goldsmith, mayor of Indianapolis, appointed a high tech task force which became the Central Indiana Technology Partnership, in cooperation with the Indianapolis Economic Development Corporation. Goals were to develop a culture to encourage technology-based enterprise, to develop links between innovation sources, to attract technology professionals, and to increase access to financial capital for technology entrepreneurs.

In spring 1999, the Indiana General Assembly appropriated $50 million for a 21st Century Research and Technology Fund. Governor O'Bannon appointed a Board of Directors for the Fund that will allocate the funds to promote high-technology business.

Where does Indiana stand in the development of an entrepreneurial type of environment? This article focuses on patent issuance--one dimension of this type of environment. A patent is an outcome of an information-generating activity involving research and development (R&D) expenditures and efforts of scientific and engineering personnel. Indiana and selected states will be ranked by measures of patent issuance, R&D expenditures, and scientific/engineering personnel. Determinants of the geographic distribution of patent issuance will be identified. This topic is important because clusters of high-technology firms have been shown to generate benefits in terms of employment, income, and economic development. Understanding the determinants of the geography of high-technology firms is important for regional economic policy.

We associate Silicon Valley with an entrepreneurial environment and creative destruction. Can Silicon Valley be transplanted to our Hoosier flatland? The birthplace of Silicon Valley, as designated by the State of California, is an old garage on Addison Avenue in Palo Alto where Hewlett-Packard originated in 1939. Frederick Terman, as Stanford University's dean of engineering and provost, played a critical role during the 1930s in fostering local business-university cooperative relationships based on the model of MIT's department of electrical engineering. His student entrepreneurs included Hewlett, Packard, and Charles Litton. Hewlett-Packard may have been the first university spin-off firm in history. Its growth was stimulated significantly by WWII military contracts--as were other fledging high-tech firms.

In the mid 1960s, a Silicon Valley model was attempted in northern New Jersey (involving Bell Laboratories, RCA's Sarnoff Research Center, Esso Research, Merck, Squibb, Ciba, Union Carbide, and others) but did not take hold. Some observers of high technology initiatives have concluded, "The timing was right," for Silicon Valley, implying that without the military contracts market of WWII and its direct aftermath, it will be a challenge to replicate Silicon Valley elsewhere.[2]

However, the two coastal high-tech concentrations mentioned above continue to be centers of innovative activity today. They have been joined by a variety of state and local initiatives to promote cooperation in research and development between industry and academia. The initiatives include industry-sponsored contract research, long-term university-industry research agreements, and industry-financed university research centers.[3]

Patent Issuance

The process of innovation is common to high-technology firms. Innovation is the commercial application of an invention. This process may be slow and expensive. In biotech, for example, there is the preclinical stage that involves discovery, patent filings, licensing technology, and investigational new drug application. The clinical stage follows and may last 6 to 7 years. The final stage is regulatory approval.

Inventors apply for a patent to protect their intellectual property. As the Biotechnology Industry Organization says, "… patents are among the first and most important benchmarks of progress in developing a new biotechnology product."[4] Thus, patent issuance is used in this study as an indicator of innovative activity.

There are limitations in using patents: 1) many patents never become innovations, and many innovations are never patented; and 2) patents differ in their economic value or impact. To measure temporal and geographic impact, patent citations have been traced. Patents assigned to certain industries, such as electronics, optics, and nuclear technology exhibit high immediate citation but a rapid fading over time due to rapid technological change. University patents tend to generate more citations than corporate which, in turn, generate more than government.

Patent Issuance in Indiana

The issuer of patents is the U.S. Patent and Trademark Office. The residence of the first-named inventor determines the patent origin. **Table 1** lists the top ten organizations in Indiana in terms of number issued from 1994 to 1998.

Individually owned patents not assigned to an organization rank first. A pharmaceutical firm, Eli Lilly, ranks second, more than doubling the next-ranked organization, Delco Electronics. Although these numbers are interesting, they take on more meaning in the broader context of information-generating inputs, such as research and development expenditures, and engineering/scientific personnel considered below.

Patent Issuance by State

How does Indiana rank among states? To compare states, we use a per employee basis, rather than a per capita one, because states differ in their age distributions--some states

Table 1
Patents Issued to Indiana Organizations, 1994 to 1998

Organization	Number issued, 1994-98	Primary locations	
Individually owned patent	902		
Eli Lilly	823	Indianapolis	777
		Lafayette	38
Delco Electronics (Delphi)	313	Kokomo	215
		Indianapolis	69
Thomson Consumer Electronics	260	Indianapolis	256
General Motors	204	Indianapolis	174
General Electric	167	Evansville	91
		Fort Wayne	65
Cummins Engine	143	Columbus	132
Dana Corporation	97	Fort Wayne	79
Zimmer	91	Fort Wayne	25
Purdue Research Foundation	67	West Lafayette	64

Source: U.S. Patent and Trademark Office, Office for Patent and Trademark Information, Technology Assessment and Forecast Program

Table 2
Rank of Patents Per Employee, Patents Issued, and Employment, for Selected States

State	Patents Issued per employee	Patents in 1996	Employment in 1996
Indiana	**22**	**14**	**14**
Illinois	14	5	4
Michigan	9	4	8
Ohio	18	8	7
Kentucky	41	33	26
Wisconsin	20	13	15
California	6	1	1
Massachusetts	4	9	13
New Jersey	5	6	9
Texas	21	3	2

Source: U.S. Patent and Trademark Office and U.S. Department of Labor

have relatively more children than others. **Table 2** ranks states in three ways: by 1996 patents per employee, the number of patents issued in 1996, and total employment in 1996.

California ranks 1st in both the number of patents and employees; that is probably consistent with public perceptions. However, it ranks 6th in patents per employee. Massachusetts ranks higher in patents per employee because its number-of-patents ranking is higher than its employment ranking. Kentucky is lower because of the reverse—a lower patent ranking compared to its employment ranking. Michigan leads the pack in the Midwest. Later in this article, we will identify determinants of these state patterns.

Research and Development Expenditures

R&D expenditures are an input in the generation of patents. Total U.S. expenditures on R&D in 1995 were 183 billion dollars; Indiana's were 3 billion. **Table 3** shows the percent distribution for the U.S. and Indiana of the primary components.

Some of the industry R&D expenditures are from the federal government (14 percent in Indiana, primarily from the Department of Defense). As Table 3 indicates, R&D expenditures may come from industry, the federal government, and universities. Because this study focuses on the spatial distribution of patent issuance at the state level, it is important to note state-level differences. For example, federally funded research and development centers are not uniformly distributed among the states. Note that California has several (see Table 4).

In the Midwest, there are relatively few. In Illinois there are Argonne National Laboratory (University of Chicago) and Fermi National Accelerator Laboratory (Universities Research Association). In Iowa there is Ames Laboratory (Iowa State University). So, Hoosier federal tax dollars exit the state for primarily California, New Mexico, Illinois, Massachusetts, and New York payrolls, buildings, and equipment. On the other hand, Hoosiers are not exposed to the uncertainties (or cutbacks) associated with Congressional funding of these centers.

Industrial Research and Development Expenditures

As **Table 3** indicates, industrial R&E is the largest component of total R&D expenditures. The National Science Foundation has compiled industrial R&D expenditures by 1995 by state. State-level expenditures reflect differences in state industrial structure. For example, the pharmaceutical industry spends a lot. A comparison of states is based on their R&D "intensity:"the ratio of industrial R&D expenditures to gross state product (GSP), a measure of state productive capacity. **Table 5** gives a ranking of research intensity for selected states, and rankings of the two components.

Michigan ranked first in intensity because of its high ranking in industrial R&D compared to its gross state product (GSP). Indiana ranked 15th in GSP, but because it ranked 13th in industrial R&D, its ranking in R&D expenditures per million dollars--moved up and was 12th nationally, and 2nd among the midwestern states listed. California, ranked 1st in both R&D expenditures and GSP--no doubt as publicly perceived, fell to 6th in R&D intensity.

Academic Research and Development Expenditures

Stanford University, and later the University of California at Berkeley and the University of California at San Francisco, played important roles in the development of Silicon Valley. Similarly, the Massachusetts Institute of Technology (MIT) spawned firms locating on Route 128 around Boston. More generally, there is evidence of the role of university research on the spatial concentration of innovative activity.[5] Varga found that there is a "critical mass" of agglomeration required to get the greatest innovative yield from university research spending.[6] The "critical mass" for a local high technology infrastructure was characterized by "…a typical city needs to have a size of around 1 million, its local university enrollment should be about 32,000, and the employment in R&D laboratories, production facilities, and business service firms should be 2,100, 43,000, and 22,000 respectively".[7]

Table 3
Totals and Percent Distribution of R&D Expenditures by Primary Components, U.S. and Indiana, 1995

Component	Totals		Percent distribution	
	U.S. (millions)	Indiana (millions)	U.S.	Indiana
Total R & D	183,045	3,162	100.0	100.0
Industry R & D	129,830	2,721	70.9	86.0
Industry federally funded R&D centers	2,273	0	1.3	0.0
Federal government R & D	17,133	62	9.4	2.0
Universities & colleges R & D	22,406	376	12.2	11.9
University federally funded R&D centers	5,388	0	2.9	0.0
Other nonprofit organizations R&D	5,203	4	3.3	0.1

Source: National Science Foundation, National Patterns of R&D Resources: 1998

It appears that Indianapolis and central Indiana have these characteristics.

One purpose of the Indiana General Assembly's $50 million 21st Century Research and Technology Fund mentioned above is to support efforts to attract academic R&D funding. This funding may come from the private sector or federal agencies such as the National Science Foundation or the National Institutes of Health. In Table 6, states are compared by two measures of R&D intensity similar to industrial R&D intensity in Table 5. The measures differ by source of funding. The 1st focuses on academic funding and is the ratio of academically funded academic R&D per dollar of higher education current-fund expenditures. The 2nd focuses on all sources of academic R&D funding (academic, federal government, and industrial) and is the ratio of academic R&D per dollar of higher education current-fund expenditures.

Table 4
Federally funded Research and Development Centers in California

Center	Administered By	Funded By
Aerospace Corporation	Department of Air Force	Department of Air Force
Arroyo Center	RAND Corporation	Department of Defense, Army
Energy Technology Engineering Center	Rockwell International	Department of Energy
Jet Propulsion Laboratory	California Institute of Technology	NASA
Lawrence Berkeley Laboratory	University of California	Department of Energy
Lawrence Livermore National Laboratory	University of California	Department of Energy
National Defense Research Institute	RAND Corporation	Department of Defense
Project Air Force	RAND Corporation	Department of Defense, Air Force
Stanford Linear Accelerator Center	Stanford University	Department of Energy

Source: National Science Foundation

Table 5
Ranki of R&D Intensity (Industrial R&D/GSP), Industrial R&D, and GSP, 1995, for Selected States

State	R&D intensity	Industrial R&D	GSP
Indiana	**12**	**13**	**15**
Illinois	17	7	4
Kentucky	40	36	26
Michigan	1	2	9
Missouri	18	16	17
Ohio	22	11	7
Wisconsin	25	18	19
California	6	1	1
Massachusetts	3	5	11
New Jersey	8	4	8
Texas	27	6	3

Source: National Science Foundation State Profiles

Table 6
Ranking of Academic R&D Intensity, 1995

State	R&D Intensity (Academically-funded)	R&D Intensity (All Sources--Academic, Federal, Industrial)
Indiana	**24**	**41**
Illinois	31	44
Kentucky	30	48
Michigan	16	19
Missouri	25	28
Ohio	38	40
Wisconsin	26	14
California	32	15
Massachusetts	46	11
New Jersey	10	33
Texas	12	8

Source: National Science Foundation, National Patterns of R&D Resources: 1998

Table 7
Ranking of Scientists and Engineers per 1,000 Employees and Components, 1995, for Selected States

State	Scientists and Engineers per 1,000 Employees	Scientists and Engineers	Employees
Indiana	**44**	**22**	**14**
Illinois	25	6	5
Kentucky	48	33	45
Michigan	31	11	8
Missouri	33	19	16
Ohio	27	9	7
Wisconsin	45	23	15
California	13	1	1
Massachusetts	5	5	13
New Jersey	7	8	9
Texas	34	3	2

Source: U.S. Patent and Trademark Office and U.S. Department of Labor

Each of the midwestern states, with the exception of Wisconsin, has a lower all-sources ranking than academically funded academic R&D ranking. California, Massachusetts, and Texas, on the other hand, have all-sources ranking higher than academically funded academic R&D ranking. This means that the latter states have been able to obtain federal and industrial funding to support their academic R&D to a greater extent than the midwestern states. Indiana is 2nd in the Midwest in academically funded ranking but drops 17 places when the broader funding base is considered. The 21st Century Research and Technology Fund should help to raise Indiana's ranking—although many other states are also appropriating such funds!

Federal Research and Development Expenditures

The federal government defense effort was instrumental in the encouragement of Silicon Valley during WWII and immediately thereafter. In 1995, the primary locations of federal R&D in terms of absolute dollars were Maryland, the District of Columbia, and California. When states are compared in terms of federal R&D expenditures per 1000 doctoral scientists and engineers, Maryland and the District of Columbia continue to rank 1st and 2nd while California falls to 13th because of significant non-federal R&D expenditures. Indiana ranks 37th by this measure.

Scientific and Engineering Personnel

Ideas are embodied in people who have been trained and have developed expertise to pursue technological advance. A recent Eli Lilly expansion announcement includes the hiring of engineers and scientists. The role of "star scientists"--highly productive people who have made a major advancement--has been studied as a means of encouraging scientific development. The focus is on key individuals rather than an average level of human capital/education. In this article, the focus is on doctoral scientists and engineers. To make interstate comparisons, the number of doctoral scientists and engineers in a state is compared to total state employment--the number of doctoral scientists and engineers per 1,000 employees. **Table 7** provides rankings for selected states by number of scientists and engineers per 1,000 employees.

These rankings reflect differences in states' industrial compositions, the particular function of firms in the state (production sites or corporate headquarters with an R&D component), and the presence of educational institutions. California, Texas, and Massachusetts rank high with a large absolute number of scientists and engineers. As this writer pointed out in an earlier issue of the Indiana Business Review, Indiana does relatively well in training doctoral scientists and engineers (2nd among surrounding Midwest states), but loses them to other states following training; thus our ranking falls.[8]

What determines patent issuance per employee?

Now we use the spatial variation at the state level of the information-generating factors in tables above as a basis for identifying determinants of patents per employee.

We propose the following tentative explanations.

- Industrial R&D intensity The higher the industrial R&D intensity, the greater the patents issued per employee.
- Academic R&D intensity The higher the academic R&D (funding for academic R&D from academic, federal, and industrial sources) intensity, the greater the patents issued per employee.
- Federal government R&D The higher the federal R&D expenditures per 1000 doctoral scientists and engineers, the greater the patents issued per employee.
- Educational attainment of persons 25 years and over Educational attainment is measured by the percent of those 25 and over who have completed a bachelor's degree or more. The higher the educational attainment, the greater the patents issued per employee.

Employment density within a state The economics of agglomeration (clustering) suggests that technological spillovers may occur from firms locating next to other firms or universities (the role of Stanford University, University of California at Berkeley and the University of California at San Francisco in Silicon Valley).

The state density index is based on employment per acre in a county compared to other counties in the state.[9] States such as New York, New Jersey, and Massachusettshave the highest density indices while South Dakota, North Dakota, and Montana have the lowest ones. We would expect higher density indices to be associated with higher patents issued per employee.

Empirical results

These tentative explanations are empirically tested via a cross-sectional regression model. The patent data were for 1996; the other variables were for 1995 to suggest a lag between the information generating activity and the patent issuance. Support was strongest for industrial R&D intensity. Also, support was found for educational attainment and academic R&D intensity. The density relationship was as hypothesized but the coefficient was not "statistically significant." On the other hand, federal R&D expenditures relationship had the opposite sign than hypothesized—meaning that higher Federal R&D expenditures per 1000 doctoral scientists and engineers were associated with fewer patents issued per employee. Congressional mandates have encouraged technology transfer at Federal R&D centers. Encouragment includes industrial partnerships, licensing, and spinouts. So, the model "explained" a high degree (63%) of the variation among states in patents per employee.

Conclusions

Patent issuance, as one dimension of innovative activity, has been described in Indiana and other states. The states have been ranked by information-generating activities that are associated with patent issuance. Indiana does relatively well among Midwestern states, especially in industrial R&D intensity which is the primary determinant of patents per employee. For academically funded academic R&D, Indiana is in the middle nationally. However, there is room for improvement when the funding sources of academic R&D are expanded to include industrial and the federal government. In this context, the 21st Century Research and Technology Fund is a step in the right direction.

Higher levels of educational attainment promote patent issuance. Indiana ranked 49th out of 51 (including the District of Columbia) based on the measure used in this study. Much has been written and is being done on raising Indiana's position. We close with two observations and an implication. Research has shown that students who enroll in "gatekeeper" courses, such as algebra and foreign language in eighth grade, are more likely to reach higher levels in high school and to apply to a four-year college than those eighth-grade students who did not.[10] Examining mathematical achievement in eighth grade, Fuchs and Reklis found that characteristics of children (such as readiness to learn in kindergarten) and the mother's education were more important than school characteristics.[11] So as the saying goes, "As the twig is bent, the tree will grow."

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Indiana's Population Growth Continues

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State population estimates released by the U.S. Bureau of the Census on December 29, 1999 indicate that Indiana's population continues to grow, but not as rapidly as the nation. (Estimates, along with ranks for all states can be seen in **Figure 1**.)

The state's July 1, 1999 population is estimated to be over 5.9 million compared with the 1990 census count of 5.5 million, for an increase of almost 400,000 persons since 1990. Indiana's growth rate of 7.2 percent since the 1990 census is lower than the growth rate of 9.6 percent experienced by the nation during the same period. The nation's population has increased from almost 249 million in 1990 to almost 273 million in 1999, an increase of 24 million persons.

In the most recent year, Indiana's population has grown by 35,000 persons for a growth rate of 0.6 percent between 1998 and 1999. Again the state's growth rate did not keep pace with the growth rate of 0.9 percent for the nation for the most recent year.

Indiana Ranks 14th in Population, 28th in Growth Rate

Indiana has been the 28th fastest growing state in the nation since 1990, and retains its position as the 14th most populous state. However, Indiana's share of the nation's population continues to decline, from 2.56 percent in 1970, to 2.42 percent in 1980, to 2.23 percent in 1990 and to 2.18 percent in 1999.

These estimates indicate that the state's population is growing more slowly than it did earlier in the decade (see **Figure 2**). The rate of population growth appears to have peaked between 1991 and 1995, with annual growth rates of 0.8 percent and 0.9 percent. In the most recent three-year period, annual growth rates have slowed to 0.6%. It is estimated that Indiana's population grew by 53,000 persons between 1992 and 1993, compared with an increase of 35,000 persons between 1998 and 1999.

Despite slower growth than earlier in the decade, recent population growth in Indiana has been much faster than the growth seen in the '80s. Between 1980 and 1990, Indiana's population grew by only 54,000 persons for a growth rate of 1.0 percent. Growth in the nine-year period since the 1990 census has been more than seven times the growth experienced by the state in the previous decade.

In-Migration Continues

In each year since 1990, Indiana has seen net in-migration (see **Figure 3**). With more persons moving into the state than moving out, this represents a reversal of the out-migration experienced in the 1980s. This recent in-migration, combined with natural increase, resulted in relatively rapid population growth for the Hoosier State in the '90s.

Of the net population increase of 399,000 persons since the 1990 census, about 73 percent were the result of more births than deaths, and 27 percent due to net in-migration.

However, the estimates indicate that in the most recent year the state has experienced negative domestic net migration; that is, more people moved from Indiana to other states than moved from other states to Indiana between 1998 and 1999. At the same time, Indiana gained more people than it lost to foreign countries, resulting in total (domestic + international) net-migration that was positive. International net in-migration to the Hoosier State has steadily increased throughout the decade.

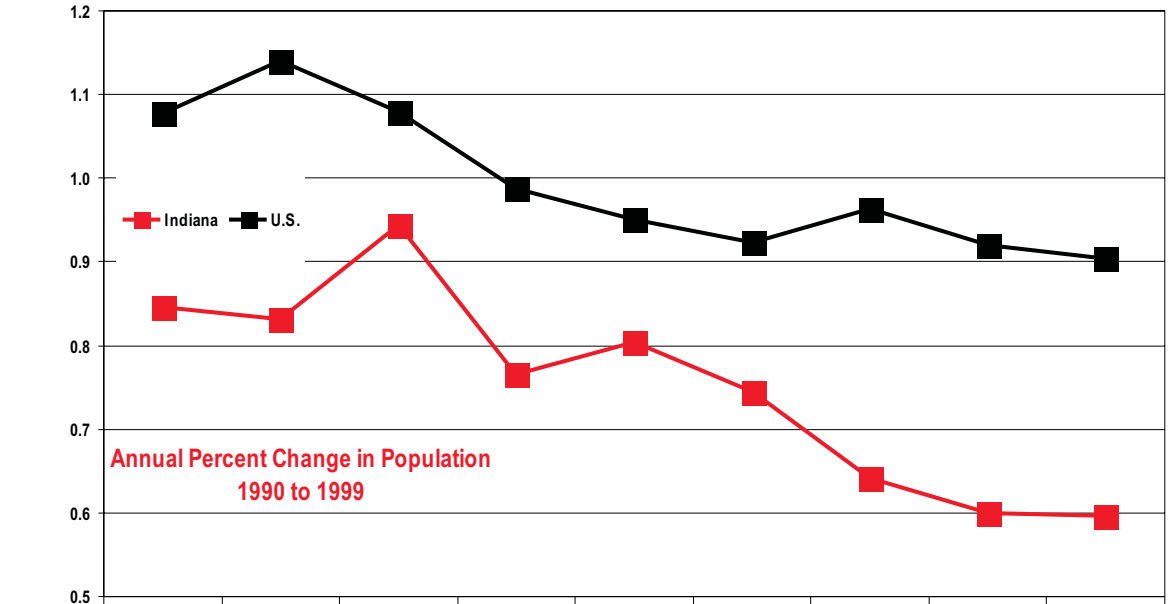
Will Indiana Retain Ten Seats in the Next Apportionment of the U.S. House of Representatives?

Following the census in April 2000, the 435 seats in the U.S. House of Representatives will be re-apportioned to states according to the census population counts. States that have not experienced population growth rates equal to that of the nation will be candidates to lose seats, while states that have grown more rapidly than the nation may gain seats in the House of Representatives.

Figure 1
1999 Population Estimates, Indiana and Neighboring States

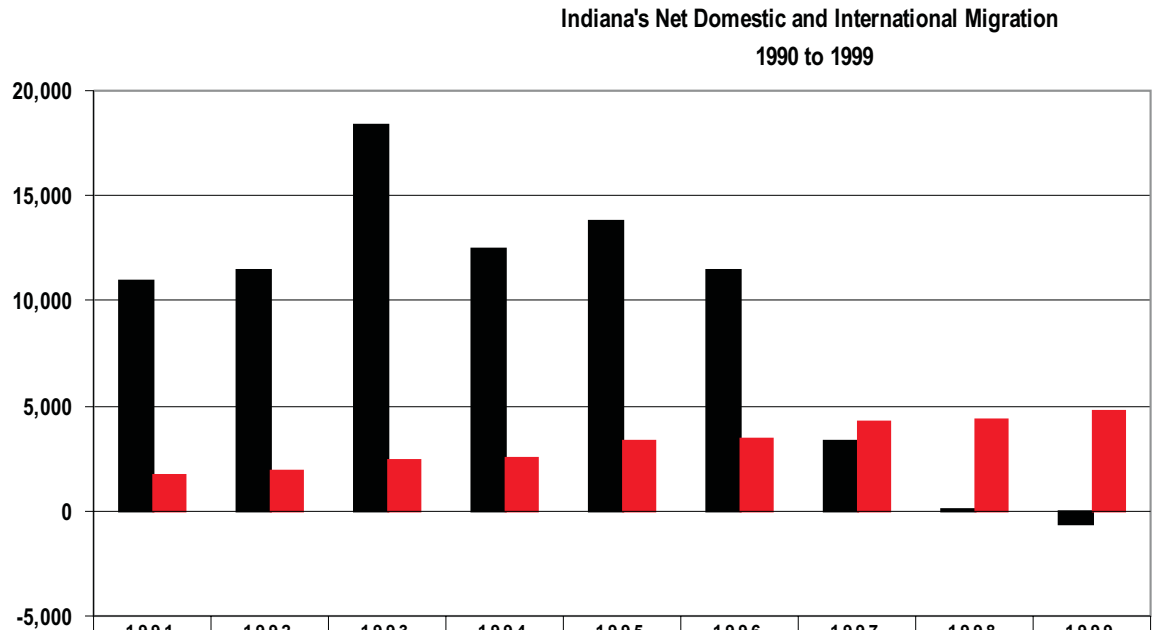
	Estimate 1-Jul-99	1999 Rank	Change 1990 to 1999	Rank	Percent Change 1990 to 1999	Rank
United States	272,690,813		23,899,888		9.6	
Illinois	12,128,370	5	697,768	9	6.1	34
Indiana	5,942,901	14	398,745	19	7.2	28
Kentucky	3,960,825	25	273,933	25	7.4	26
Louisiana	4,372,035	22	150,209	34	3.6	41
Michigan	9,863,775	8	568,488	13	6.1	33
Minnesota	4,775,508	21	399,843	17	9.1	20
Mississippi	2,768,619	31	193,144	31	7.5	25
Ohio	11,256,654	7	409,539	15	3.8	40
Wisconsin	5,250,446	18	358,492	22	7.3	27

Figure 2
Percent Change in Population



	1991	1992	1993	1994	1995	1996	1997	1998	1999
Indiana	0.84544	0.831605	0.943872	0.765718	0.803968	0.743963	0.642032	0.600218	0.597263
U.S.	1.077787	1.140818	1.079446	0.987038	0.951209	0.922856	0.963333	0.920294	0.903914

Figure 3
Net Migration



	1991	1992	1993	1994	1995	1996	1997	1998	1999
Net Domestic Migration	10965	11460	18339	12501	13814	11463	3284	104	-659
Net International Migration	1702	1877	2386	2513	3340	3458	4243	4329	4801

If the apportionment process were applied to the 1999 state population estimates, Indiana would narrowly retain its ten seats in the House. However, if Indiana's 1999 population had been estimated to be only 0.5 percent lower than it was, the state would be assigned only nine seats in the House.

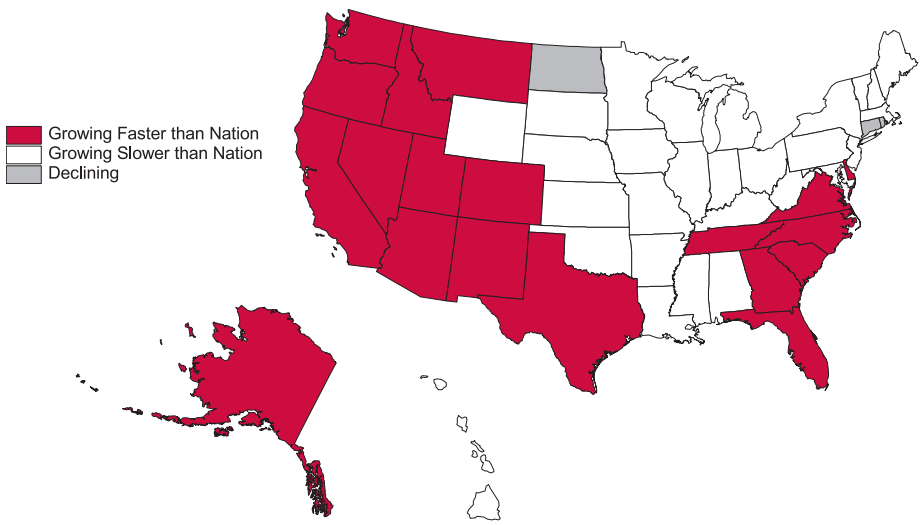
It is important therefore for Indiana to count all Hoosiers in the 2000 Census. It appears that the state is "on the bubble" in terms of holding onto its current number of seats in the House of Representatives. If all Indiana residents return their census forms filled out completely and accurately it will increase the chances that the state will retain ten seats in the House. Census awareness activities in the state are currently in progress, with the goal to reach as many Hoosiers as possible with the message that the census is important, confidential and easy (see *www.census.indiana.edu*).

Indiana Compared to Other States

Figure 4 shows rates of population change between 1990 and 1999 for all states. Indiana's 7.2 percent rate of growth compares favorably with neighboring states. The Midwest Region grew by 6.0 percent since 1990. Indiana has grown faster than Michigan (6.1%), Illinois (6.1%) and Ohio (3.8%), with a slightly lower rate of growth than Kentucky (7.4%).

The South and West regions continue to outpace the rest of the nation in population growth. The South added 11 million persons since 1990, for a growth rate of 12.9 percent. The West added 8.3 million persons for the highest regional rate of growth of 15.7 percent. Growth in the Northeast was 2.0 percent since the 1990 census count.

Figure 4
Rates of Population Change, 1990 to 1999



Nevada has grown from 1.2 million persons in 1990 to more than 1.8 million persons in 1999 with a net population increase of over 600,000 persons. This 50.6 percent growth rate makes it the fastest growing state in the nation. Explosive growth during the '90s has moved Nevada past Maine, Nebraska, New Mexico and West Virginia to jump from 39th to 35th in population rankings. Growth of over 65,000 persons (3.8%) in the most recent year between 1998 and 1999 makes Nevada the fastest growing state in the nation for 14 consecutive years.

Other fast-growing states, between 1990 and 1998, include Arizona (30.4%), Idaho (24.3%), Utah (23.6), Colorado (23.1%), Georgia (20.2%), Washington (18.3%), and Texas (18.0%). California and Texas added the largest numbers of persons since 1990 (3.3 million in California and almost 3.1 million in Texas). Other states adding large numbers of persons include Florida, Georgia, Arizona, North Carolina and Washington.

Migration is driving the rapid population growth in the south and west. About two-thirds of the nation's population growth since 1990 is due to natural increase, (more births than deaths), with the remaining one-third due to net in-migration. States with more than 50 percent of their growth attributed to net migration include Florida, Nevada, Oregon, Arizona, Idaho, Tennessee, North Carolina, Colorado, Washington, Georgia, Montana, Arkansas, and Delaware.

The District of Columbia has lost almost 88,000 persons since 1990, for a rate of decline of 14.5 percent. Rhode Island, Connecticut and North Dakota have also lost population since the 1990 census. The District of Columbia has lost population in the most recent year, along with Pennsylvania, West Virginia, North Dakota, Hawaii and Wyoming.

Ten Most Populous States

Illinois has moved up from being the 6th most populous state in 1990 to 5th position, due to Pennsylvania's loss of population in the last few years. The ten most populous states are California (33.1 million), Texas (20.0 million), New York (18.2 million), Florida (15.1 million), Illinois (12.1 million), Pennsylvania (12.0 million), Ohio (11.3 million), Michigan (9.9 million), New Jersey (8.1 million) and Georgia (7.8 million).

It is important to note that these population figures are estimates produced using a demographic model and are not the result of a direct attempt to count population, as is done in a census year. These estimates were produced by the U.S. Bureau of the Census using the Tax Return Method; details on this method can be found at *www.census.gov*.

The Indiana Business Research Center, in the Kelley School of Business at Indiana University, serves as the state's official liaison with the U.S. Bureau of the Census. Its present and future role will be to work with the state and its localities to provide a full and accurate census count in the year 2000. For more information about the Census in Indiana, see *www.census.indiana.edu*. For more statistical data for and about Indiana, see *www.stats.indiana.edu*.

Measuring Indiana's Goods and Services: Gross State Product 1987 to 1997

Morton J. Marcus

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The value of all goods and services produced in the nation is measured by Gross Domestic Product (GDP). The counterpart on the state level is Gross State Product (GSP). It tells us the value added to a good or service by economic activities within the state. Value added is simply the dollar amount of sales less the amounts paid for inputs purchased from outside the area.

For example, an automobile sold in Indiana may be imported from Missouri with a transmission built in Indiana. The value added in Indiana is the activity at the dealership as well as the activity at the transmission plant. GSP for Missouri is the assembly effort. The easiest way to think of value added is the price charged for goods at the shipping dock minus the cost of inputs at the receiving dock. All that happens in between is valued added by labor and capital, broadly defined, within the plant.

There are three major components to GSP: compensation of employees, returns to owners, and non-income taxes paid by the firm[1]. For Indiana, in 1997, employees contributed 60 percent of GSP, capital or ownership 34 percent and indirect business taxes (perhaps a proxy for government services) 6 percent.

Indiana's Gross State Product has advanced from $108 billion in 1987 to $148 billion in 1997 (as measured in constant 1992 dollars-see **Figure 1**). The rise has been steady except during the recession and its aftermath in 1990 and 1991. From 1991 to 1994, Indiana enjoyed a rising share of the nation's output and has been in relative decline since then. The apparent rise in the early '90s was the result of poor performance in the California economy rather than any strength in Indiana.

Figure 1
Gross State Product

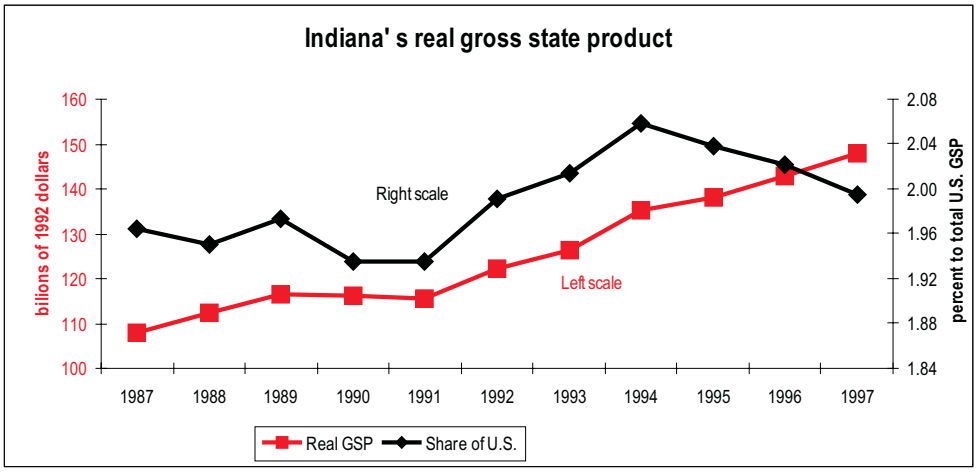


Table 1
Major Industries By Relative Size

Major divisions, summary	Indiana $ mil	Industry as a percent of Indiana GSP	Industry as a percent of U.S. GSP	Indiana's rank in U.S. 1987	Indiana's rank in U.S. 1997	Change in rank	Between 1987 and 1997: Indiana fell below	Between 1987 and 1997: Indiana moved ahead of
Total	161,701	100.0	100.0	15	15	0	WA	MD
Manufacturing	50,155	31.0	17.0	11	9	2		NJ, MA
Services	25,676	15.9	20.4	20	21	-1	CO	
Finance, insurance, and real estate	21,351	13.2	19.4	20	22	-2	AZ,CO	
Government	15,732	9.7	11.9	20	20	0		
Retail trade	14,807	9.2	8.8	15	16	-1	WA,TN	MD
Transportation & public utilities	12,369	7.6	8.3	14	17	-3	WA,MA,CO	
Wholesale trade	10,036	6.2	6.9	20	18	2		MD,CT
Construction	7,845	4.9	4.1	19	14	5	WA	MD,MA,MO,AZ,MN,CT
Agriculture, forestry, and fishing	2,883	1.8	1.6	19	14	5		MO,WI,KY,MI,NY
Mining	846	0.5	1.5	25	24	1	AZ	MS,ND

The leading sector of the Indiana economy, as measured by GSP, has been manufacturing, which accounted for more than 30 percent of total output, compared to 17 percent nationally. This is in sharp contrast to the nation, where the leading sector was services followed closely by finance, insurance, and real estate (see **Figure 2** and **Table 1**).

Indiana ranked 15th in the nation in total GSP in 1987 and retained that position in 1997, but was surpassed by the state of Washington during this period. At the same time, we moved ahead of Missouri in the rankings. In manufacturing, Indiana found its highest ranking (9th place in 1987) advancing over New Jersey and Massachusetts. In construction as well as in agriculture, forestry, and

Figure 2
Distribution By Sector

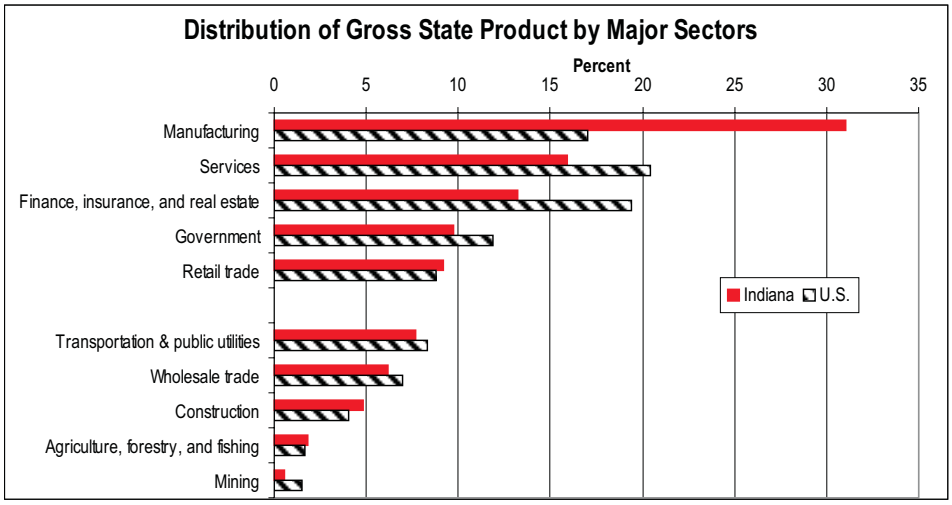


Table 2
Major Industries: Change 1987 to 1997

Major divisions, Change '87 to '97	Indiana's percent share of U.S.			Real percent change 1987 to 1997		Percent of change 1987 to 1997		Contribution to Indiana's growth relative to 1987 share
	1987	1997	Change	Indiana	U.S.	Indiana	U.S.	
Total gross state product	1.96	2.00	0.03	37.0	29.7	100.0	100.0	
Wholesale trade	1.63	1.78	0.15	80.1	64.8	7.3	7.6	1.36
Mining	0.80	0.70	-0.10	68.9	27.2	0.2	0.9	0.26
Agriculture, forestry, and fishing	2.04	2.19	0.14	56.0	43.2	1.5	1.3	0.77
Manufacturing	3.21	3.64	0.43	51.4	31.5	30.8	14.2	0.99
Construction	1.82	2.39	0.57	50.5	14.5	5.6	3.2	1.29
Retail trade	2.05	2.08	0.03	42.2	40.0	8.4	8.0	0.86
Services	1.56	1.55	-0.01	31.4	34.3	19.1	25.3	1.43
Finance, insurance, and real estate	1.40	1.36	-0.04	18.1	26.6	13.8	21.4	1.09
Transportation & public utilities	2.18	1.83	-0.35	17.9	41.9	4.5	7.4	0.45
Government	1.60	1.63	0.03	13.3	11.6	8.8	10.7	0.84

fisheries, Indiana jumped five places from19th to 14th in the national rankings. During the same period, the Hoosier state declined three places in transportation and public utilities from 14th to 17th place. Again, see **Table 1** where the major industry divisions are shown by relative size in Indiana.

Of greater importance than ranks are market shares. From 1987 to 1997, Indiana's share of the nation grew slightly from 1.96 percent to 2.00 percent. This was a consequence of more rapid growth in Indiana (37 percent after adjustment for inflation) than in the nation (29.7%)(see **Table 2**).

Figure 3 shows that in seven of the ten major divisions of economic activity, Indiana's GSP grew faster than the nation between 1987 and 1997. But the rate of growth does not indicate the importance of each sector's contribution to total growth. For example, wholesale trade grew by more than 80 percent in the decade, but contributed only 7.3 percent of the state's total GSP increase. Manufacturing, which had a more modest advance (31.5%), added 30.8 percent of state's total GSP growth (see **Table 2** again).

We have placed two additional tables on the web with the same types of data, but presented for 62 detailed sectors of the state's economy. Most noteworthy are Indiana's primary metals industry (ranked 2nd in the nation) and motor vehicles sector (ranked 3rd nationally). But primary metals accounted for only 2.3 percent of the state's growth while motor vehicles and parts contributed 7.1 percent of that advance. Retail trade made the greatest contribution of these 62 sectors only because it is not disaggregated into its separate parts.

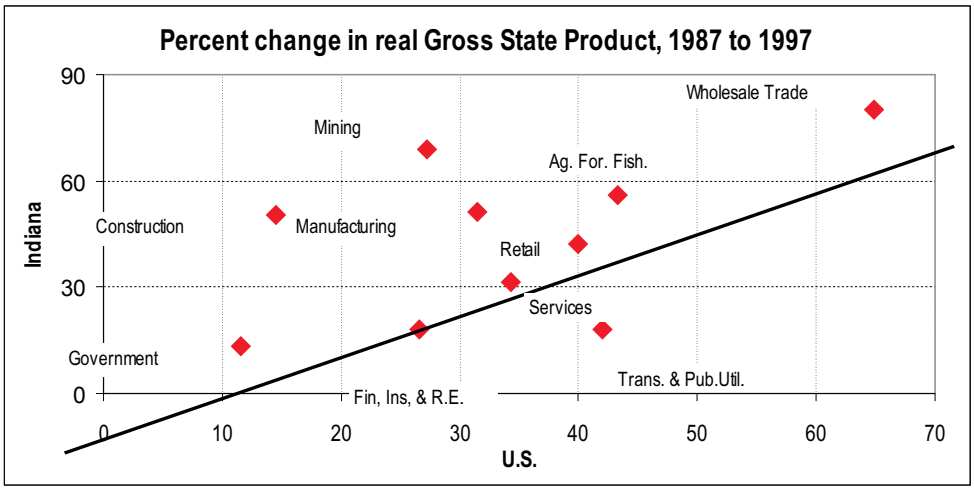
One way to put these data in perspective is to compare a sector's contribution to GSP relative to the sector's share of GSP in 1987. These numbers are shown in **Table 2**. It can be seen that Services as well as Wholesale Trade contributed to output growth well beyond their initial role in the economy. Manufacturing and F.I.R.E. were more in line with their original dimensions, while Transportation and Public Utilities failed to match their size.

In examining these data for the period 1987 to 1997, readers should be careful to remember the opening point: Indiana's role in the nation at the end of the period was diminished. The gains seen in 1997, relative to 1987, may be wiped out by the time data for the current year become available to us.

Note

[1]These "indirect business taxes" include taxes not explicitly charged to the customer (for example motor fuel taxes, property taxes, franchise taxes, and license fees).

Figure 3
Change 1987 to 1997



Census 2000 Update

Carol O. Rogers

Editor, and Information Services Director, Indiana Business Research Center, Kelley School of Business, Indiana University

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The 22nd Decennial Census is winding down. Millions of questionnaires have been sent to households throughout Indiana; enumerators have gone to special places (aka group quarters and shelters) to count people in dormitories, nursing homes, prisons and jails and at soup kitchens and shelters and campgrounds. People are calling in to talk shows upset that they got a form or upset that they didn't. The general tenor of the calls coming in to Indiana's ICAUSE (Indiana Census Awareness project) has been positive – most people were seeking assistance or wondering where their forms were.

Since the beginning of March, an orchestrated sequence of events has occurred:

•Letter to all households from the Bureau Director telling people to expect the questionnaire (yes, the addresses had an extra digit at the front, but the Post Office used the bar code info on the envelope, which was correct)

•The Census Road Tour came through Indiana spreading word of the Census. First Lady Judy O'Bannon was a prominent speaker at many of these stops

•Public service announcements for radio and TV by First Lady Mrs. O'Bannon, Bobby Knight, and Purdue quarterback Drew Breeze began running in late March

•School children brought home Teach Census Week assignments, geared to helping the child learn about the census AND to encourage parents to fill out the form and return it

•Congregations received special bulletin inserts and perhaps specific comments from their congregational leadership encouraging response to the Census

•Media articles and television and radio broadcasts have been filled with news about the census

•Many communities in Indiana have gone all out in making their residents aware of the census, plastering posters all over town, holding rallies and contests and many other creative activities to support the census

•Governor O'Bannon asked all State employees to support the census. Many State Agencies, including the Department of Health, the Department of Revenue, and the Attorney General's Office, the Department of Administration and Family and Social Services went all out communicating the importance of the census to their employees and clients throughout the state. Many state legislators sent letters to people in their districts that included information about the census.

•The Purdue Extension Services offices in each county assisted by distributing posters and spreading the word.

•Special Indiana specific posters were printed and distributed throughout Indiana

•Many State agency web sites ran special animated banners encouraging response to the Census, including the Indiana Lottery, Revenue, and Natural Resources agencies.

•ICAUSE awareness specialists made contact with, and where needed, provided assistance to, communities and officials in each of the 92 counties.

Table 1
Indiana Local Offices of the U.S. Bureau of the Census

Indianapolis	Michael Pillar	317-226-0402
Marion County	Mark Fiddler	317-890-7632
Gary	Rodney Jackson	219-884-3163
South Bend	Melvin Spiegel	219-245-5170
Fort Wayne	Jim Mitch	219-424-9561
Muncie	Susan Byers	765-286-1501
Kokomo	Joyce Smith	765-864-8950
Terre Haute	Don McVeigh	812-242-2937
Clarksville	Lucien Polk	812-282-3008
Evansville	Jane Albin	812-434-8000

What's Left?

Throughout April and May, the Census Bureau's local offices (Indiana has 10 – **see table 1**) will send out enumerators as part of the phase called "non-response follow up". Households that have not returned the form will be contacted by phone where possible and in person if necessary. The Census Bureau has calculated that it costs taxpayers an additional $70 to $100 for each non-responding household. April 18th has been designated as "Because You Count" day, encouraging non-respondents to participate.

It's Not Too Late to Promote Census 2000

Communities, businesses and people of influence can still get the word out about the importance of this census to Indiana. This will help ensure Indiana retains its 10th congressional seat and that Indiana and its communities and neighborhoods get their fair share of federal funding. We must get an accurate picture of the people and housing of Indiana to assistant in government, non-profit and business planning for the next ten years. Please encourage your friends, family, co-workers, neighbors and employees to fill it out and mail it back. For more information, call ICAUSE at 800-877-415-3963.

Questionnaire Assistance is Just a Phone Call Away

A series of toll free numbers have been activated to assist people who may have language difficulties or other concerns regarding filling out the questionnaire. Households with questions are asked to look at the "bar code" number on their questionnaire and refer to that when calling one of the following numbers (based on primary language spoken):

English	800-471-9424
Spanish	800-471-8642
Chinese	800-471-9401
Vietnamese	800-471-7913
Korean	800-471-9131
Tagalog	800-470-9897
TDD	800-582-8330

Inside:

www.ibrc.indiana.edu
www.stats.indiana.edu
www.ibrc.indiana.edu/incontext

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