

BRAIN DRAIN IN ERIE COUNTY

by

James Arthur Washburn
and
Hazel Garcia Sadiarin

Advisor:

Dr. James Kurre
(814) 898-6266
k12@psu.edu

November, 2001



Economic Research Institute of Erie
School of Business
Penn State Erie, The Behrend College
Station Road
Erie, PA 16563-1400

*This research was made possible by a grant from the
Penn State Erie Summer Undergraduate Research Program.*

BRAIN DRAIN IN ERIE COUNTY

I. INTRODUCTION

In a growing economy, success depends on many factors such as geographic location, availability of natural resources, access to major transportation channels, and the area's local workforce. This study focuses on the last factor, the area's local workforce. If the local economy, Erie County in this case, is successful at attracting and retaining valuable workers, then the future of the county is sure to improve. The question then becomes, who is a valuable worker? Valuable workers could be older professionals that bring with them experience and knowledge that can only be attained with the passage of time. Valuable workers could be those types of individuals who understand the importance of technology and how it will affect a local economy. Valuable workers could also be those people who perform the jobs that most people do not like to do. For the purpose of this study however, a crucial part of the focus will be on the younger generation, with ages between 15 and 30.

This age group was determined to be one of the major focal points because many recent college graduates and young professionals are in this age category. This younger group of people can provide fresh thinking, the latest advances in their field from recent schooling, and a willingness to take some of the jobs that older workers might not take. This age category is also the most mobile, meaning they are more likely to move to another location. In contrast, a person in their forties or fifties may not be as willing to move if they have a house, a family, and other commitments to an area. If this

study shows that Erie County is attracting these young workers, it could mean that the county is doing some things right, economically speaking. After this age group was determined to be the focus, the next step was to see whether these people were leaving or coming into the region.

The term “brain drain” is used to describe the exit of these important workers from the area. “Brain gain” is used to describe the entrance of workers. The following study therefore becomes a type of migration study. Within migration, there are inflows and outflows of people. These people are not only bringing or taking themselves, they are also bringing or taking their incomes as well. Another part of the study will focus on income flows in and out of Erie County. If people who are leaving are taking more income out of Erie County than the income brought in by people who are moving in, then brain drain is also occurring. Using data from 1996 to 1997, the correlation between migration and income can be further examined.

II. LITERATURE REVIEW

This study’s focus was to measure brain drain or brain gain in a local economy. The popularity of this topic seems to have been growing over the past few years both at the international, national, and state levels. Unfortunately not very many studies have been done on the effects of brain drain at the county or metropolitan level.

The few studies that do measure brain drain on a more local or regional level focused on a couple of different aspects than the Erie County study. Gottlieb (2001), from the Center for Regional Economic Issues in Cleveland Ohio, created a regression

model that provides a way to measure brain drain controlling for the numbers of high-tech jobs and the flow of university graduates.

Gottlieb's study also contains rankings of all U.S. states on retention, attraction, and trade balance. According to this study, Pennsylvania turns out to be an exporter of people with science and engineering degrees. The focus of Gottlieb's study is on college graduates who earn science and engineering degrees. While these people do play a crucial role in brain drain/gain, the Erie County study is directed at a broader scope of individuals.

With four colleges in Erie County, a good study might consider where the local students go when they graduate from college. Some previous studies that have been done focus on education (Hsing, 1996 and Tornatzky, 1998). They track where the college graduates go, what types of jobs they are getting, and what percentage of them stay in a local area.

A similar approach to tracking the college students is to track where high school students are going. These also may prove to be interesting and useful data for a lot of reasons. Erie County has four colleges, so it might be expected that the County would also have a large number of local high school graduates attending local colleges. The four colleges all are unique and offer a variety of majors that can fit a wide range of students.

Staying close to home, going to college, and then getting a decent job would probably prove to be enticing for a lot of high school students. If Erie County were successful at retaining its high school graduates, they would probably be more likely to

stay in the area after college as well. Although this would also be an interesting and worthwhile study, it is another small piece of the bigger picture.

One source of data for research like this would be the National Science Foundation's National Survey of Recent College Graduates (NSRCG). This survey could allow examination of location choices for selected types of students after they graduate from the local colleges. The survey has many questions regarding education, employment status, other work-related issues, and background information.

The Southern Technology Council under the direction of Louis G. Tornatzky (1998) conducted one such study. This study provides Migration and Retention Indexes for each state with the focus mainly on science and engineering students. Tornatzky and his team seem to have created a benchmark in the field. The Tornatzky study tried to find a correlation between education and migration into and out of the South. Their technique can be applied to other regions of the country as well.

One of the recommendations that Tornatzky makes through his analysis is that states should intensify their efforts to build 21st century economies. States that don't redirect their focus to technology-based businesses and continue to invest significant tax dollars on educating the new-economy students will be functioning as "farm teams" for other states. These states will watch as they lose their best and brightest to other states (Tornatzky, p. 22). This analysis can also be applied at the county level as well.

One of the reasons a "college graduates" study was not pursued was because the focus of this paper is on the workforce as a whole. While it is a very interesting and important topic, the migration of *students* is only part of a bigger problem. The bigger problem is that everyone in the area, not just the college students, can leave and take

away a valuable resource, their brain. (It is important to note that some people's brains are more valuable than other's.)

Another reason this type of study could not be conducted for Erie County was the lack of sufficient data. Most of the previous brain drain studies were based on data gathered through extensive surveys. For example, the data collection from Tornatzky's study took over a year, with many telephone interviews and surveys sent through the mail.

Another study that is very useful for the state is one done by the Pennsylvania State Data Center in 1999. The study conducted by De Jong and Klein (1999) looks at brain drain migration in Pennsylvania in the mid-1990's. This study uses the *Current Population Survey*, compiled by the U.S. Bureau of the Census. This study looks at many aspects of the brain drain issue, including education, skilled occupations, and income concerns for Pennsylvania's migrants.

Their research also found that Pennsylvania is a net loser in the battle against brain drain. They found that between 1995 and 1997 Pennsylvania not only lost more people than it gained, but it also lost many of its highest educated working age population. It should be noted that Pennsylvania does attract some workers to the state. On net (in-migration minus out-migration), Pennsylvania's trend is negative though. To make matters worse, the in-migrants are in occupations that require less skill than out-migrants (De Jong, p. 7). While this study addresses specifically what we wanted to accomplish at the state level, unfortunately the data are not available for this study at the county level, to our knowledge.

III. DATA ANALYSIS

A. Overview

The data for this study were not as easy to find as first anticipated. Since not a lot of research has been done in this area, the first question to ask is “How can brain drain be measured?” In a perfect world specific data on every individual in Erie County would be available. These data would provide information such as the residence, annual income, educational attainment, and age of the individual in a base year, such as 1999. The data could also include whether or not the individual moved by the following year, 2000, accounting for any births and deaths. Unfortunately, detailed data like those are not available.

Unlike previous studies, this study used three different approaches to get a broader view of whether Erie is experiencing brain drain/gain. The first approach involved looking at total change in population and net migration data for Erie County and Pennsylvania over the last decade. The second approach used age cohorts to get a more specific demographic representation of the migrants. The final approach explored the destination of migrants and an estimate of their incomes.

B. Total Migration through the 1990's

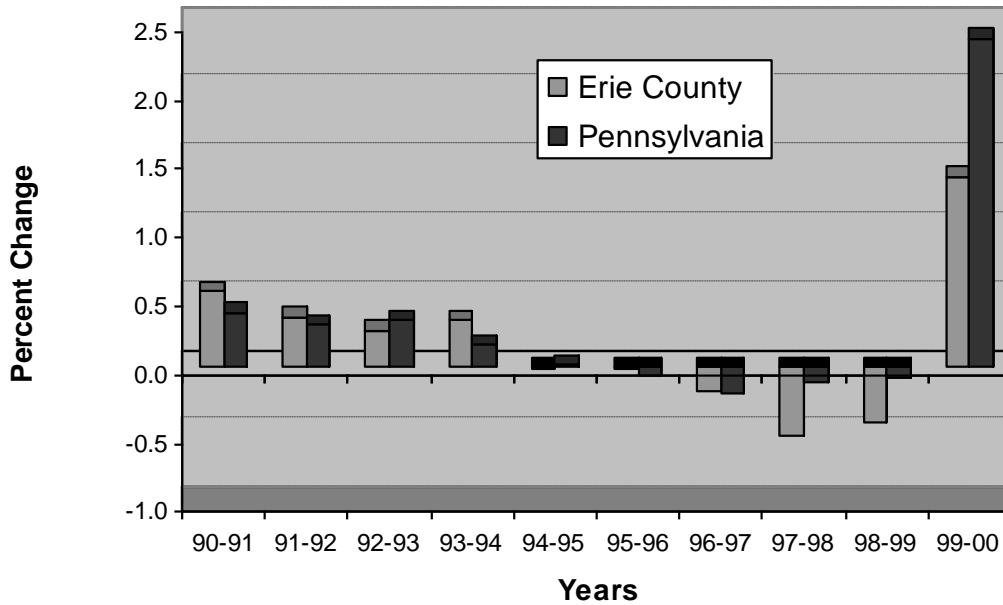
The 2000 United States Census provided a wealth of information about migrants and their migration patterns. The Census's county-to-county migration data are the most complete data source for state and county level migration. The data, now available online, were recently released from the 2000 Census. Table 1 shows the population totals for Erie County and Pennsylvania.

**Table 1
Population Totals**

Year	Erie	PA
1990	275,795	11,895,604
1991	277,335	11,943,160
1992	278,362	11,980,819
1993	279,117	12,022,128
1994	280,085	12,042,545
1995	280,044	12,044,780
1996	280,009	12,038,008
1997	279,513	12,015,888
1998	278,114	12,002,329
1999	276,993	11,994,016
2000	280,843	12,281,054

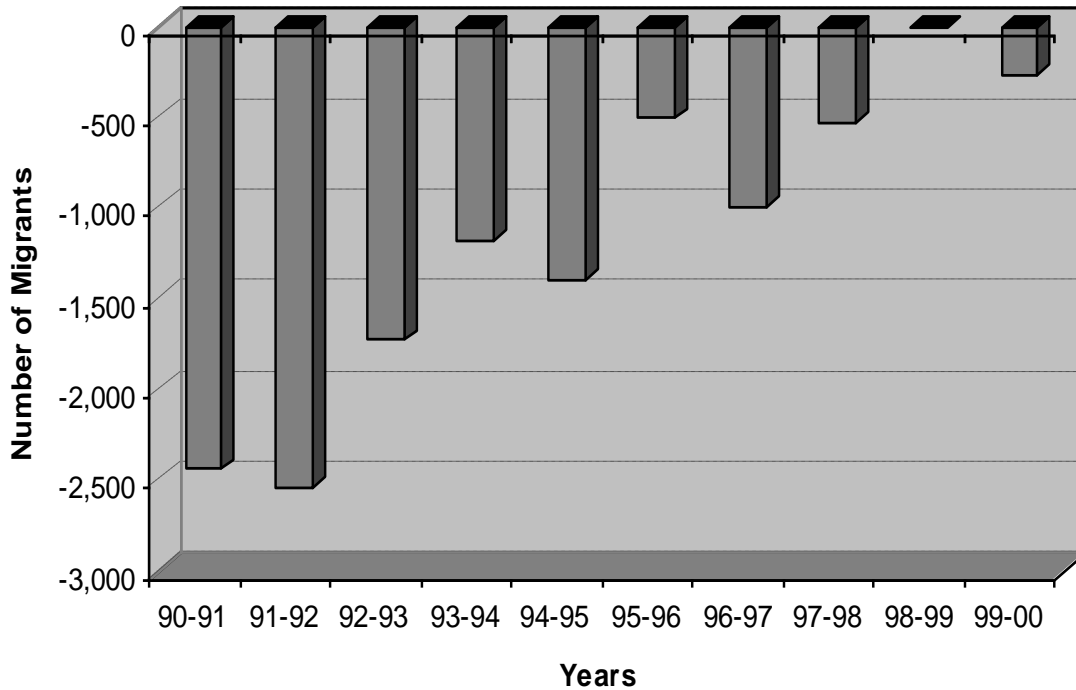
Analysis of these numbers shows that Erie County and Pennsylvania experienced a decrease in population during the last half of the decade. Figure 1 compares the percentage change in population for every year between 1990 and 2000 for Erie County and Pennsylvania. It also indicates that the last half of the decade had negative population changes. Though population changes remained positive between 1992 and 1995, the pattern of Figure 1 shows that the population trend pattern had begun to decline in 1992. However, the rate of population decrease slowed significantly in 1999 compared to the previous years. These data show that Erie's population has been declining in the last decade.

Figure 1
Percentage Change of Population for Erie and Pennsylvania



Population change may be due to natural change (births and deaths), or migration. Figure 2 shows the migration pattern for Erie County during the last decade. Net migration has been negative, indicating that more people are leaving than are coming into Erie. This could be an explanation as to why Erie County has seen a negative growth rate in total population during the last half of the decade. On the positive side, these data indicate a slowing of out migration in recent years. Unfortunately these figures do not describe who in the population is leaving. The next section of our analysis will address this issue.

Figure 2
Net Migration for Erie County in the 1990's



C. Age Cohorts

In an analysis of brain drain, the demographic details may be more important than the total number of migrants. Demographics such as age, sex, race, occupation, annual income, marital status, etc. help to give a precise illustration of who was coming or going and what they actually provided the local economy. The data that were located for this study provide population totals broken down by ages; they were obtained from a variety of sources. The Philadelphia Branch office of the U.S. Census Bureau provided the county level age data from 1950 through 1990. Data prior to 1990 are not yet available on the World Wide Web. The data can be found in the Census Bureau's *Characteristics of the Population* or *General Population Characteristics* publication

(Brunsman). The 2000 data can be found on the U.S. Census Bureau's website at www.census.gov, under the *American Fact Finder* tool (Census 2000).

These data are broken into five-year age groups with the totals coming from the nation's census every ten years. A comparison can be made between the age cohorts from one census with the corresponding cohort from the next census. If there is a decline in the population then one of two possibilities had to occur. The people (1) could have moved out of Erie County, or (2) could have died. This means we can estimate the number of net migrants in an area from the population change data if we can adjust for births and deaths.

The actual mathematical equations for this measure are as follows:

$$\text{Net Migration} = \text{In Migration} - \text{Out Migration}$$

$$\Delta\text{Population} = \text{Net Migration} + \text{Births} - \text{Deaths}$$

$$\text{Net Migration} = \Delta\text{Population} - \text{Births} + \text{Deaths}$$

In order to calculate the number of deaths for each of the five-year age categories, death rates were used as an approximation. The death rates were calculated by the U.S. National Center for Health Statistics and are available in their *Monthly Vital Statistics Report*, 1997. These death rates were calculated as of 1995 so they are a good approximation for the 1990 to 2000 data. However, these rates are not going to be as accurate when they are applied to the previous censuses. For example, the death rates between 1950 and 1960 may be expected to be much higher than in 1990 because of the technological and medical advances that have been made. Unfortunately the death rates for periods before 1995 were not available, so the 1995 rates will be used in our estimate for earlier years.

To make things even more complicated, as individuals age, their death rates change. So the death rate for a person who is in the 20 to 24 year old age group has a different death rate as the next census comes around. To account for this, an average of the two corresponding death rates was used as that section of the population aged over the ten years.

The most recent data, specifically the 1990 and 2000 Censuses, show that Erie County has suffered a loss of the young mobile workers that are the major focus of this research. An ideal situation for the County would be to at least retain those native young people and possibly even draw workers from other areas. However, this was not the case for Erie County in recent years. For example, Table 2 shows that for the 1990 Census there were 22,126 people who were in the 20 to 24 year age bracket. Ten years later, in the 2000 Census these people were now in the 30 to 34 year age bracket, and there were only 18,147 of them still in Erie. Accounting for deaths, this was a net migration of almost -17%. This 17% decrease translates into about 3,700 people who could have contributed to the County's economy but chose to leave.

Another vital group is the 15 to 19 year olds. This group was just entering or preparing to enter college when the 1990 Census took place. After the ten years, these people had graduated from college or had been working for a few years. In 1990 there were 22,507 of these 15 to 19 year olds, the highest number of any of the age cohorts during this Census. Ten years later, the 25 to 29 year olds accounted for only 17,078 of Erie's population. This was a percentage change of -23%. This has an even larger impact on the number of possible workers than the previous example; this decrease of 23.17% is 5,215 people. The combined effect of these two age cohorts is 9,408 people

migrating to other parts of the state, country, or elsewhere, people who have either just begun a new career or who have worked in that career for only about ten years.

**Table 2
Percentage Change for All Age Groups in Erie County between
1990 and 2000**

Age Groups for the 1990 Census		Age Groups for the 2000 Census		Change in Population	Expected Number of Deaths	Net Migration	Net Migration as a % of the '90 Base
N/A	-	under 5	17,440	-	-	-	-
N/A	-	5 to 9	19,997	-	-	-	-
under 5	19,973	10 to 14	20,251	278	828	1,106	5.54
5 to 9	20,393	15 to 19	22,404	2,011	46	2,057	10.09
10 to 14	19,449	20 to 24	20,419	970	106	1,076	5.53
15 to 19	22,507	25 to 29	17,078	-5,429	214	-5,215	-23.17
20 to 24	22,126	30 to 34	18,147	-3,979	250	-3,729	-16.85
25 to 29	20,242	35 to 39	20,283	41	283	324	1.60
30 to 34	22,349	40 to 44	22,224	-125	413	288	1.29
35 to 39	21,598	45 to 49	21,003	-595	524	-71	-0.33
40 to 44	18,093	50 to 54	17,185	-908	590	-318	-1.76
45 to 49	14,451	55 to 59	13,454	-997	682	-315	-2.18
50 to 54	11,878	60 to 64	10,702	-1,176	855	-321	-2.70
55 to 59	11,486	65 to 69	9,702	-1,784	1,295	-489	-4.26
60 to 64	13,002	70 to 74	10,266	-2,736	2,237	-499	-3.84
65 to 69	12,733	75 to 79	9,163	-3,570	3,304	-266	-2.09
70 to 74	10,301	80 to 84	6,233	-4,068	4,045	-23	-0.22
75 to 79	7,291	85 and over	4,892	-2,399	4,471	2,072	28.42
80 to 84	4,380	N/A	-	-	-	-	-
85 and over	3,320	N/A	-	-	-	-	-
Totals	275,572		243,406				

For a small city, this large amount of outflow can have an enormous impact on Erie County's economic future. Further data analysis reveals that this large number of exiting youth has not always been the case for Erie County. Before 1980, brain *gain* was evident among the 20 to 24 year olds. This steady increase of young workers during the 50's, 60's, and 70's has, in more recent years, turned into a massive exodus.

Figure 3 depicts this dramatic change. It seems that whatever was drawing this age group to our County previously is not as effective on the current generation.

Figure 3
Percentage Change between Censuses Going
from the 20-24 Age Group to the 30-34 Age Group

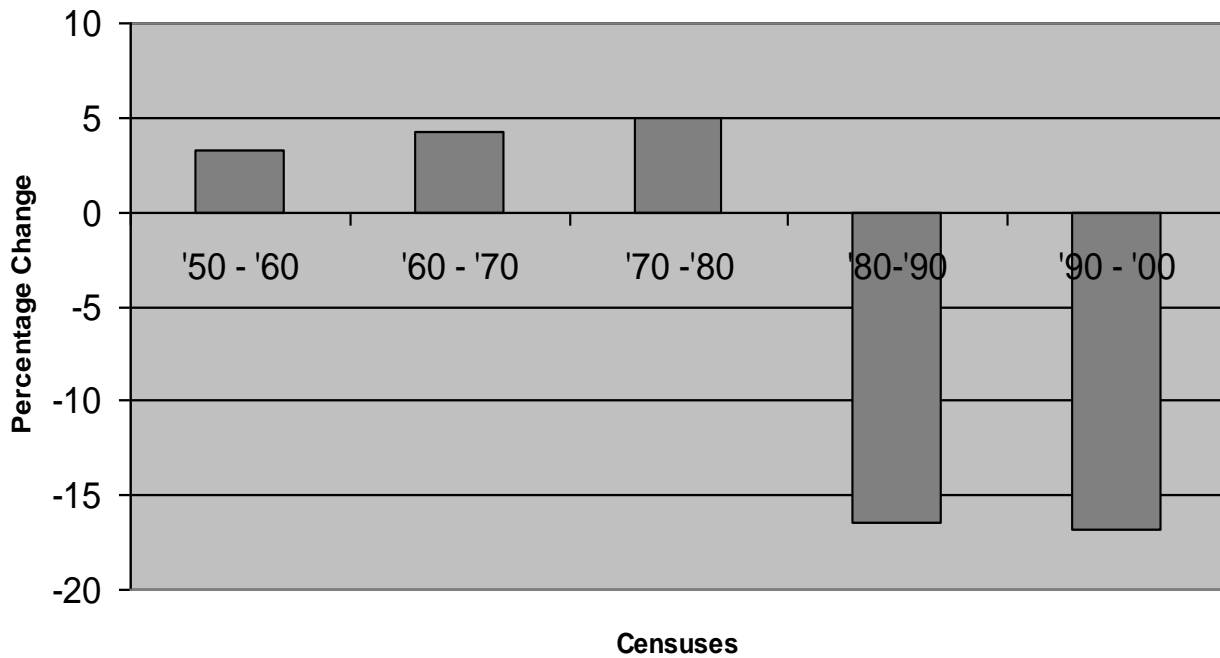
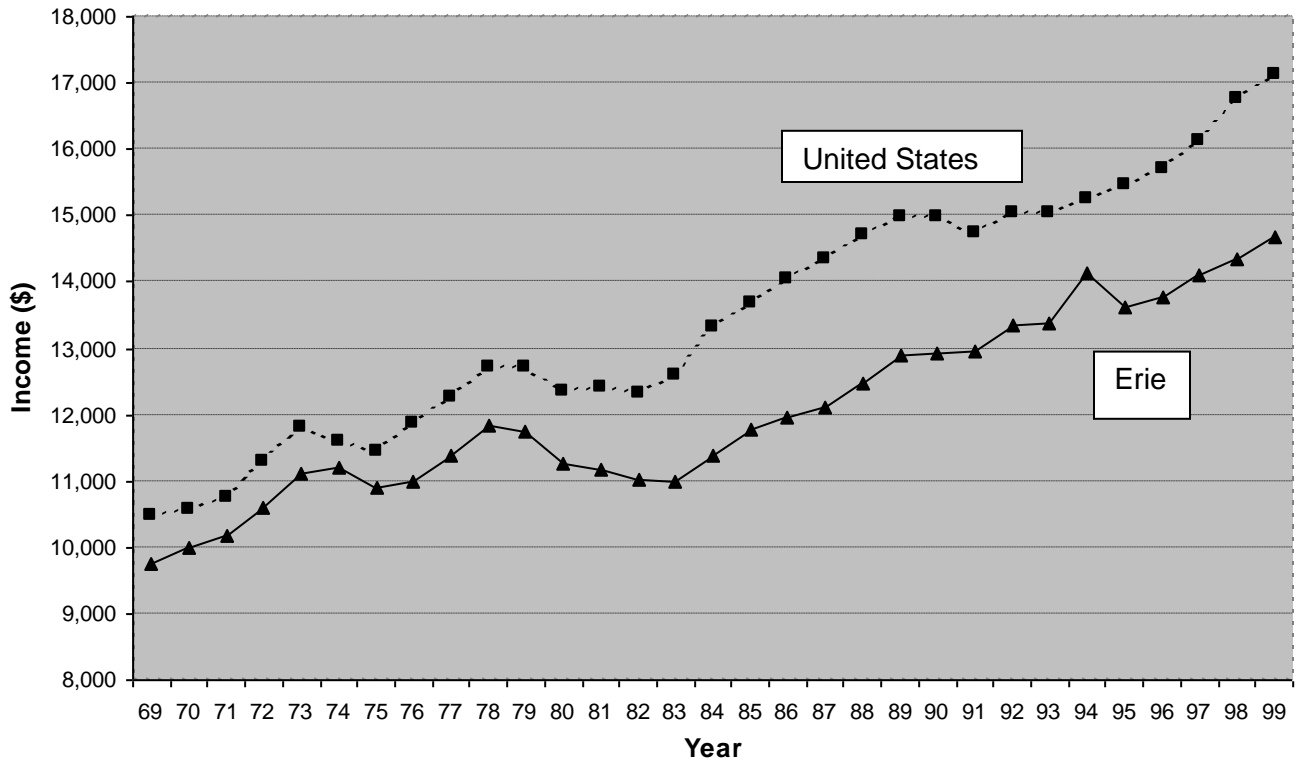


Figure 3 shows a drastic change in the population growth rate for these age cohorts before and after 1980. One possibility is that the recession that the U.S. experienced in the early eighties changed the way in which Erie operates. The recession may have had such an impact on the County's local businesses that they are now less attractive to younger workers compared to other cities. As seen in Figure 4, Erie's real income per capita had grown at a comparable rate with the nation until the 1980 recession¹. Although Erie recovered, it is now a further distance away from the national average than it was before the recession of the early '80s. It is possible that

¹ The National Bureau of Economic Research is the group that officially identifies business cycle peaks and troughs. They place a peak in January 1980 for the nation and a trough at July of 1980. See www.nber.org/cycles.html for details.

whatever affected Erie County's per capita income also affected the County's ability to attract younger workers.

Figure 4
Erie and US Real Income Per Capita



Another alarming trend, evident from the age cohort data, is the total numbers of negative migrants. Looking at the whole population in the County, there are very few positive net migration numbers. In Table 2 there are only six positive out of sixteen numbers in the right-most column for the 1990-2000 period. This has almost always been the case in Erie County. In Appendix 1, there are very few cases in which there is a positive percentage change in one of the various age groups. In fact, out of the 80 age cohort comparisons between 1950 and 2000, only nine times was there a positive change between age groups. It seems that Erie not only loses young workers, but also

older, more experienced workers, although the rates for these migrants are far less than those of the younger ones.

While this analysis has been instructive, its limitations should be recognized. One of the major problems with these data is that they correspond with ten-year intervals. It is hard to look closely at the brain drain issue without looking at yearly numbers. Our economy has had to change and adapt so rapidly in recent years that it is hard to infer things from decennial data. As fast as the economy changes, the population may change just as fast.

Another problem with these data is that we cannot tell whether the people counted in succeeding censuses are the same individuals or not. The people in one age cohort in the 1980 count could conceivably all be different from the people in the corresponding cohort in the 1990 count. However, this minor problem can be overlooked if the assumption is made that these people provide approximately the same economic benefits. It will not make a difference if one person moves into the county and one person leaves the county as long as these two people are in the same age category. However, this assumption is not entirely realistic. We know that there are differences between people due to their education and how well they perform their specific job duties. There were no data available to the public that could give the desired combination of age, educational status, occupation, and income data for the migrants of Erie County.

Even though these data are more specific than the total migration patterns for the entire population of Erie County, the migration approach does not tell all there is to know about brain drain. Another measure would be to look at the educational

attainment of these young migrants. Unfortunately, those specific demographics were not available. Since income appears to be correlated with education, income of Erie County migrants was used as a proxy for the third measure of brain drain.

D. Income of Migrants

When people are moving, not only are they moving themselves, they are also taking with them their incomes. Intuitively, if the education level attained is higher for a person, then his or her income should also be higher. This means that examination of income data can also help determine whether brain drain or brain gain is occurring.

The most accurate and up-to-date accounting of this continual migration is the IRS County-to-County Migration Statistics available for all counties in the nation. These data can be ordered online at <http://gemini.berkshire.net/~migrate> (Wheat, 1996). The data contained within the Migration database was obtained directly from the Statistics of Income Division of the Internal Revenue Service. The data are the result of a joint effort between the Internal Revenue Service (IRS) and the Census Bureau.

A database was created for Erie County which included the number of tax returns, exemptions, and aggregate income for 1996 and 1997. These data were sorted by state, county, and city. Each category was broken down into migration flows: inflow from other places to the county, outflow to other places from the county, and the net flow (the difference between inflow and outflow). The net flow is particularly important because this number tells whether or not people are leaving Erie County.

While the Internal Revenue Service's database does not provide age-specific migration data, it does allow for the analysis of the county-to-county migration patterns

of all taxpayers. The data from the IRS are based on changes in the addresses entered on individual income tax returns. If the county of residence changes from one year to the next, the taxpayer was counted as a migrant. If the county of residence did not change, the taxpayer was classified as a non-migrant. The number of tax returns can be used as a proxy for the number of households. It is not a perfect proxy, though, because not all taxpayers file from their primary address. Some may use post office boxes, business addresses, or addresses of accountants. Only returns for which the primary taxpayer's Social Security number matches in two consecutive years are included in the data. Some of the most-common causes for a non-match include divorces, deaths, and people marrying between filings.

In this final approach, brain drain was measured by using 1996 and 1997 IRS income tax returns. According to the IRS data, 1996 proved to be a year for brain drain migration in Erie County.

The net flow numbers for 1996 -1997 in the three categories shown in the table below were negative for Erie. This indicates that more people and income were flowing out of Erie rather than into the county. These data suggest that Erie County is simply not replacing the people it loses. Even though Table 3 shows that the County has experienced a net migration loss, there are implications when analyzing these numbers.

Table 3
People and Income Migration Flow by Category
for Erie County (1996-1997)

	Inflow	Outflow	Net Migration
<i>Returns (households)</i>	2,953	3,822	-869
<i>Exemptions (people)</i>	5,518	6,921	-1,403
<i>Aggregate Income</i>	\$84,259,000	\$111,532,000	-\$27,273,000

Table 3 reports that 869 more households moved from Erie County than moved to Erie County between 1996 and 1997. Data on personal exemptions in Table 3 include the actual number of individuals reported on a return (including both taxpayer(s) and dependents), so it may be used as a proxy for population. These numbers may change from year to year due to births, deaths, marriages, and dependents no longer being counted as exemptions, as well as the migrants we are trying to measure. Exemptions include dependents that may not be earning income. Closer consideration of the data suggests that it is best to focus on the number of tax returns and aggregate income, because the goal is to tie the number of households migrating with income migration. Brain drain would occur if people leaving the area are taking away a larger, average household income than those coming into the area. In the 1996-1997 filing year, Erie had a net loss of \$27,273,000 in income, resulting from the net loss of 869 households.

Table 4 presents data on the states where migrants are moving to, from Erie, and from, to Erie. For example, 42 households moved to Erie from Arizona, while 58 Erie

households moved to Arizona from Erie, resulting in a net migration of 16 households out of Erie to Arizona. This resulted in a net loss of \$412,000 of income for the area.

These data were sorted by county and state. The numbers for each state are generated from the totals of all counties within that state that had Erie migration, and had more than 10 returns. "Other flows" include all cases in which any county in a different state had less than 10 returns involved in Erie migration. The columns for county information in Table 4 illustrate roughly the percentage of counties from each state that had households moving into and out of Erie. Each county that was included in the percentage of counties with household migration for each state had at least 10 households that were involved in migration into or out of Erie. Pennsylvania had the biggest percentage of counties with Erie migration at 43%. This accounts for Pennsylvania's larger aggregate income totals in Table 4. Kentucky, on the other hand, was one of two states that had the lowest percentage of counties with household migration. Interestingly enough, the net aggregate income that Erie lost to Kentucky was significantly higher than to other states that had more county involvement.

Of the 18 states reported in the data, Erie received positive migration from only four states. The shading indicates a net gain of aggregate income for Erie from those individual states. It was not a surprise to see either Pennsylvania or New York as states in this group. Households may have moved here from the smaller, rural counties surrounding Erie County. Texas and Maryland also yielded a positive net gain for Erie. Erie lost the most households to Ohio, Florida, and North Carolina; Erie suffered net aggregate income losses of at least \$5 million to each of these states.

Table 4
Number of Households and Aggregate Income
Flowing into and out of Erie County
(1996-1997)

State	County Information			Number of Returns (Households)			Aggregate Income		
	# of Counties with Household Migration	Total # of Counties in State	% of Counties with Household Migration	Households moving into Erie from:	Households moving from Erie to:	Net Household Migration	Agg. Incomes of Household moving into Erie from:	Agg. Incomes of Households moving from Erie to:	Net Aggregate Income of Household Migrants
Arizona	2	15	13.3	42	58	-16	\$801,000	\$1,213,000	-\$412,000
California	15	58	25.9	25	48	-23	\$660,000	\$1,035,000	-\$375,000
Florida	11	67	16.4	53	208	-155	\$1,062,000	\$6,887,000	-\$5,825,000
Georgia	2	159	1.3	0	21	-21	\$0	\$703,000	-\$703,000
Illinois	1	102	1.0	12	19	-7	\$318,000	\$543,000	-\$225,000
Indiana	1	92	1.1	0	14	-14	\$0	\$398,000	-\$398,000
Kentucky	1	120	0.8	0	13	-13	\$0	\$1,196,000	-\$1,196,000
Maryland	3	14	21.4	13	36	-23	\$2,328,000	\$917,000	\$1,411,000
Michigan	1	83	1.2	0	28	-28	\$0	\$725,000	-\$725,000
Nevada	2	17	11.8	13	45	-32	\$362,000	\$828,000	-\$466,000
New York	8	62	12.9	225	200	25	\$5,715,000	\$5,073,000	\$642,000
North Carolina	6	100	6.0	12	120	-108	\$221,000	\$5,921,000	-\$5,700,000
Ohio	12	88	13.6	148	348	-200	\$3,658,000	\$10,241,000	-\$6,583,000
Pennsylvania	29	67	43.3	1,184	1,196	43	\$30,402,000	\$26,840,000	\$3,562,000
South Carolina	2	46	4.3	0	21	-21	\$0	\$1,114,000	-\$1,114,000
Tennessee	2	95	2.1	0	20	-20	\$0	\$400,000	-\$400,000
Texas	2	254	0.8	11	10	1	\$584,000	\$141,000	\$443,000
Virginia	3	136	2.2	0	52	-52	\$0	\$1,171,000	-\$1,171,000
Other Flows-Different State	N/A	N/A	-	1,145	1,354	-209	\$36,577,000	\$45,361,000	-\$8,784,000
Foreign flows	N/A	N/A	-	70	66	4	\$1,571,000	\$825,000	\$746,000
Totals				2,953	3,822	-869	\$84,259,000	\$111,532,000	-\$27,273,000

After establishing that income and people are leaving Erie, the question still remains: Is there brain drain? Are the “best and the brightest” leaving Erie County?

Table 5 presents the average income of returns for inflows into Erie from different states and outflows, from Erie, to each destination state.

For example, Erie had an aggregate income flow from Arizona of \$801,000 and 42 returns (households) that year. Average income is calculated by dividing aggregate income by the number of returns. The calculations are the same for outflows. The

average income for households moving to Erie from Arizona was \$19,071, and the average income for households moving from Erie to Arizona was \$20,914.

Data in Table 5 show that 7 of the 18 states only had outflow migration from Erie and no inflows to Erie. These states were all in the southern region of the United States, including Virginia, Tennessee, Kentucky, North Carolina, South Carolina, Georgia, and Florida. Of those, Kentucky, South Carolina, and North Carolina showed relatively high average household incomes flowing out of Erie at \$92,000, \$53,048, and \$49,342, respectively. These types of flows tend to indicate brain drain – higher income families leaving Erie.

In comparison to Table 4, the data in Table 5 show that six more states had a positive net gain for Erie, reflecting a type of brain gain. Once again, the shading stands for a gain in net average income per household for Erie, while the unshaded cells represent a loss for Erie in net average income per household. California and Nevada had higher average incomes flowing into Erie. It was a surprise to see that even though Erie lost more households to Maryland than it gained, the average income flow from Maryland was remarkably high at \$179,077. Is Erie attracting “smarter”—or at least richer--people from Maryland?

The last column in Table 5 shows the difference between the average income of households that moved into Erie from a particular state and those that moved out of Erie to that same state. For example, the average income of a household that is moving from Arizona into Erie County was \$19,071, while the average income of a household that moved from Erie County to Arizona was \$20,914. The difference is calculated by

subtracting one from the other, -\$1,842. This is the net amount of income per household that Erie lost to Arizona.

Table 5
Average Income of Households flowing into and out of Erie County
(1996-1997)

State	Households moving into Erie from:	Agg. Incomes of Household moving into Erie from:	Average Income of Households moving to Erie from:	Households moving from Erie to:	Agg. Incomes of Households moving from Erie to:	Average Income of Households moving from Erie to:	Net Difference in Average Income of Households moving into and out of Erie
<i>Arizona</i>	42	\$801,000	\$19,071	58	\$1,213,000	\$20,914	-\$1,842
<i>California</i>	25	\$660,000	\$26,400	48	\$1,035,000	\$21,563	\$4,838
<i>Florida</i>	53	\$1,062,000	\$20,038	208	\$6,887,000	\$33,111	-\$13,073
<i>Georgia</i>	0	\$0		21	\$703,000	\$33,476	-\$33,476
<i>Illinois</i>	12	\$318,000	\$26,500	19	\$543,000	\$28,579	-\$2,079
<i>Indiana</i>	0	\$0		14	\$398,000	\$28,429	-\$28,429
<i>Kentucky</i>	0	\$0		13	\$1,196,000	\$92,000	-\$92,000
<i>Maryland</i>	13	\$2,328,000	\$179,077	36	\$917,000	\$25,472	\$153,605
<i>Michigan</i>	0	\$0		28	\$725,000	\$25,893	-\$25,893
<i>Nevada</i>	13	\$362,000	\$27,846	45	\$828,000	\$18,400	\$9,446
<i>New York</i>	225	\$5,715,000	\$25,400	200	\$5,073,000	\$25,365	\$35
<i>North Carolina</i>	12	\$221,000	\$18,417	120	\$5,921,000	\$49,342	-\$30,925
<i>Ohio</i>	148	\$3,658,000	\$24,716	348	\$10,241,000	\$29,428	-\$4,712
<i>Pennsylvania</i>	1,184	\$30,402,000	\$25,677	1,196	\$26,840,000	\$22,441	\$3,236
<i>South Carolina</i>	0	\$0		21	\$1,114,000	\$53,048	-\$53,048
<i>Tennessee</i>	0	\$0		20	\$400,000	\$20,000	-\$20,000
<i>Texas</i>	11	\$584,000	\$53,091	10	\$141,000	\$14,100	\$38,991
<i>Virginia</i>	0	\$0		52	\$1,171,000	\$22,519	-\$22,519
<i>Other Flows-Different State</i>	1,145	\$36,577,000	\$31,945	1,354	\$45,361,000	\$33,501	-\$1,556
<i>Foreign flows</i>	70	\$1,571,000	\$22,443	66	\$825,000	\$12,500	\$9,943
Totals	2,953	\$84,259,000	\$28,533	3,822	\$111,532,000	\$29,182	-\$648

These data suggest that the households leaving the Erie area are also taking away higher average household incomes than the households moving into Erie. If education is correlated with higher incomes, this implies that brain drain is occurring.

IV. CONCLUSIONS

A. Summary

All three of the methods used for this research showed negative results for Erie County. Our conclusion then has to be that brain drain has been occurring during the last decade. In all three cases, Erie is seeing more people leaving the County than moving into the County. Erie experienced negative net migration numbers every year during the last decade, which explains the declining population of the workers that were the primary focus of the study. Interestingly enough, Erie appears not only to be losing these young, valuable workers, but the older, more experienced workers as well.

Also, people with higher average incomes appear to be leaving the area more frequently, as seen from the IRS data. If education is correlated with the level of income, then Erie is losing more of its educated workers than it is able to attract into the local economy.

B. Policy Implications

In all three of the methods used for this research, each measurement showed negative results for Erie County. Brain Drain is occurring and has been in the last decade.

One has to wonder what is causing all of these possible contributors to our economy to leave our region. With the ensuing uncertainty of our nation's economy, local officials should take a careful look at what is going on with our young people. If the nation does go into a recession there are two possible outcomes for the County.

The first outcome could be that whatever was wrong with the local economy before the recession of the early 1980s was “fixed” when the recession was over. It could be that local businesses learned from that recession and are now able to handle the rough times. This efficiency could translate into virtually no migration of workers or we could even see an inflow of young people into the County.

The second outcome should be considered carefully. If the local economy continues the most recent trends of outmigrating young workers, Erie may suffer from a severe case of brain drain in the next few years. If the businesses that were hit hard in the early eighties just managed to get by without making substantive changes in the way they operate, we may see a lot of companies shut down or move out of this region.

A key question might be what would induce young and more highly educated workers to stay in the Erie area. Presumably better job opportunities with higher incomes would be part of the answer. But other factors may play a role, too such as more social activities aimed at this audience. This may be an issue for local leaders to consider during the “regional assets” debate.

C. Further Research

This research can be extended using explanatory techniques. Due to time constraints, this study only focused on defining brain drain and measuring whether Erie County is experiencing it. Using explanatory methods, another study can probe into the reasons behind the migration patterns. Are people leaving because Erie County does not provide jobs better suited for more educated people? Are these people more attracted to metropolitan areas with better standards of living? Or are they simply

moving to locations that have less snow? The analysis of the income data did show more migration to the southern regions of the nation.

Other possible studies can include the use of measuring instruments such as surveys to determine where specific college graduates go. With four local colleges and universities in Erie County, an important study could deal with where graduates are going and why. This is important because Erie County attracts young students, educates them using local tax dollars, and then loses them. The surveys can help establish the reasons behind their exiting patterns.

Appendix 1
Erie County Migration for Decennial Censuses, 1950-2000

1950		1960		Change in Population	Expected Deaths w/ avg death rate	Adjusted Change in Pop (Migration)	% migration
under 5	23,755	10 to 14	23,726	-29.00	1922.73	1893.73	7.97
5 to 9	19,114	15 to 19	18,545	-569.00	43.20	-525.80	-2.75
10 to 14	15,651	20 to 24	12,821	-2830.00	85.30	-2744.70	-17.54
15 to 19	14,522	25 to 29	13,547	-975.00	138.39	-836.61	-5.76
20 to 24	16,517	30 to 34	16,868	351.00	186.97	537.97	3.26
25 to 29	18,709	35 to 39	18,184	-525.00	261.55	-263.45	-1.41
30 to 34	17,919	40 to 44	17,308	-611.00	330.78	-280.22	-1.56
35 to 39	16,899	45 to 49	15,533	-1366.00	409.63	-956.37	-5.66
40 to 44	14,155	50 to 54	12,941	-1214.00	461.45	-752.55	-5.32
45 to 49	12,332	55 to 59	11,048	-1284.00	581.95	-702.05	-5.69
50 to 54	11,815	60 to 64	9,938	-1877.00	850.38	-1026.62	-8.69
55 to 59	10,859	65 to 69	8,771	-2088.00	1223.86	-864.14	-7.96
60 to 64	9,324	70 to 74	6,829	-2495.00	1604.01	-890.99	-9.56
65 to 69	7,387	75 to 79	4,277	-3110.00	1916.82	-1193.18	-16.15
70 to 74	5,091	80 to 84	2,243	-2848.00	1999.18	-848.82	-16.67
75 to 79	4,928	85 and ove	1,355	-3573.00	3021.97	-551.03	-11.18
80 to 84	*	under 5	29,422				
85 and ove	811	5 to 9	27,326				

1960		1970		Change in Population	Expected Deaths w/ avg death rate	Adjusted Change in Pop (Migration)	% migration
10 to 14	23,726	20 to 24	18,882	-4844.00	129.31	-4714.69	-19.87
15 to 19	18,545	25 to 29	15,782	-2763.00	176.73	-2586.27	-13.95
20 to 24	12,821	30 to 34	13,214	393.00	145.13	538.13	4.20
25 to 29	13,547	35 to 39	13,250	-297.00	189.39	-107.61	-0.79
30 to 34	16,868	40 to 44	16,056	-812.00	311.38	-500.62	-2.97
35 to 39	18,184	45 to 49	16,829	-1355.00	440.78	-914.22	-5.03
40 to 44	17,308	50 to 54	15,815	-1493.00	564.24	-928.76	-5.37
45 to 49	15,533	55 to 59	13,553	-1980.00	733.00	-1247.00	-8.03
50 to 54	12,941	60 to 64	10,825	-2116.00	931.43	-1184.57	-9.15
55 to 59	11,048	65 to 69	8,112	-2936.00	1245.16	-1690.84	-15.30
60 to 64	9,938	70 to 74	6,859	-3079.00	1709.63	-1369.37	-13.78
65 to 69	8,771	75 to 79	4,966	-3805.00	2275.94	-1529.06	-17.43
70 to 74	6,829	80 to 84	3,015	-3814.00	2681.68	-1132.32	-16.58
75 to 79	4,277	85 and ove	1,945	-2332.00	2622.76	290.76	6.80
80 to 84	2,243	under 5	23,392				
85 and ove	1,355	5 to 9	26,358				
under 5	29,422	10 to 14	28,035	-1387.00	-57.50	-1444.50	-4.91
5 to 9	27,326	15 to 19	26,766	-560.00	-1.27	-561.27	-2.05

1970		1980		Change in Population	Expected Deaths w/ avg death rate	Adjusted Change in Pop (Migration)	% migration
20 to 24	18,882	30 to 34	19,610	728.00	213.74	941.74	4.99
25 to 29	15,782	35 to 39	15,648	-134.00	220.63	86.63	0.55
30 to 34	13,214	40 to 44	13,046	-168.00	243.93	75.93	0.57
35 to 39	13,250	45 to 49	12,751	-499.00	321.18	-177.82	-1.34
40 to 44	16,056	50 to 54	15,171	-885.00	523.43	-361.57	-2.25
45 to 49	16,829	55 to 59	15,774	-1055.00	794.16	-260.84	-1.55
50 to 54	15,815	60 to 64	13,705	-2110.00	1138.28	-971.72	-6.14
55 to 59	13,553	65 to 69	10,898	-2655.00	1527.49	-1127.51	-8.32
60 to 64	10,825	70 to 74	7,946	-2879.00	1862.22	-1016.78	-9.39
65 to 69	8,112	75 to 79	5,331	-2781.00	2104.94	-676.06	-8.33
70 to 74	6,859	80 to 84	3,530	-3329.00	2693.46	-635.54	-9.27
75 to 79	4,966	85 and ove	2,831	-2135.00	3045.28	910.28	18.33
80 to 84	3,015	under 5	20,651				
85 and ove	1,945	5 to 9	21,528				
under 5	23,392	10 to 14	23,259	-133.00	969.72	836.72	3.58
5 to 9	26,358	15 to 19	27,481	1123.00	59.57	1182.57	4.49
10 to 14	28,035	20 to 24	27,127	-908.00	152.79	-755.21	-2.69
15 to 19	26,766	25 to 29	23,493	-3273.00	255.08	-3017.92	-11.28

1980		1990		Change in Population	Expected Deaths w/ avg death rate	Adjusted Change in Pop (Migration)	% migration
30 to 34	19,610	40 to 44	18,093	-1517.00	362.00	-1155.00	-5.89
35 to 39	15,648	45 to 49	14,451	-1197.00	379.31	-817.69	-5.23
40 to 44	13,046	50 to 54	11,878	-1168.00	425.30	-742.70	-5.69
45 to 49	12,751	55 to 59	11,486	-1265.00	601.72	-663.28	-5.20
50 to 54	15,171	60 to 64	13,002	-2169.00	1091.93	-1077.07	-7.10
55 to 59	15,774	65 to 69	12,733	-3041.00	1777.81	-1263.19	-8.01
60 to 64	13,705	70 to 74	10,301	-3404.00	2357.67	-1046.33	-7.63
65 to 69	10,898	75 to 79	7,291	-3607.00	2827.87	-779.13	-7.15
70 to 74	7,946	80 to 84	4,380	-3566.00	3120.31	-445.69	-5.61
75 to 79	5,331	85 and ove	3,320	-2011.00	3269.10	1258.10	23.60
80 to 84	3,530	under 5	19,973				
85 and ove	2,831	5 to 9	20,393				
under 5	20,651	10 to 14	19,449	-1202.00	856.09	-345.91	-1.68
5 to 9	21,528	15 to 19	22,507	979.00	48.65	1027.65	4.77
10 to 14	23,259	20 to 24	22,126	-1133.00	126.76	-1006.24	-4.33
15 to 19	27,481	25 to 29	20,242	-7239.00	261.89	-6977.11	-25.39
20 to 24	27,127	30 to 34	22,349	-4778.00	307.08	-4470.92	-16.48
25 to 29	23,493	35 to 39	21,598	-1895.00	328.43	-1566.57	-6.67

1990		2000		Change in Population	Expected Deaths w/ avg death rate	Adjusted Change in Pop (Migration)	% migration
40 to 44	18,093	50 to 54	17,185	-908.00	589.83	-318.17	-1.76
45 to 49	14,451	55 to 59	13,454	-997.00	681.94	-315.06	-2.18
50 to 54	11,878	60 to 64	10,702	-1176.00	854.92	-321.08	-2.70
55 to 59	11,486	65 to 69	9,702	-1784.00	1294.53	-489.47	-4.26
60 to 64	13,002	70 to 74	10,266	-2736.00	2236.73	-499.27	-3.84
65 to 69	12,733	75 to 79	9,163	-3570.00	3304.02	-265.98	-2.09
70 to 74	10,301	80 to 84	6,233	-4068.00	4045.10	-22.90	-0.22
75 to 79	7,291	85 and ove	4,892	-2399.00	4471.02	2072.02	28.42
80 to 84	4,380	under 5	17,440				
85 and ove	3,320	5 to 9	19,997				
under 5	19,973	10 to 14	20,251	278.00	827.98	1105.98	5.54
5 to 9	20,393	15 to 19	22,404	2011.00	46.09	2057.09	10.09
10 to 14	19,449	20 to 24	20,419	970.00	106.00	1076.00	5.53
15 to 19	22,507	25 to 29	17,078	-5429.00	214.49	-5214.51	-23.17
20 to 24	22,126	30 to 34	18,147	-3979.00	250.47	-3728.53	-16.85
25 to 29	20,242	35 to 39	20,283	41.00	282.98	323.98	1.60
30 to 34	22,349	40 to 44	22,224	-125.00	412.56	287.56	1.29
35 to 39	21,598	45 to 49	21,003	-595.00	523.54	-71.46	-0.33

Appendix 2
Death Rates for Age Cohorts Using 1995 Data

Age Group	Death Rates per 100,000 in %	Death Rates per 100,000	Corresponding Age Groups for then years	Average Death Rate for ten years
Under 1-4 years	0.8094%	0.008094*	0-4 & 5-9	0.0041455
5-9 years	0.0197%	0.000197	5-9 & 10-14	0.000226
10-14 years	0.0255%	0.000255	10-14 & 15-19	0.000545
15-19 years	0.0835%	0.000835	15-19 & 20-24	0.000953
20-24 years	0.1071%	0.001071	20-24 & 25-29	0.001132
25-29 years	0.1193%	0.001193	25-29 & 30-34	0.001398
30-34 years	0.1603%	0.001603	30-34 & 35-39	0.001846
35-39 years	0.2089%	0.002089	35-39 & 40-44	0.002424
40-44 years	0.2759%	0.002759	40-44 & 45-49	0.00326
45-49 years	0.3761%	0.003761	45-49 & 50-54	0.004719
50-54 years	0.5677%	0.005677	50-54 & 55-59	0.0071975
55-59 years	0.8718%	0.008718	55-59 & 60-64	0.0112705
60-64 years	1.3823%	0.013823	60-64 & 65-69	0.017203
65-69 years	2.0583%	0.020583	65-69 & 70-74	0.0259485
70-74 years	3.1314%	0.031314	70-74 & 75-79	0.039269
75-79 years	4.7224%	0.047224	75-79 & 80-84	0.0613225
80-84 years	7.5421%	0.075421	80-84 & >84	0.115058
85 years and over	15.4695%	0.154695	85 and over	0.154695

REFERENCES

- Brunsmann, Howard G. "Characteristics of the Population" *Census of Population: 1960, 1970, 1980, 1990*. Volume I, part 40.
- DeJong, Gordon F. and Klein, Pamela M. *Pennsylvania's Brain Drain Migration in the Mid-1990s*. Middletown, PA: Pennsylvania State Data Center, July 1999. 14 pages.
- Gottlieb, Paul D. *The Problem of Brain Drain in Ohio and Northeastern Ohio: What Is It? How Severe Is It? What Should We Do About It?* Cleveland, OH: Center for Regional Economic Issues, January 2001. On the web at: <http://weatherhead.cwru.edu/rei/Publications/braindrain/>
- Hsing, Yu and Mixon, Franklin G. Jr. "A Regional Study of Net Migration of College Students." *Review of Regional Studies*, 26(2), Fall 1996, pp.197-209.
- Schachter, Jason. "Geographical Mobility, Population Characteristics." US Census Bureau, Current Population Reports, May 2001.
- Tornatzky, Louis G.; Gray, Denis O.; Tarant, Stephanie A.; and Zimmer, Cathy. *Where Have All the Students Gone? Interstate Migration of Recent Science and Engineering Graduates*. Research Triangle Park NC: Southern Growth Policies Board, Feb, 1998.
- United States Census Bureau, 2000 Census, Table P12, "Sex by Age", available online at: <http://factfinder.census.gov/servlet/BasicFactsServlet>
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. *Mortality Tables*. Data online at: <http://www.cdc.gov/nchs/datawh/statab/morttables.htm#morttable>. "Death Rates from 1995", available online at: <http://www.infoplease.com/ipa/A0193945.html>
- U.S. Department of the Treasury, Internal Revenue Service. Income and migration data from 1996 available online at: <http://gemini.berkshire.net/~migrate>.
- Wheat, Douglas. "IRS, Income and Migration Statistics from 1996", Wheat Information Systems, 194 North Street, Northampton, MA 01060. 1996