Which Foreign Trade Partners Will Best Help to Stabilize the Erie Economy?

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I. Introduction

A business cycle is a naturally occurring event in any economy and is defined by Greenwald (1982) as being:

> A type of fluctuation found in the aggregate economic activity of nations . . . a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle (96).

To track economic activity, economists rely on economic indicators. Economic indicators include employment or unemployment, output and gross domestic product (GDP), and the fluctuation of several of these indicators in the same direction often signals expansion or decline in the business cycle and certain indicators may help to forecast changes. Gwartney, et al. (2006) explains, "The index of leading indicators is the single most widely used and closely watched forecasting tool. The index is a composite statistic based on ten key variables that generally turn down prior to a recession and turn up before the beginning of a business expansion" (330). Permits for new housing starts are one of these ten variables. When a new permit is obtained it signifies that a new house is going to be built and if several permits are obtained, it is likely that the housing market will soon be thriving.

The press typically defines a recession as being, "A decline in economic activity measured by falling [gross national product] GNP and rising unemployment. Officially a recession in the U.S. occurs when GNP falls for two consecutive quarters" Knopf (1991, 255). The National Bureau of Economic Research, the group which officially identifies national business cycle peaks and troughs, and therefore officially defines recession periods, has a more formal definition which involves many more factors. "A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales." Kurre, et al. (2007) explains that Erie's business cycle exhibits longer recessions, typically nine months longer, than the U.S. on average. The Erie economy experienced an 8% average decrease in employment during recent recessions, while the U.S. experienced only a 3% decrease on average. The following chart depicts Erie county unemployment rates as graphed against the nation for the years 1990 until 2007.

Annual Unemployment Rates
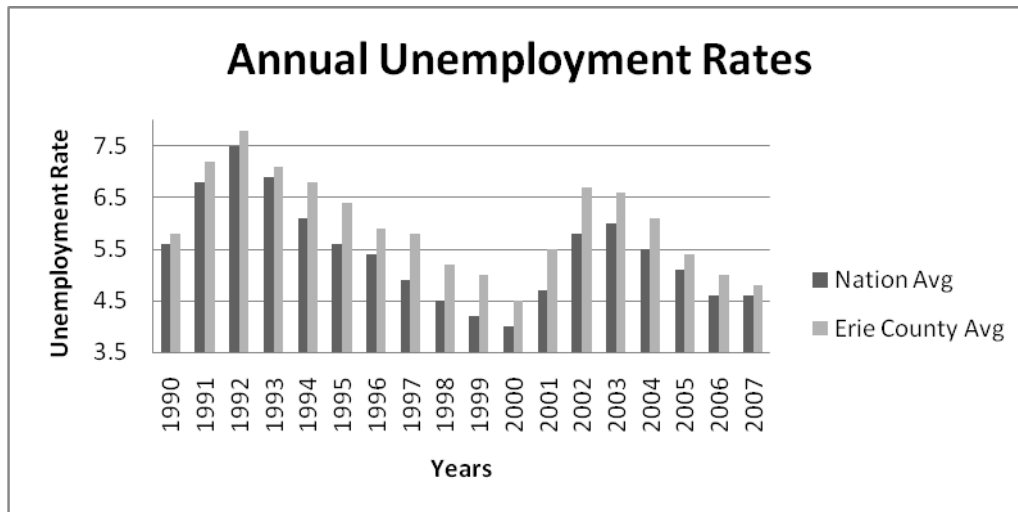
Source: Calculated from BLS Current Population Survey (CPS)

Why does Erie experience longer recessions on average? Erie's industry mix includes a heavy concentration of manufacturing, especially of durable goods such as locomotives, which are products that last for more than three years. This industry is usually hit the hardest during a recession because people, or in this case corporations, choose not to spend a great deal of money on a new mode of transporting goods, but instead save the money until the economy turns upward again.

At this point, one might wonder what can be done to smooth Erie's economic volatility. On the national level, the Federal Reserve System plays a major role by changing interest rates. Their two primary goals are to encourage output and to maintain stable prices (Federal Reserve Bank of San Franciso 2008). When the Federal Reserve System lowers interest rates, money is less expensive to borrow, which causes an increase in demand for goods. This brings more spending into the economy and, hopefully, encourages more stability in the business cycle.

Fiscal policy, the manipulation of government spending and taxes, is another method used to stabilize the economy on the national level. Weil (2008) explains that there are two types of fiscal policy that can be used to ease cyclical swings, automatic stabilizers and discretionary fiscal policy. Tax collection is an example of an automatic stabilizer. Weil (2008) says, "Taxes are roughly proportional to wages and profits, [and] the amount of taxes collected is higher during a boom than during a recession." This means that when the economy is experiencing a period of growth, higher taxes are collected, naturally, and excess demand is removed from the economy. Discretionary fiscal policy encourages the same benefits, during a recession, by providing tax cut incentives and expanded spending programs in hopes of encouraging corporations and consumers to spend more. However, a central bank such as the Federal Reserve is not available on the regional level which excludes monetary policy as an option for Erie's stabilization. As a practical method, state and local governments typically do not engage in fiscal policy for the purpose of stabilization.

On the regional level, foreign trade can help to stabilize an economy if the trading partner experiences a business cycle that is counter-cyclical to the region in question. This means that when Erie is feeling the pangs of recession and decreased demand, the foreign trading partner is enjoying a period of growth and high demand. The opposite will be true when Erie exhibits a period of growth. Overall, this can help to maintain a more stable demand, which will also keep employment levels more even. A practical question that arises is, "are there potential trading partners whose economies are counter-cyclical to Erie's?"

Part of the objective of this project is to update earlier research by Warner and Kurre (2000) which found foreign trade partners that exhibited counter-cyclical business cycles in order to help stabilize Erie's economy. However, a nation that has a counter-cyclical business cycle will not be able to stabilize Erie's economy if they do not need or use a product that Erie produces. To address this issue, Erie's employment will be disaggregated into the 12 supersectors, as outlined by the Bureau of Labor Statistics (BLS). The 12 industrial supersectors are industry categories and include construction, education and health services, financial activities, government, information, leisure and hospitality, manufacturing, natural resources and mining, professional and business services, other services, transportation and utilities, and wholesale and retail trade. Then each statistically significant, counter-cyclical country will be correlated once more to see if negative correlations are evident.

II. Literature Review

The purpose of this project is to build on earlier research done by Warner and Kurre (2000). The goal of their research was to determine if there were any countries that exhibited a business cycle counter-cyclical to that of Erie. They found that there are some countries that meet this criterion. Warner found that most of the countries that exhibit counter-cyclical business cycles are low-income.

A good starting point, and Warner's first question, would be to find out if business cycle volatility is a problem in Erie's economy. She found that regions with most of their employment located in the manufacturing sector and areas that have slow growth patterns, such as Erie's, also have a less stable business cycle. This is because industries such as manufacturing and construction, which produce durable goods, typically have unstable employment levels due to the nature of the demand for their goods as explained above. Erie certainly fits into this category. Dunne and Fee (2008) report that Erie has "80 percent higher proportion of its workforce in manufacturing than the nation as a whole."

So what are some potential ways to smooth out Erie's volatility? Warner reports that one way to build a more stable economy is to change the region's industrial mix, so that the goods manufactured are domestically demanded. This makes sense if one is considering Basevi's

(1970) empirical studies. He says, to create a successful exporting industry, an economy must have successfully met domestic demand for that product and remained profitable. It would be a bad choice to sell a product internationally if it wasn't making a profit domestically. The extra costs of tariffs and other trade barriers would cut further into the revenue, therefore decreasing profits even more.

Burns (1960) reports that the focus of stabilization should be on a change in the occupational mix, not the industrial mix. Burns explains,

> For many years now, the proportion of people who work as managers, engineers, scientists… has been increasing…Workers of this category are commonly said to hold a 'position' rather than a 'job' and to be paid a 'salary' rather than a 'wage'. Hence, they are often sheltered by a professional code which frowns upon frequent firing and hiring. Moreover, much of this type of employment is…less responsive to the business cycle.

Another way to stabilize an economy is through foreign trade. As mentioned earlier, Warner found that countries with counter-cyclical patterns to Erie's business cycle were all low-income. This reflects and supports earlier research done by Yih-Luan Chyi. Chyi (1998) found that the G7 nations (France, Germany, Italy, Japan, the United Kingdom, the United States of America, and Canada), had business cycles that were negatively correlated with those of developing nations. However, this is expected since Chyi also found that the G7 nations are positively correlated with each other.

Calderon et al. (2007) explains that this is due to the differences in specialization and goods produced. Amurgo-Pacheco and Pierola (2007) found that developing nations tend to export only a small number of agricultural products. These products include things such as wheat, rice, or sugar; products in which the price is based on the market demand as a whole. Because of this, demand will fluctuate in a more volatile manner, moving with the entire market, and therefore affecting prices, profits, and income in a more cyclical manner.

Developed nations, on the other hand, manufacture goods such as sports utility vehicles (SUVs) or hybrid vehicles, which are both made out of similar materials. When demand for SUVs decreases due to the increasing gasoline costs, the materials used to make the SUV's can be used to produce hybrid vehicles instead. This ability to use technology and the same materials to produce different goods allows developed nations to enjoy more stable demand, profits, and income.

However, there is a concern that increased trade with other nations might expose Erie to those nations' financial and economic problems. Baumohl (2008) explains why this should be a concern:

> One potential risk to America's growing dependence on global trade is that the U.S. economy is no longer immune to financial and economic disruptions abroad. Relatively

distant and seemingly modest events, such as the Asian financial meltdown of 1997…
can have a detrimental impact on U.S. stocks, bonds, and even the economy (241).

A fluctuating exchange rate is another cause of concern. Baumohl (2008) also explains that high inflation in the U.S. will make our goods more expensive in foreign markets and lead to a decrease in trade. However, the opposite is also true. An increase in inflation in foreign markets will make U.S. goods seem less expensive, therefore increasing exports while decreasing imports. In fact, anecdotal evidence says that Erie manufacturers are currently benefiting from the drop in the value of the dollar in the past year. Hocke (2008) from Work Boat magazine says that "Erie Shipbuilding LLC in Erie, PA., hired about 150 workers when it opened in 2005. The yard now has orders for eight oceangoing barges and is looking to add more workers." They continue to write that the weak dollar is helping GDP by "[energizing] industrialized America and [enabling] the exporting of things made in the United States." Martin (2008) from the *Erie Times News* reports much of the same. "GE Transportation spokesman Stephan Koller said that at a time when the U.S. rail market is off by more than 30 percent, the locally based division has been boosted by international sales and a diversified product line."

Graham and Wada (2000) disagree with the above mentioned concerns of Baumohl. Foreign direct investment (FDI) occurs when a foreign country builds a factory in a domestic country for business operations and, in a sense, allows for the same vulnerability as exporting alone. However, the authors found that countries with FDI were more stable than countries without and it seems as though more developing nations are seeking ways to attract FDI. It may be concluded that the stabilization benefits of foreign trade outweigh the risk of vulnerability to foreign crisis.

With that being said, this research will focus on updating that of Warner and Kurre (2000). Another business cycle has occurred since their research in 2000. After determining which countries have business cycles that are counter-cyclical to Erie's, the countries will be analyzed again to determine if they are counter-cyclical to Erie's exporting industries, as determined by the 12 supersectors. This will further help to determine which nations will be the most beneficial foreign trade partners for Erie.

III. Data

A. International Data

International real GDP data were taken from the Penn World tables, which are compiled at the University of Pennsylvania's Center for International Comparisons of Production, Income and Prices. There are data for 188 countries, which includes 20 more countries than the previous version of the tables.

The Penn World Tables employs a system in which the quality of data from each country is given a grade, A-D. Heston, et al. (2006) explains why this is important.

> "The basis…involved three factors: (1) the number of benchmark comparisons a country had entered; (2) its income level, because within benchmarks it has been found that the margin of error was greater for low income countries; and (3) for non-benchmark countries, the sensitivity of their estimates."

For this project, analysis will be performed only on countries whose data is grade C or higher. However, based on Warner's (2000) work, it is expected that the best trading partners for Erie will be low income countries, who most likely have a grade of D. If no stable trading partners are identified after the first analysis, those countries with a D grade will be analyzed. However, it is important to remember that these data will also be less reliable.

The original proposal for this research stated that cross-correlations would be used for analysis. However, after much consideration, it was determined that simple correlations will better help to answer the question that this project poses. Cross-correlations are done with models such as the Vector Autoregression estimates, which identify counter cyclical business patterns, as well as leads and lags, which will ultimately help to explain causality. This project asks whether or not counter cyclical patterns exist, not which country led or lagged at each turning point in the business cycle. For this reason, simple correlations will be used.

The following two graphs display the difference in using real GDP data versus using the percent change of real GDP data. The percent change of the data offers a clearer way to see each individual peak and trough, and for this reason, the percent change of the data will be used for correlations.

USA GDP Percent Change
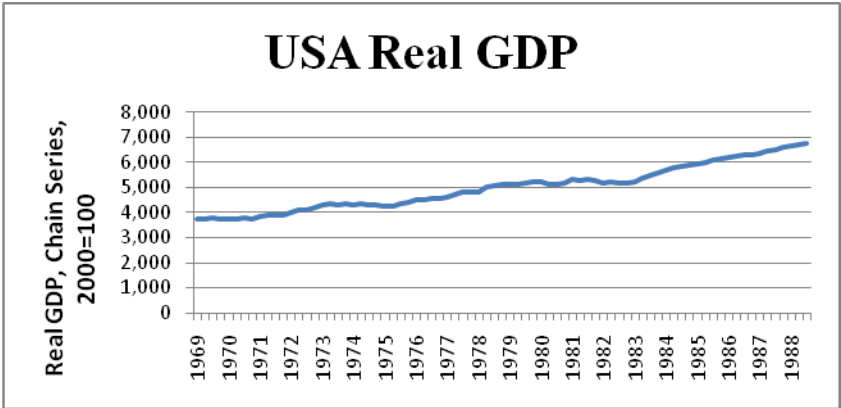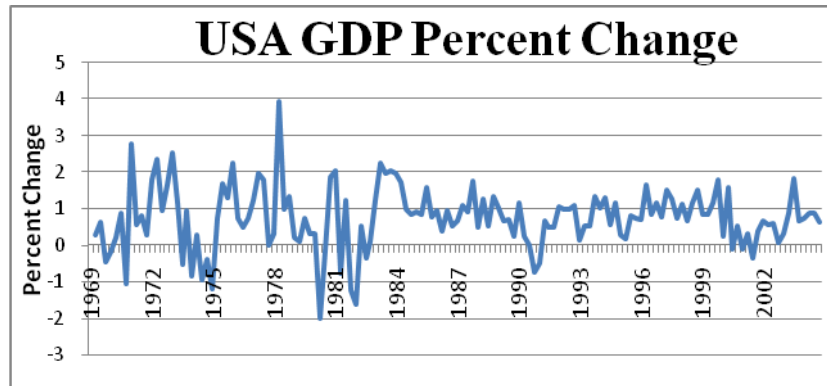
After counter cyclical business cycles are identified, the graphs will be viewed using the standard normal version of the percentage change data. The equation for converting percentage change into standard normal (z-scores) is as follows:

$$Z = (\text{Percentage Change} - \text{Mean}) / \text{Standard Deviation}$$

Z-scores make it easier to compare each foreign country's graph against Erie. Mason and Lind (1996) explain.

> Each distribution [or country] has a different mean or standard deviation. The number of normal distributions is therefore unlimited… Fortunately, one member of the family of normal distributions can be used for all problems where the normal distribution is applicable. It has a mean of 0 and a standard deviation of 1 and is called the standard normal distribution (258-259).

This means that converting the percentage change series to z-scores will make comparisons among different economies clearer. The first graph below shows the raw percentage change data, which puts Erie and the USA on the same axis, but still makes it relatively difficult to see the correlations of each expansion and contraction. The second graph, which shows standard normal values, converts each country's data so that it follows the normal distribution pattern. This makes it easier to view the co-movements in relation to each other.

7

Percentage Change

Standard Normal
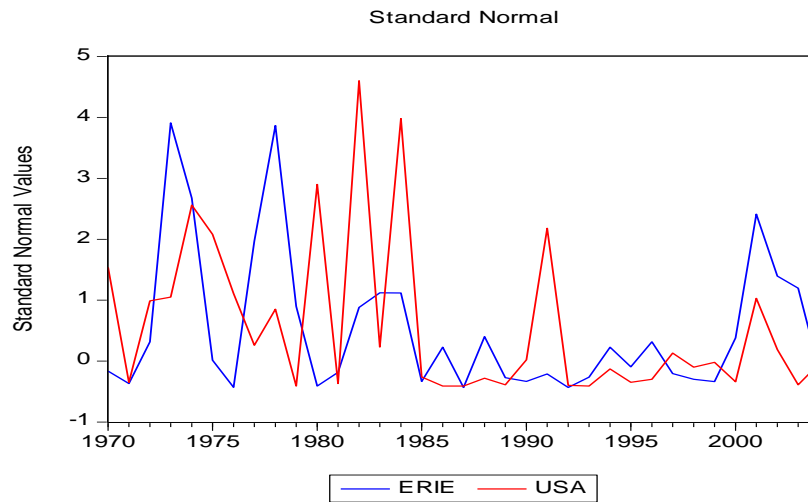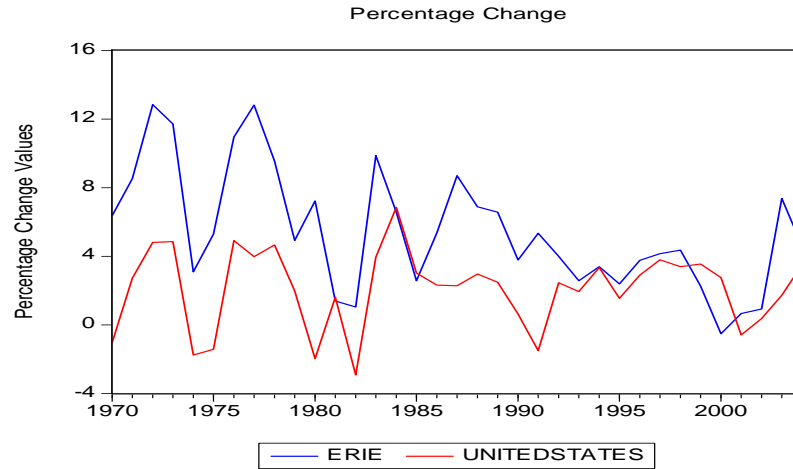
Some countries have data available for only one year, which makes it difficult and inaccurate to analyze. To find accurate results, it is best that there be more than one peak and trough in the business cycle of the country. For this reason, all countries with at least two business cycles will be used in the analysis. The table below shows each peak and trough for the US, as defined by the National Bureau of Economic Research, since 1969. The USA, which experienced two full business cycles between 1982 and 2004, will serve as a base, and therefore, each country with data from 1982 on will be used in analysis.

USA Real GDP Percent Change
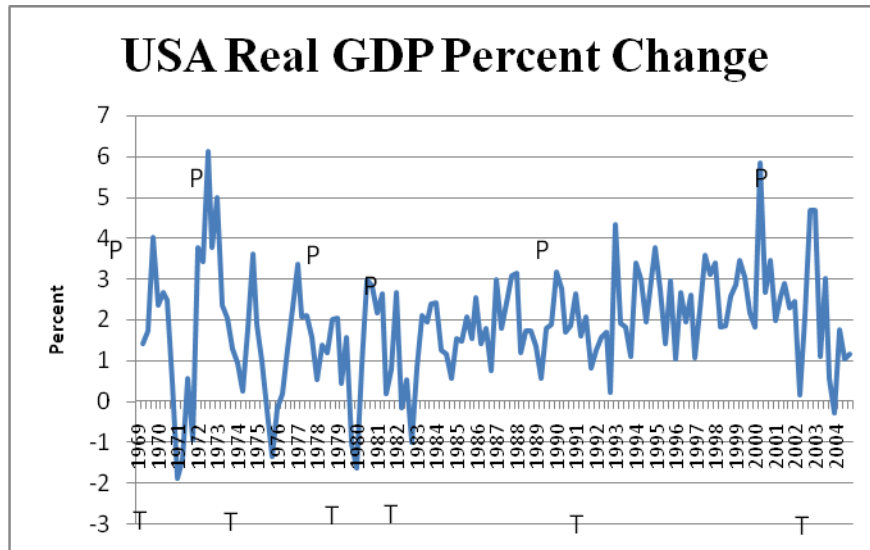
B. Erie Data

In order to compare Erie to each country, real GDP data should be used because those are the data available at the international level. However, these data are not available for Erie and a proxy must be identified. Earnings by place of work (EPW) and income data for Erie were both analyzed to determine which would be the better proxy for GDP data.

Gwartney (2006) defines real GDP as "the market value of all final goods and services produced within a country during a specific period" (515). After analyzing the BEA's definition of EPW and income, it was determined that EPW would be the closer match for a couple of reasons. First, GDP only includes production in the domestic economy, while income data includes personal dividends, which sometimes come from international corporations. Also, GDP accounts for transactions in which production occurs. One part of income is personal current transfer receipts, which are transfers in which no production occurs.

EPW data are available through the regional economic accounts at the Bureau of Economic Analysis's website. These data are nominal, while GDP data are expressed in real terms, making it necessary to convert the EPW data into real terms. Data expressed in real terms means that inflation has been accounted for and eliminated. In order to do this, price indices must be used. There are two widely used indices available, the consumer price index (CPI) and the GDP deflator. Gwartney (2006) explains that the CPI includes goods that the typical household buys, while the GDP deflator accounts for a broader range of goods, all of which are included in GDP.

Both indices were compared in a time series graph to observe whether or not they moved together and both had a prominent upward trend in the data. To better see each peak and trough,

that trend had to be removed. The following graph shows the annual percent change of the CPI and GDP deflator from 1929-2007. The correlation coefficient for CPI and GDP is .950032, which is a strong positive correlation, and implies that either data set would be a good choice. However, this project focuses on GDP comparisons, which makes the GDP deflator the better choice.
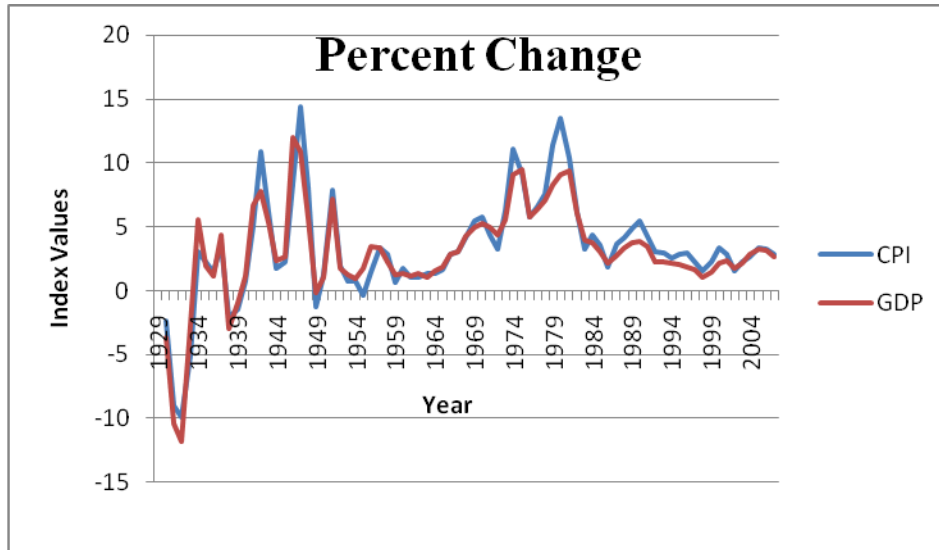
To convert EPW into real terms, the following equation was used. The year 2000 was used as the base year.

$$\text{Real GDP}_{\text{year x}} = \text{Nominal GDP}_{\text{year x}} * \frac{\text{GDP deflator}_{\text{base year y}}}{\text{GDP deflator}_{\text{year x}}}$$

C. Identifying Export Industries

By computing location quotients for each of the 12 supersectors, exporting industries can be identified.   The 12 supersectors as outlined by the Bureau of Labor Statistics include Construction, Education and Health Services, Financial Activities, Government, Information, Leisure and Hospitality, Manufacturing, Natural Resources and Mining, Other Services, Professional and Business Services, Transportation and Utilities, and Wholesale and Retail Trade. See Appendix 1 for detailed industries and sub industries of the 12 supersectors.

Location quotients were computed for earnings by place of work data. The following equation shows how a location quotient for manufacturing would be computed.

$$\text{Location Quotient} = \frac{\text{(Erie manufacturing earnings / Erie total earnings)}}{\text{(USA manufacturing earnings / USA total earnings)}}$$

Baer and Brown (2006) explain the importance of location quotients in determining exporting industries.

> "Following accepted economic theory, an LQ greater than 1.0 indicates that an area has proportionately more workers than the larger comparison area employed in a specific industry sector. This implies that an area is producing more of a product or service than is consumed by area residents. The excess is available for export."

From 1969-2000, the data were classified by using Standard Industrial Classification (SIC), which is simply a way of classifying data by industry. In 2001, the North American Industry Classification System (NAICS) replaced SIC as the leading classification system. The following table shows the location quotient averages for the years 1969-2006. Due to the change from SIC to NAICS, some of the industry titles have changed, but the data that are included remain the same.

Location Quotients: for Erie, PA			
SIC: 1969-2000		**NAICS: 2001-2006**	
Manufacturing	*1.612*	*Manufacturing*	*1.939*
Retail	0.840	*Health Care*	*1.536*
Construction	0.745	*Education*	*1.456*
Other	0.724	*Retail*	*1.133*
Transportation	0.658	*Other*	*1.116*
Finance and Insurance	0.546	Government	0.850
Government	0.541	Accommodation and Food	0.811
Wholesale Trade	0.540	Construction	0.746
Forestry	0.494	Finance and Insurance	0.738
Mining	0.169	Administrative	0.714
		Wholesale Trade	0.635
		Transportation	0.611
		Information	0.610
		Utilities	0.598
		Real Estate	0.581
		Arts and Entertainment	0.573
		Professional	0.395
		Management	0.324
		Forestry	0.276
		Mining	0.184

The location quotient technique identifies manufacturing, retail, education, health care, and other services as industries in which Erie specializes, making them available for export. The International Trade Administration confirmed manufacturing as Erie's largest exporting sector in their analysis of data on metropolitan exports by Top 5 Global NAICS codes.

Before analysis is conducted on all of the identified location quotients, it is important to remember what the definition of a location quotient is. A location quotient simply means that a given area, in this case Erie, is producing more goods or services than the people of that area would be expected to consume. This does not necessarily mean that the extra goods or services are being exported internationally; they may just be exported to a neighboring state or region. Because of this, it is important to look at each category closely to identify which sectors are most likely exporting internationally.

First is manufacturing. GE Transportation, a self-proclaimed global leader in rail, is located in Erie and specializes in the manufacturing of locomotives. Recently, GE Transportation won an award at the first Africa Rail Awards ceremony. A press release article on GE's website explains that "GE Transportation has a long history of providing innovative and advanced technologies to the rail industry throughout the world and has more than 15,000 locomotives running worldwide." Eriez Magnetics, which is headquarted in Erie, has branches in Canada, Europe, Australia, South Africa, Japan, India, China, and Mexico (Magnetic Link 2004). Therefore, manufacturing will be used in the exporting analysis.

Retail is the second supersector to be identified as an exporting industry. The category of retail simply includes the selling of merchandise, not the process of making it, which would be included in manufacturing. Therefore it is unlikely and rare that people from Mexico or Europe come to Erie to shop. However, some Canadians do their shopping in Erie, but this portion does not account for a significant number of sales. Because of Presque Isle and the new casino, Erie is a tourist attraction. Most of the exporting identified by the location quotient is probably accounted for by the people from surrounding areas, who come to enjoy the lake and other attractions. For these reasons, retail will not be included in the export analysis.

The same can be said for Education and Health Care. There are a small number of international students who come to Erie to attend college at nearby universities, but the majority of students are from Pittsburgh, Pennsylvania, New York, or Ohio. This is also the case with health care. Some people from nearby cities may travel to Erie to receive specialized cardio vascular care, but it is rare that any of these patients come from Europe or Asia.

Finally, Other services is a sector that includes general automobile care, computer and similar electronic repair, and personal care such as nail and hair salons. While someone may consider traveling to a nearby city for a great hair cut or excellent automobile repair service, it is unlikely

that the same person will travel across the border for that service. After following the above logic, it was determined that only manufacturing be used for determining exporting industries.

IV. Analysis

A. Africa

There are data available for 51 countries in Africa, but only 29 meet the criterion of a grade of C or higher for data quality, and at least two business cycles. Gabon, with $28,819 per person, has the highest level of GDP per capita in Africa. Gabon is only producing at 34% of the country with the highest GDP per capita worldwide, Qatar. Liberia[1] produces the lowest GDP per capita in Africa, $171, while the average is $2,564.

The following table shows the correlation coefficients for each country in Africa with Erie's earnings data. Botswana has the strongest negative correlation coefficient, -.3094. 48% of the countries in Africa are negatively correlated with Erie's business cycle.

Africa					
Country	**Coef.**	**Data Points**	**Country**	**Coef.**	**Data Points**
Botswana	-0.3094	35	Mauritius	0.0254	55
Morocco	-0.2886	54	Madagascar	0.0326	45
Siera Leonne	-0.2701	34	Kenya	0.0419	54
Congo Republic	-0.2168	44	Nigeria	0.0948	55
Ethiopia	-0.1873	54	Tunisia	0.0978	44
Cameroon	-0.1709	44	Mauritania	0.1051	34
Burundi	-0.1630	44	Egypt	0.1478	54
Zambia	-0.1565	49	Mali	0.1570	45
Malawi	-0.1371	51	Benin	0.1753	45
Rwanda	-0.1314	44	Gambia	0.1824	44
Tanzia	-0.1105	44	Gabon	0.2040	45
South Africa	-0.0783	55	Senegal	0.2199	44
Zimbabwe	-0.0621	50	Ghana	0.2267	49
Burkina	-0.0186	46	Swaziland	0.4720	35
Guinea	0.0006	46			

The following graph displays Botswana's GDP data against Erie's earnings data. The counter-cyclical patterns are especially evident between lines one and two. At line one, Erie is

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[1] Although Liberia is mentioned as having the lowest GDP per capita, it is not included in the correlation analysis because it received a grade of D.

increasing, while Botswana is simultaneously decreasing. This counter-cyclical pattern is one that will ultimately help to stabilize Erie's economy, if trade were to occur, by decreasing the overall volatility of both business cycles.
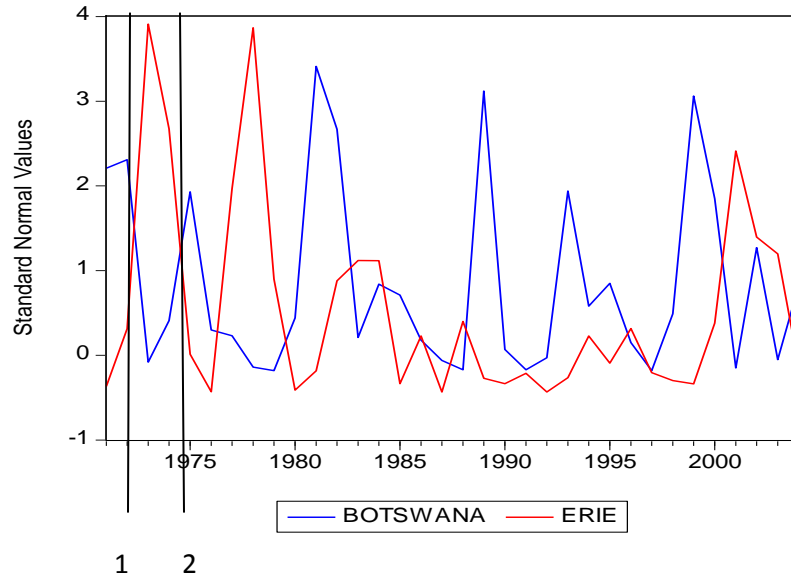
Swaziland, with a correlation coefficient of .4720, is a country in Africa that exemplifies a business cycle that is very similar to Erie's. It is evident that between lines one and two on the graph below, Swaziland and Erie are moving in the same direction, and in essence, trading with this country will not help to stabilize Erie's business cycle.
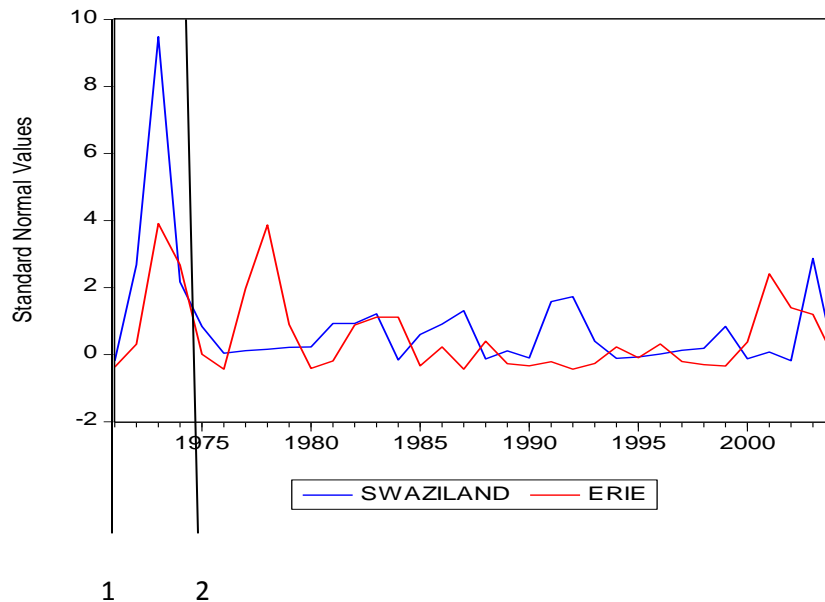
The following table shows the correlation coefficients for each country in Africa against Erie's exporting data. The "Identifying Export Industries" section above explains the logic for gathering Erie's manufacturing earnings. Most of the countries that showed negative correlations in the first analysis also showed negative correlations in the exporting analysis. However the total number of countries with negative correlations increased from 48% to 51%.

Africa				
Morocco	-0.3176		Zimbabwe	0.0041
Botswana	-0.2711		Ghana	0.0058
Siera Leonne	-0.2531		Gambia	0.0072
Burundi	-0.1871		Gabon	0.0174
Congo Republic	-0.1826		Mauritius	0.0356
Ethiopia	-0.1821		Tunisia	0.0421
Cameroon	-0.1788		Egypt	0.0548
Rwanda	-0.1777		Nigeria	0.0898
Zambia	-0.1300		Guinea	0.0962
Tanzia	-0.1233		Benin	0.1059
South Africa	-0.1079		Madagascar	0.1564
Malawi	-0.0328		Mali	0.1676
Mauritania	-0.0260		Senegal	0.3468
Burkina	-0.0126		Swaziland	0.3648
Kenya	-0.0034			

B. Asia

Of the 42 countries with available data in Asia, only 21 met the criteria. Qatar, the country with the highest GDP per capita is located on this continent, with GDP at $84,408. Qatar has a great deal of oil reserves and is located on the Persian Gulf, which allows for reduced transportation costs. The lowest GDP per capita is from Bhutan at $227, while the average in Asia is $7,703.

Kuwait has the strongest negative correlation with Erie's earnings data at -.2252. 52% of the countries in Asia are negatively correlated with Erie's economy.

Asia					
Country	**Coef.**	**Data Points**	**Country**	**Coef**	**Data Points**
Kuwait	-0.2252	34	Korea	0.0063	52
Malaysia	-0.1621	40	Sri Lanka	0.0376	54
Singapore	-0.1533	45	Indonesia	0.0709	45
Thailand	-0.1098	54	India	0.0949	54
Iran	-0.1075	40	Oman	0.1096	34
Qatar	-0.1035	34	Syria	0.1566	44
Japan	-0.0533	55	Philippines	0.1764	55
Nepal	-0.0439	44	Jordan	0.2002	50
Pakistan	-0.0143	55	Bangladesh	0.2605	55
China	-0.0126	53	Bahrain	0.3193	34
Turkey	-0.0013	55			

The following table lists each correlation coefficient in Asia against Erie's manufacturing data. The correlations for both earnings data and exporting data yielded the same number of negative and positive correlations.

Asia			
Kuwait	-0.1949	Pakistan	0.0078
Thailand	-0.1763	Syria	0.0374
Korea	-0.1479	Oman	0.0457
Iran	-0.1185	India	0.0832
Jordan	-0.1116	Turkey	0.2015
Qatar	-0.0706	Japan	0.2214
Indonesia	-0.0564	Singapore	0.3398
Malaysia	-0.0352	Sri Lanka	0.3408
Nepal	-0.0304	Bahrain	0.3729
Philippines	-0.0279	Bangladesh	0.4576
China	-0.0255		

C. Europe

In Europe, 21 countries out of the 40 countries meet this research's data requirements. The country with the second highest GDP per capita worldwide is Luxembourg, which is producing at 60% of Qatar. Bosnia and Herzegovina[2] produces the lowest GDP per capita in Europe, $846, while the average is $10,797.

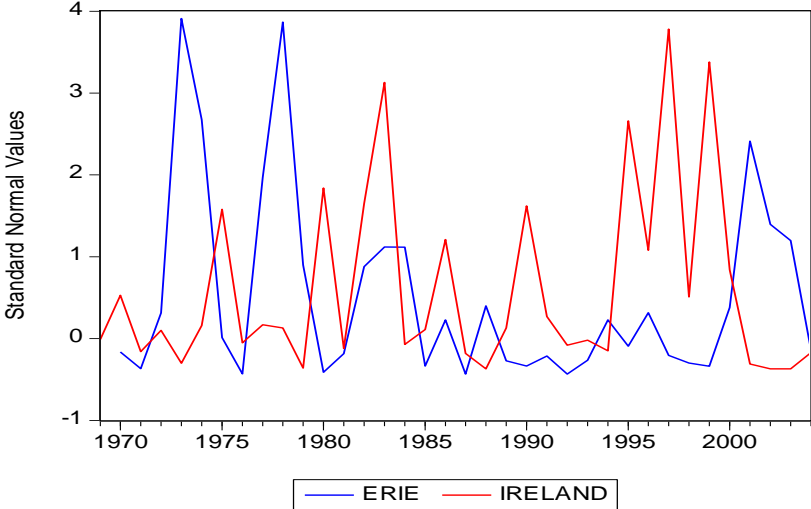The following table shows the correlation coefficients for the countries in Europe against Erie's earnings data. Ireland had the strongest negative correlation with a coefficient of -.2452, while

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[2] Although Bosnia and Herzegovina is mentioned as having lowest GDP per capita in Europe, they were not included in the correlation analysis because there were not enough data points available.

Greece had the strongest positive correlation with a coefficient of .2796. 55% of the countries in Europe are negatively correlated with Erie's earnings data.

Europe						
Country	Coef.	Data Points		Country	Coef.	Data Points
Ireland	-0.2452	55		Iceland	-0.0247	55
Finland	-0.2315	55		Belgium	0.0438	55
Sweden	-0.1521	55		Germany	0.0486	35
Switzerland	-0.1329	55		Italy	0.0829	55
Luxembourg	-0.1136	55		Romania	0.1057	45
Denmark	-0.1061	55		Portugal	0.1441	55
Netherlands	-0.0930	55		Spain	0.2387	55
France	-0.0698	55		United Kingdom	0.2443	55
Poland	-0.0497	35		Austria	0.2540	55
Hungary	-0.0463	35		Greece	0.2796	54

The following graph shows the negatively correlated business cycles of Erie and Ireland. Notice that the two economies often move in opposite directions.

The following table shows the correlation coefficients of each country in Europe against Erie's exporting data. As with Asia, the number of countries with negative and positive correlations coefficients remained the same in both analyses.

| Europe				
Ireland	-0.2580		Denmark	-0.0335
Finland	-0.2428		Belgium	0.0467
Sweden	-0.1891		Austria	0.0540
Switzerland	-0.1220		Italy	0.0593
Hungary	-0.1088		Iceland	0.0615
Luxembourg	-0.0986		Spain	0.0656
France	-0.0839		Germany	0.0669
Poland	-0.0736		Portugal	0.0867
Romania	-0.0665		United Kingdom	0.1294
Netherlands	-0.0353		Greece	0.3219

D. North America

The countries of Central America will be included in North America's analysis. North America has data available for 23 countries, 20 of which meet the criteria to be analyzed. This is the highest percent of countries on one continent that meet the requirements. The United States produces the highest GDP per capita in this region, performing at 43% of Qatar. The country with the lowest GDP per capita in North America is Honduras with produces $1,526 per person, while the average GDP per capita is $7,046. Only 35% of the countries in North America are negatively correlated with Erie's business cycle.

The following table shows the correlation coefficients for the countries of North America. Jamaica exhibits the strongest negative correlation with a coefficient of -.2608, while the United States has the strongest positive correlation coefficient of .2492, which is unsurprising.

North America						
Country	Coef.	Data Points		Country	Coef.	Data Points
Jamaica	-0.2608	51		St. Kitts	0.0318	34
Dominican	-0.1853	53		Guatemala	0.0420	54
Grenada	-0.1649	34		Mexico	0.0498	55
Barbados	-0.0855	45		Belize	0.1205	35
Nicaragua	-0.0604	55		Honduras	0.1482	55
Canada	-0.0230	55		St. Lucia	0.1750	34
Costa Rica	0.0166	55		Bahamas	0.2144	35
Dominica	0.0191	34		United States	0.2492	55
Antigua	0.0309	34				

The following graph shows the positively correlated business cycle of Erie and the United States. There are several points on the graph in which the two data series move in the same direction. This is expected because Erie is located in the United States and is more likely to experience a similar business cycle.
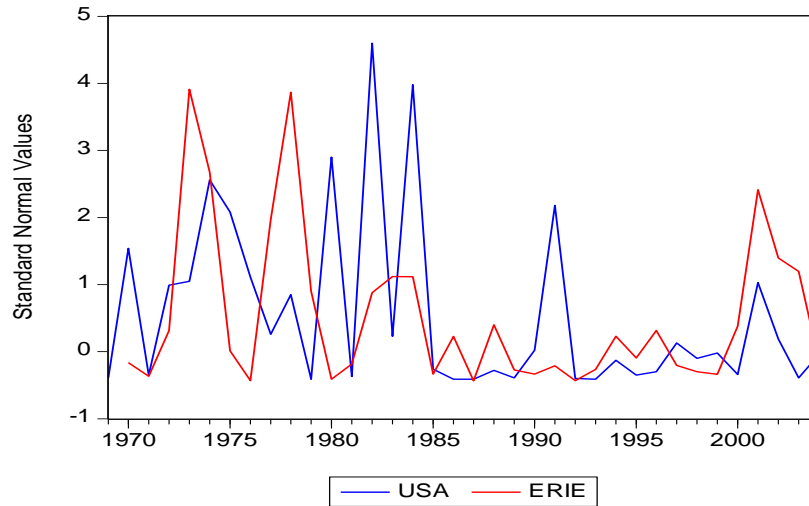
The correlation coefficients for Erie's exporting data are displayed below. The number of countries negatively correlated with Erie increased from 35% to 47%, however, it is important to note that several of the countries in North America have coefficients that are close to zero. This means that there is little to no correlation.

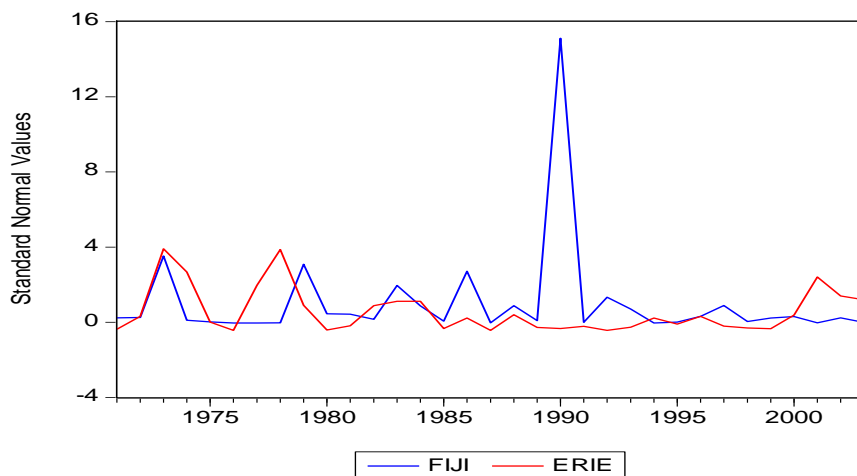| North America			
Jamaica	-0.2065	Guatemala	0.0269
Grenada	-0.1411	Costa Rica	0.0534
Dominican Republic	-0.1329	Antigua	0.0617
Belize	-0.094	Dominica	0.1082
Canada	-0.0797	St. Lucia	0.1377
Nicaragua	-0.0738	Bahamas	0.1533
St. Kitts	-0.0487	Honduras	0.1578
Barbados	-0.0434	United States	0.2121
Mexico	0.0156		

E. Oceania

Of the 11 countries with data available, only 3 will be analyzed. It was the first time that many of these countries were analyzed in the Penn World Tables, which is why tthere was no grade available. Australia was the country with the highest GDP per capita in this region, producing at

33% of Qatar. Tongo produces the lowest GDP per capita in Oceania, $990, while the average is $5,853.

Only one country in Oceania is negatively correlated with Erie's business cycle. Fiji has a correlation coefficient of -.0399, which is very close to zero. The graph directly below the coefficient table shows the patterns of Erie and Fiji. It's evident that there is no strong correlation throughout the time series.

Oceania		
Country	**Coef.**	**Data Points**
Fiji	-0.0399	34
Australia	0.1734	55
New Zealand	0.2723	55

F. South America

Nine countries will be analyzed in South America from a total of 12. Chile has the highest GDP per capita on this continent, performing at 15% of Qatar. The average GDP per capita is $5,255 while the lowest is Brazil at $1,802.

Only 30% of the countries in South America are negatively correlated with Erie's earnings data, and none have a strong correlation. Argentina's coefficient is -.0936, which is fairly close to zero. Ecuador has a very strong positive correlation coefficient of .4569. The graph below the coefficient table shows the strong positive correlation between Erie and Ecuador.

South America						
Country	**Coef.**	**Data Points**		**Country**	**Coef.**	**Data Points**
Argentina	-0.0936	55		Trinidad	0.1007	54
Peru	-0.0389	54		Bolivia	0.1144	54
Venezuela	-0.0118	55		Paraguay	0.3368	53
Brazil	0.0417	54		Columbia	0.449	54
Chile	0.0517	54		Ecuador	0.4569	54
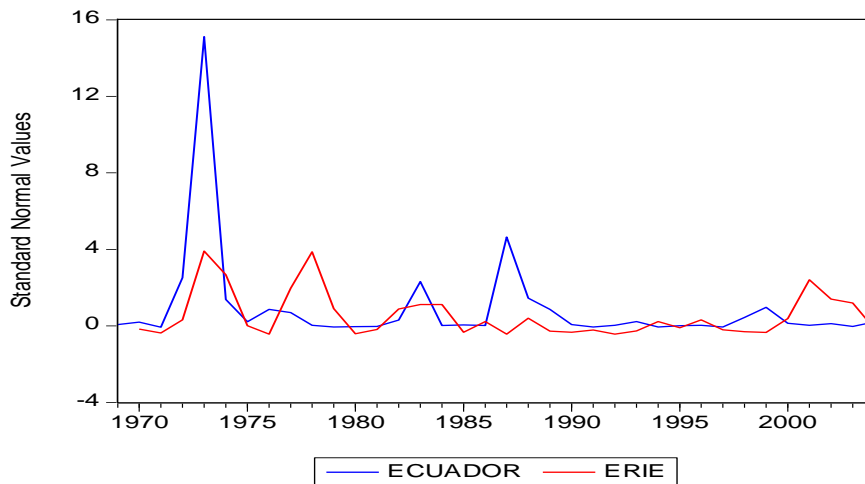
The following table displays the correlation coefficients of the countries of South America with Erie's manufacturing data. There were no significant negative correlations.

South America			
Peru	-0.0769	Bolivia	0.1080
Chile	-0.0147	Paraguay	0.1586
Argentina	-0.0020	Trinidad	0.1924
Brazil	0.0634	Columbia	0.2102
Venezuela	0.0772	Ecuador	0.3021

V. Conclusion

A. Continent Analysis

This project's main goal was to identify foreign trading partners whose business cycles were counter-cyclical to Erie's exporting sector. The following tables display the number of countries from each continent that exhibit significant (greater than .1 in absolute value) correlation coefficients with Erie's exporting/manufacturing sector.

Africa: exporting data	
# of Negative Correlations	15
# of Positive Correlations	14
Strongest Negative	-0.3176
Strongest Positive	0.3648

With 15 negative correlations, Africa has the most negatively correlated countries (46%) with Erie's manufacturing sector. This was expected since Warner (2000) found that developing nations are often negatively correlated with G7 nations, and most developing countries are located on this continent.

Asia: exporting data	
# of Negative Correlations	11
# of Positive Correlations	10
Strongest Negative	-0.1949
Strongest Positive	0.4576

Asia has second highest number of countries negatively correlated with Erie's manufacturing sector, tying with Europe. It is important to note that the strongest negative correlation in Asia is barely statistically significant, while the strongest positive correlation is the strongest of any country, worldwide. This implies that Erie's economy closely follows the cyclical pattern of most Asian countries and an increase in trade with Asian countries would not be beneficial to Erie's stabilization.

Europe: exporting data	
# of Negative Correlations	11
# of Positive Correlations	9
Strongest Negative	-0.2580
Strongest Positive	0.3219

As stated previously, Europe has the second highest number of negatively correlated countries to Erie's manufacturing sector, tying with Asia. Europe is a continent full of thriving developed nations, such as Ireland, Sweden, Finland, and Switzerland. This provides a great opportunity for trade and economic stabilization for Erie's economy. A more in depth look into the trading history of Ireland and the United States is provided below in the Country Analysis Section.

North America: exporting data	
# of Negative Correlations	8
# of Positive Correlations	9
Strongest Negative	-0.2065
Strongest Positive	0.2121

North America had roughly the same number of positively and negatively correlated countries. This may be expected since some of these countries (Mexico and other countries who trade with Mexico) are able to participate in the North American Free Trade Agreement with the United States, and therefore, Erie. Free trade agreements help to eliminate trade barriers and, in turn, increase the amount of trade.

South America: exporting data	
# of Negative Correlations	3
# of Positive Correlations	7
Strongest Negative	-0.0769
Strongest Positive	0.3021

South America has the least amount of negatively correlated countries of all regions, other than Oceania which had none. Although this region failed to have any statistically significant negative correlations to Erie's manufacturing sector, the positive correlations are significant. This implies that it would not be beneficial, at least for stability purposes, Erie to trade with South American countries since it is likely they are experiencing similar business cycles.

B. Country Analysis

The following table lists the countries, along with their coefficients, that exhibited a negative correlation to Erie's manufacturing sector. [Offered below the table is a look into the top three countries, by trading industries, to identify whether or not Erie's economy could actually benefit by trading.] Considering only the countries that exhibited significant correlation coefficients, 25 were negatively correlated, while 24 were positively correlated. It is interesting to note that

when all coefficients are considered, 48 are negatively correlated, while 49 have positive coefficients. (A more in depth look into the top three countries, Morocco, Botswana, and Ireland, is provided below).

11 of the 14 negatively correlated countries in Africa are statistically significant. This result is somewhat expected since a majority of the world's developing nations are located in Africa. The few negatively correlated countries in North America are all developing nations. In Europe, there are a few countries that may prove to be good trading partners for Erie. These include Ireland, Finland, Sweden, and Switzerland. Each of these countries are developed and are likely to produce and consume similar goods to that of Erie.

Continent	Country	Coefficient
Africa	Morocco	-0.3176
Africa	Botswana	-0.2711
Europe	Ireland	-0.258
Africa	Siera Leonne	-0.2531
Europe	Finland	-0.2428
N. America	Jamaica	-0.2065
Asia	Kuwait	-0.1949
Europe	Sweden	-0.1891
Africa	Burundi	-0.1871
Africa	Congo Republic	-0.1826
Africa	Ethiopia	-0.1821
Africa	Cameroon	-0.1788
Africa	Rwanda	-0.1777
Asia	Thailand	-0.1763
Asia	Korea	-0.1479
N. America	Grenada	-0.1411
N. America	Dominican Republic	-0.1329
Africa	Zambia	-0.1300
Africa	Tanzia	-0.1233
Europe	Switzerland	-0.1220
Asia	Iran	-0.1185
Asia	Jordan	-0.1116
Europe	Hungary	-0.1088
Africa	South Africa	-0.1079
Descriptive Statistics for All Countries		
Average overall	0.0116	
Average of negatives	-0.1126	
Average of positives	0.1333	
Maximun	0.4576	
Minimum	-0.3176	

Morocco, the country that exhibits the most counter-cyclical pattern to Erie, is located in Africa. The United States and Morocco Free Trade Agreement states that "The five largest import categories in 2006 [from Morocco] were: Electrical Machinery, Salt, Sulfur, Earth and Stone (calcium phosphates, Woven Apparel, Preserved Foods [i.e. olives]" (United States-Morocco Free Trade Agreement 2006).   Alternatively, the top U.S. exporting categories to Morocco in 2006 were aircraft, spacecraft, cereals, machinery, and grain, seed, and fruit. Currently, the closest city importing goods from Morocco is Cleveland, Ohio, while Philadelphia, Pennsylvania is the only importer in PA (United States – Morocco Free Trade Agreement 2006).

All of this trade is made possible by the U.S.-Moroccan Free Trade Agreement (FTA), which "is expected to be the most comprehensive FTA that the U.S. has every negotiated" (United States – Morocco Free Trade Agreement 2004). This agreement will result in more foreign direct investment from the United States into Morocco, as well as increase the amount of agricultural exports to the U.S. The FTA also hopes to improve literacy and education rates for young Moroccans, while providing more jobs (Central Intelligence Agency 2008). The free trade agreement is expected to help improve the standard of living in Morocco. It will surely take a great deal of time for Morocco to become a thriving, self-supporting nation. However, the increase in trade will likely lead to an increase in foreign direct investment and better technology. Ultimately, it is possible for Morocco to begin experiencing a more positively correlated business cycle to Erie's, but for now, trading with Morocco would help stabilize Erie's economy.

The second most counter-cyclical economy to Erie's is Botswana, also located in Africa. Botswana meets the requirements of the African Growth Opportunity Act, which means that "Botswana traders can export to USA under benefit of preferential treatment on customs duty and quotas until 2015. Products that can be traded under this scheme are both non-textile and textile products" (BEDIA 2008). Botswana currently exports "textile, polishing of diamonds and semi-precious stones, leather goods … and glass products" (BEDIA 2008). Diamond mining is a major exporting sector of Botswana and contributes a great deal to the country's GDP (70%). Since 1966, Botswana has maintained one of the fastest growing GDP rates in the world, transforming itself from poverty to a middle-income country. This is mostly due to diamond mining and the fact that two major investment banks of Africa are located in Botswana. However, Botswana is plagued with the second highest amount of AIDS infections of one country, worldwide (Central Intelligence Agency 2008). Erie does not have a thriving jewelry sector and it is likely that trade with Botswana would be unbeneficial for Erie's stabilization.

The third most counter-cyclical country to Erie's exporting data, and potentially the country who could benefit Erie the most, is Ireland which is located in Europe. "The range of U.S. exports includes electrical components and equipment, computers and peripherals, drugs and pharmaceuticals, and livestock feed. Exports to the United States include alcoholic beverages,

chemicals and related products, electronic data processing equipment, electrical machinery, textiles and clothing, and glassware". 11% of Ireland's trade is done with the United States (Background Note: Ireland 2008).

Since 2008, the United States has been running a trade deficit with Ireland. The following graph shows how this deficit has been increasing gradually.

Trade Deficit: U.S.-Ireland
in millions of USD
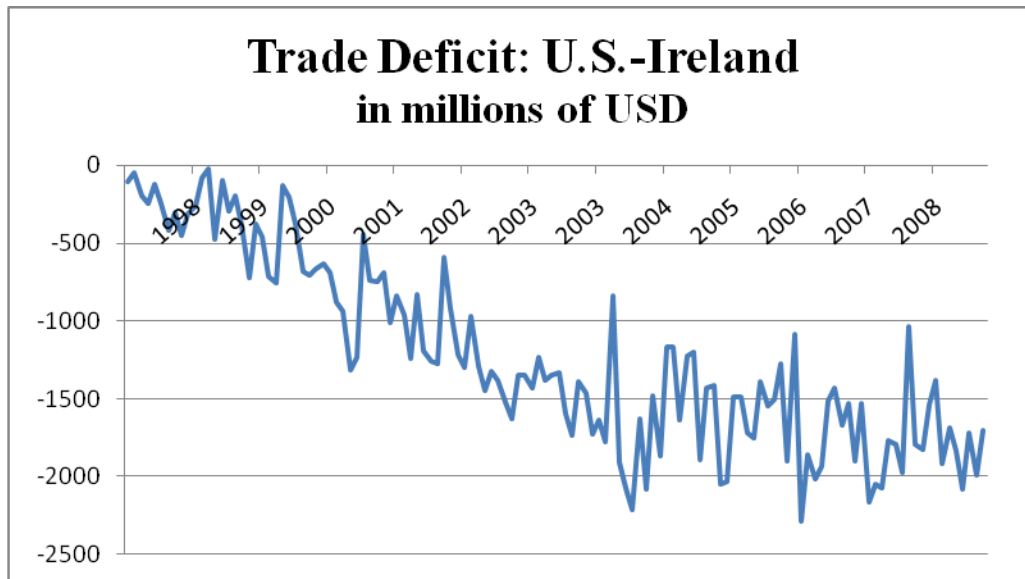
Source: The Census Bureau 2008

Shelton (2007) explains why having a trade deficit is not necessarily something to worry about.

> "One reason some economists worry about the deficit is America's low rate of savings compared to the rest of the world. To make up for the lack of savings, Americans and their government have to borrow from other countries in order to buy consumer goods and make investments. This manifests itself in a trade deficit. But whether U.S. investors are borrowing from the rest of the world to invest here or the rest of the world is investing here directly … the result is good for the American economy. Though such investment shows up as a trade deficit … it actually demonstrates economic strength. [Rodríguez-Clare says] 'Countries with stable economies and good rates of growth, like the United States, will naturally attract investment from the rest of the world'" (Shelton 2007).

Swaziland, Bangladesh, and Ecuador, with correlation coefficients of .4720, .4576, and .4569, respectively, were the only countries with exceptionally significant coefficients, none of which were negative. This trend in the results, along with no very significant negative coefficients, can possibly be attributed to globalization and the fact that individual economies are merging through trade. This suggests that the idea of globalization and one world market may be on its

way to becoming a reality, which would mean that the entire world would experience recessions and periods of growth at the same time. At this point, it can not be determined if that would be a beneficial or detrimental actuality.

The results of the correlations between Erie's total earnings data and Erie's manufacturing data had minimal variations. Most of the continents showed the same number of positive and negative correlations between both analyses. This suggests that it would be viable to use either data set. Furthermore, it may imply that the exporting data is strongly correlated to earnings or GDP data, on average.

In the future, researchers could use these results to identify leads and lags in the data sets. Cross-correlations will identify these types of patterns, which help to predict when Erie will be entering or exiting a growth period. With that type of information, Erie could prepare for a downturn in the business cycle which would further help to smooth the cyclical volatility.

It would also be beneficial if GDP data at the metropolitan level existed. The Bureau of Economic Analysis is making progress on finding a way to measure this type of data and that type of knowledge would be helpful for further work on this topic of study.

Appendix 1

The following table, taken from the Bureau of Labor Statistics (2007), shows the industries and sub industries included in the supersectors.

	NAICS Industries and sub industries
NAICS	**Forestry, fishing, related activities, and other \7**
111	Crop Production
112	Animal Production
113	Forestry and Logging
114	Fishing, Hunting and Trapping
	Support Activities for Agriculture and Fishery NAICS 115
	Mining
211	Oil and Gas Extraction
212	Mining (except Oil and Gas)
213	Support Activities for Mining
	Construction
236	Construction of Buildings
237	Heavy and Civil Engineering Construction
238	Specialty Trade Contractors
	Manufacturing
311	Food Manufacturing
312	Beverage and Tobacco Product Manufacturing
313	Textile Mills
314	Textile Product Mills
315	Apparel Manufacturing
316	Leather and Allied Product Manufacturing
321	Wood Product Manufacturing
322	Paper Manufacturing
323	Printing and Related Support Activities
324	Petroleum and Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing

334	Computer and Electronic Product Manufacturing
335	Electrical Equipment, Appliance, and Component Manufacturing
336	Transportation Equipment Manufacturing
337	Furniture and Related Product Manufacturing
339	Miscellaneous Manufacturing
	Retail trade
441	Motor Vehicle and Parts Dealers
442	Furniture and Home Furnishings Stores
443	Electronics and Appliance Stores
444	Building Material and Garden Equipment and Supplies Dealers
445	Food and Beverage Stores
446	Health and Personal Care Stores
447	Gasoline Stations
448	Clothing and Clothing Accessories Stores
451	Sporting Goods, Hobby, Book, and Music Stores
452	General Merchandise Stores
453	Miscellaneous Store Retailers
454	Nonstore Retailers
423	Merchant Wholesalers, Durable Goods
424	Merchant Wholesalers, Nondurable Goods
425	Wholesale Electronic Markets and Agents and Brokers
481	Air Transportation
482	Rail Transportation
483	Water Transportation
484	Truck Transportation
485	Transit and Ground Passenger Transportation
486	Pipeline Transportation
487	Scenic and Sightseeing Transportation
488	Support Activities for Transportation
	Utilities
	Information
511	Publishing Industries (except Internet)
512	Motion Picture and Sound Recording Industries
515	Broadcasting (except Internet)
517	Telecommunications
518	Data Processing, Hosting, and Related Services
519	Other Information Services

		Finance and insurance
521		Monetary Authorities - Central Bank
522		Credit Intermediation and Related Activities
523		Securities, Commodity Contracts, and Other Financial Investments and Related Activities
524		Insurance Carriers and Related Activities
525		Funds, Trusts, and Other Financial Vehicles
		Real estate and rental and leasing
531		Real Estate
532		Rental and Leasing Services
533		Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
		Professional and technical services
54		Professional, Scientific, and Technical Services
55		Management of Companies and Enterprises
56		Administrative and Support and Waste Management and Remediation Services
		Educational services
61		Educational Services
		Health care and social assistance
621		Ambulatory Health Care Services
622		Hospitals
623		Nursing and Residential Care Facilities
624		Social Assistance
		Arts, entertainment, and recreation
711		Performing Arts, Spectator Sports, and Related Industries
712		Museums, Historical Sites, and Similar Institutions
713		Amusement, Gambling, and Recreation Industries
		Accommodation and food services
721		Accommodation
722		Food Services and Drinking Places
		Other services, except public administration
811		Repair and Maintenance
812		Personal and Laundry Services
813		Religious, Grantmaking, Civic, Professional, and Similar Organizations
814		Private Households
		Government and government enterprises

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