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Maritime Exposure and Economic Prosperity: Why Location Matters

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By

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Abstract

Maritime trade and access to deep water territory are important when determining a country's economic success. Today, as much as 75% percent of trade is done over water. This thesis examines issues in economic geography such as the landlocked curse, resource curse, maritime port dependency, import and export competition, and trade openness, and attempts to explain the importance of maritime exposure. This study explores the relationship between six major factors in maritime exposure and overall economic prosperity. Findings suggest a positive correlation between maritime exposure and Gross Domestic Product (purchasing power parity and per capita). Interestingly, findings also show a negative relationship between maritime exposure and the United Nations Human Development Index rank score.

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Preface

I spent my first year after my undergraduate studies working at an educational center in the middle of the country far from any large settlement of people. This gave me the opportunity to discover new academic interests and explore new possibilities. Shortly after I concluded my work at this educational center, I took my first professional education position as an eighth grade world history teacher. The next year I worked as a ninth and tenth grade history teacher as well. Throughout this experience I became interested in the study of international trade, specifically maritime trade. I finally decided to attend graduate school and pursue a career in geography. Geospatial science has always been of great interest to me, especially throughout my teaching experience.

I joined the Geospatial Science Graduate Program at the University of North Alabama at the beginning of the spring semester in 2013. Early that semester, students were required to produce a research topic that would later become the subject of their thesis. I had always been intrigued about geopolitics and historical maritime travel, but I had not thought too deeply on a research topic. I went to sleep one evening frustrated and confused. As I laid my head on the pillow, I imagined that I was traveling the world on a masted schooner. I recalled reading articles on the maritime shipping industry and an idea came to me; how does location to water affect prosperity? This began my journey to discover the relationship between maritime exposure and prosperity.

Chapter 1

INTRODUCTION

Throughout history, civilizations have struggled over the control of resources, land, and water. One factor that continues to appear as a prominent driver of economic competition and prosperity is access to water. Proximity to water presents an intriguing concern for countries around the world, especially when considering the average cost of transportation and the total amount of trade that takes place over international waterways (Heiberg, 2012). Even with a technologically advancing society, ocean freighters are still the most fuel efficient and cost effective. Freight ships can also carry substantially more cargo that the average cargo plane, freighter truck, and railroad freighter (Maritime Statistics, 2015). So how important is "maritime exposure" to the economic success of a given country? Is there a relationship between the geographic aspects of "maritime exposure" and economic growth and prosperity? This thesis will provide some answers to these compelling questions.

The ability to trade goods and services can help promote economic growth and prosperity. This study assesses the relationship between "maritime exposure" and economic prosperity. "Maritime exposure" is defined as the ability of a given country to participate in maritime trade. This includes access to water and trade dependency. By comparing "maritime exposure" to economic prosperity, I will be able to determine if there is a relationship between the variables.

Prosperity is defined in many different ways. Western countries often define the success of a given country by its economic numbers. Gross Domestic Product (GDP) is a standard form of measuring economic well-being around the world. This is defined as the true value of goods and services produced in a country in a given year. Purchasing Power Parity transforms these numbers by considering the effects of living cost and inflation rates. This makes it much easier to compare different countries to one another. GDP PPP per capita averages the total GDP PPP per person within a given country's population. This may be the standard measurement of prosperity throughout the western world; however, many nations define prosperity in very different ways. The United Nations has developed an index that includes such factors as life expectancy,

educational attainment, and Gross National Income PPP per capita. This is an effective means-tested variable that is useful in determining overall prosperity in any country around the world (Kelley, 1991).

Maritime ports have an important role in creating long-term growth. The growth of economic prosperity due to geographic proximity can be attributed to and multiplied with effective free market trading strategies, the application of international trading standards, the creation of an advanced telecommunication system, and efficient and spacious ports. The World Bank found that there was a positive correlation between an efficient port system and economic growth (Barnes and Oloruntoba, 2005). With an increase in the number of high efficiency ports within coastal countries there will be an increase in economic growth.

Two important measurements for determining the ability of a country to participate in maritime trade are coastline length and coast/area ratio. A country with a long coastline length might likely benefit from international trade because of its ability to gain water access. More coastline can provide more area to build efficient and secure ports. How important is access to shorelines? Coast/area ratio compares the length of coastline to the total area of land. As an example, a country like the Federated States of Micronesia has a high coast/area ratio because it has a long coastline but a very small area of land. Canada has the longest coastline length in the world, however, it has a small coast/area ratio because its total landmass dwarfs its total coastline length.

In order to determine if a relationship exists between maritime trade and a given economy, it is important to review how much cargo is transported in and out of a country's ports (Figures 1.1 and 1.2). As dependency on foreign goods and services increases, so increases the need for an efficient merchant fleet. However, variables such as population size and population growth may also affect the overall increase in shipped goods. It is important to consider to what extent a country depends on trade for economic success. If a country depends heavily on trade in order for its economy to see any growth, it will be important for this country to have unimpeded access to shipping lanes.

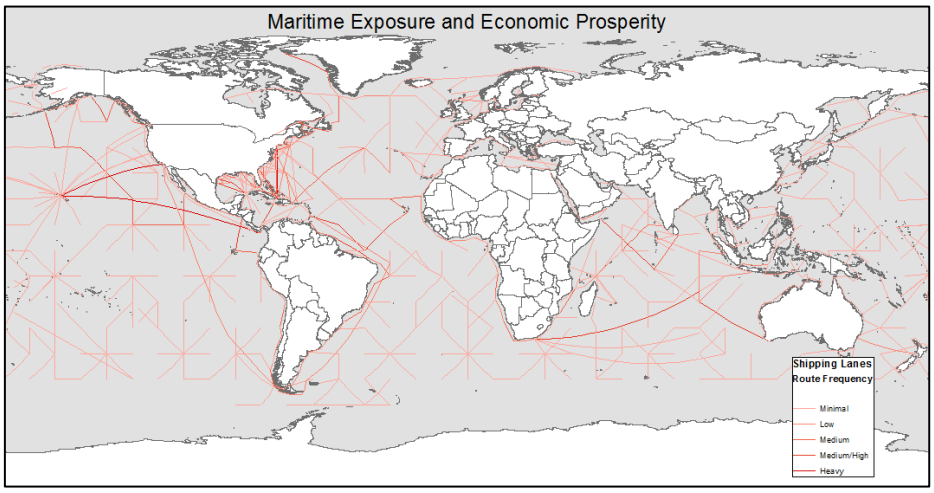

Figure 1.1 *Global shipping lanes and merchant fleet route frequency*

With recent conflicts in around the world such as the Russian annexation of Crimea, Palestinian and Israeli conflict over control of the Gaza Strip, and the conflict between Peru and Chile over EEZ control, the importance of coastal access makes headlines around the world. Technology has also helped spur growth in developing island countries allowing access to goods and services historically difficult to attain. The variable that continues to show up in these examples is maritime exposure.

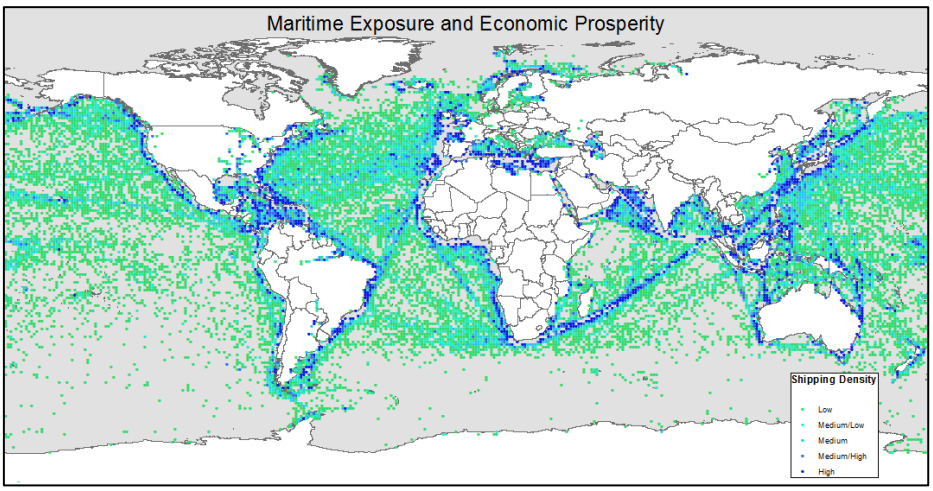

Figure 1.2 *Global merchant fleet density*

Maritime trade has become increasingly important to the survival of the economic system. Today, as much as 75% of worldwide trade is done over water (Heiberg, 2012). This number alone shows the profound importance that maritime exposure has on the value of international trade. Transportation costs greatly affect the ability of a country to participate in trade. This is one reason why many landlocked countries find it difficult to send and receive foreign goods. According to the Department of Transportation's Maritime Statistics (2015), the average freight ship burns one gallon of fuel for every 514 miles traveled. Compared to 202 miles per gallon for trains and 59 miles per gallon for freight trucks, this statistic alone shows just how important shipping costs are to maritime countries.

In a different report, the U.S. Energy Information Administration compared average fuel consumption between domestic waterborne freight, air freight, class 1 railroads, and heavy trucks and found that domestic freight ships consume as little 160 kilojoules (kJ) per ton kilometer (km) compared to 209 kJ per ton km for rail, 2,426 kJ per ton km for heavy trucks, and 6,900 kJ per ton kilometer for air freight (Consumption & Efficiency,

2010). These statistics show the magnitude of maritime shipping within a globalized world and provide a reasoning for providing quality access to maritime shores. As energy consumption and transportation cost is concerned, maritime shipping is the cheapest form of transportation.

The culmination of the above mentioned factors provides insight on the ability of a country to participate in maritime trade. These factors also represent the interconnection and interdependency of countries around the world. The evaluation of maritime exposure may help provide some clues and insight on future development and growth patterns. The next step in the systematic research of maritime trade will be to create a multiple regression analysis explaining any relationship that may exist between maritime exposure and economic prosperity. The multiple regression model sets will be analyzed in a stepwise fashion in order to find the best fit model that explains maritime exposure in the most efficient and effective manner. These model sets will be compared and the results will show if any relationship exists between the factors included and which model best explains the relationship that exists between maritime exposure and prosperity.

Chapter 2

LITERATURE REVIEW

How does trade effect the overall success of a given group of people? This is a question that has intrigued scholars throughout history. Some scholars have looked at this relationship from an economic perspective but others have explored these studies in geospatial terms. Some of the literature attempts to research concepts in broad terms while others break down these concepts into valuable case studies. Research within this field has provided valuable information on economic geography and maritime trade. Much of the literature discusses the effects of being landlocked, the resource curse, how maritime trade has evolved, the importance of exports and imports, economic growth theories, trade openness, and economic geography.

Landlocked Countries

Many scholars have studied the effects of being landlocked on a country's Gross Domestic Product and overall economic well-being. What is the overall effect of being landlocked? Does being landlocked inhibit growth? Must all landlocked countries depend on their neighbors for success? While there is an abundance of material on the subject of being landlocked and most scholars agree that there is some negative effect on overall economic growth, many scholars disagree to what extent there is an adverse effect.

A major disagreement between many scholars is to what extent the geographic location of a country affects the overall success of that country's economy. By definition, a landlocked country is completely excluded from access to oceanic water (Figure 2.1). Some scholars believe that the basic issue of being landlocked is a curse for the host country (Arvis, 2005; Arvis, et al; 2010). According to Arvis (2005), "The high logistics cost and the many developmental problems faced by the landlocked countries of the world can be attributed to their geographical fate. The importance of the transit facilitation agenda to these countries and to the countries of transit stem from these circumstances (p. 244)." The main concern in both of these studies is the

ability of a landlocked country to reach inexpensive yet efficient transit systems and trade corridors. While these studies provided valuable information on underdeveloped landlocked countries, they did not provide an explanation as to how some countries such as Switzerland and Luxembourg have been able to circumvent the impediment of being landlocked.

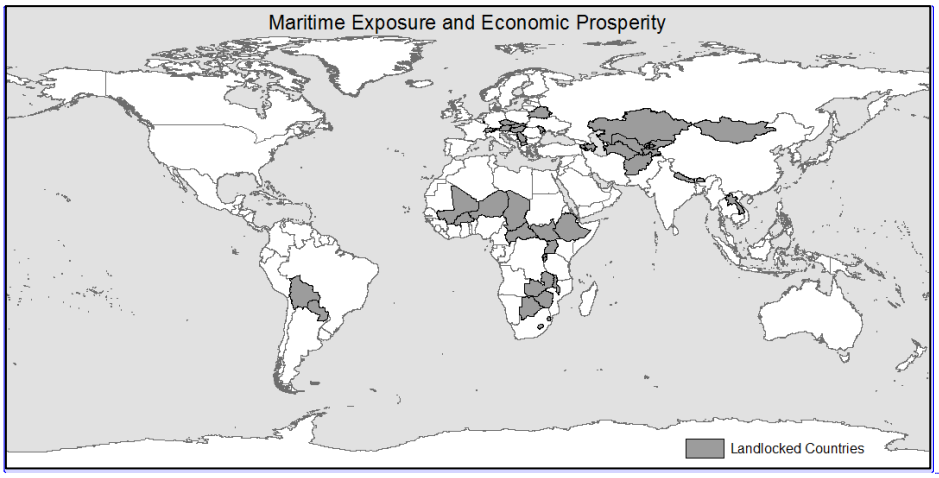

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Figure 2.1 *Locations of landlocked countries throughout the world*

Other authors vary in their explanations of the overall causes of low economic output. Some authors conclude that the root cause of the economic woes of landlocked countries stem from their relationship to neighboring countries (Faye, et al., 2004; Srinivasan, 1986). This has pushed other scholars to define exactly what the relationship is between landlocked countries and their neighbors. Arvis (2005) concluded that the high cost of transporting goods is the main factor of the poor economic performance within landlocked countries. Faye, et al. (2004) go even further to state that the economic woes of landlocked countries can be attributed to a combination of its distance from a viable sea port and the high cost of transportation through a neighboring country.

Does being remote and removed from the main trading centers negatively affect a country's economy? Some scholars have argued that being removed from the interference of main trading powers in turn means that the landlocked countries can have more freedom to choose their own path (Srinivasan, 1986). Other scholars argue that there is an inverse relationship between the cost of transportation and the number of items transported (Chowdhury and Erdenebileg, 2006). This analysis states that as the number of items transported from a landlocked country increases, the cost of transportation for each item decreases.

Collier (2007) even argues that landlocked developing countries find it harder to see substantial growth today because of the control that super giants such as China and India have on their natural resource trade. Throughout the past few decades, China's role in resource exploitation in many developing nations, especially in Africa, and the subsequent loans that are given to these developing countries to build infrastructure has given the Chinese government more control over the decision-making abilities of these countries. These countries often find it hard to choose an appropriate destiny while China's control looms overhead (Alden and Alves, 2009).

There is an abundance of research on the negative effects of being landlocked on a country's economy. Unfortunately, there are inconsistencies with the root cause. Most of the research done on landlocked countries has been built around the effect of geography of that country's particular economy. Also, most research on landlocked countries seems to focus on landlocked developing countries. An exception is Radelet and Sachs (1998), who published research about the overall effects of shipping cost on any country's ability to trade. Still, most of the research fails to give reasons why some countries where able to succeed within the world economy while remaining landlocked. This is important in understanding how and to what extent maritime exposure relates to prosperity.

Landlocked countries often find it difficult to participate in the most basic forms of trade due to the high costs associated with overland travel. Authors have explored the effects of logistics cost on exchange trade

goods and how this has forced many nations to withdraw from trade they might otherwise benefit. Others have shown that improved neighbor relations could help stimulate growth and trade. While all these studies have provided necessary information on the subject of water access, it is important to explore other areas that relate to maritime trade participation, economic geography, and prosperity.

Resource Curse

The resource curse implies that a country with a large amount of natural resources is inevitably doomed to failure. Is this a true statement? Does a country with resource wealth eventually fail economically? What kind of correlation is there between resource wealth and economic failure? An abundance of resources along with a corrupt government often leads to failure in GDP growth. Scholars disagree to what extent the root cause of economic failure is to resource wealth. The most basic assumption of the resource curse is that a wealth of natural resources inevitably leads to economic failure.

Some scholars claim that resource wealth itself is the direct cause of slow economic growth (Ross, 1999). Richard Auty coined the term resource curse. According to Auty (2001), nations with an abundance of one particular resource have a tendency to place too much weight on the use of that resource, creating a climate of instability once those resources run thin. Nations with fewer resources tend to invest more money and time on industrial development, creating a more efficient economic environment. This theory states that by putting more emphasis on primary labor rather than secondary and tertiary labor, the natural resources are mined and shipped off to other countries for manufacturing. Low skilled labor is needed for natural resource mining so more often than not, there is limited growth in median income. Many of these countries depend solely on one or two resources to bring in tremendous wealth but overlook the long term effects of having no manufacturing to support a collapse of resources.

Auty's argument relates to David Hume's price-specie flow mechanism. According to his theory, two countries that participate in trade with one another offset trade balances. In countries that use gold as their currency, or back the currency with gold, one country may depend on exporting commodities such as raw natural resources and import gold to cover the cost of mining the product. As the amount of gold increases in that country, inflation causes gold to devalue forcing prices for the commodity to rise. This forces imports to become more competitive. In the other country, gold is exported in exchange for these natural resources causing deflation and making exports more competitive. He argued that due to this relationship, a positive trade balance is inconsequential when related to long term growth (Hume, 1752).

Shafer (1994) used four case studies to come to the conclusion that political ties to natural resources inadvertently forces the government to depend on the resource controlling elite for power. Others don't even go as far as to say what the direct cause is and only point out that there is a correlation (Papyrakis and Gerlagh, 2004). Some authors have gone even further to claim that the direct cause of low economic growth in resource rich countries is the volatility of the free market system (Robinson, et al., 2006). These authors approach the study of the resource curse from an economic framework rather than an all-encompassing geographic model.

So what kind of correlation is there between resource wealth and slow economic growth? Stevens (2003) studied several different theories on the correlation of low economic growth and resource wealth. Of these theories, the "Dutch disease" and the "crowding out effect" are covered in great detail. According to him, "Dutch disease had a very specific meaning. It referred to the appreciation of the real exchange rate. This was a result of inflation arising from spending the revenues leading to an overheated economy plus an appreciation of the nominal exchange rate as the domestic currency attracted higher demand" (p. 13). The crowding out effect refers to the point where a particular resource project has high value relative to the economy of a particular country. Because government and private companies must use a large portion of revenue to refine or mine a

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natural resource, other industries may find it difficult to receive much needed subsidies from the governing body. Stevens admits that none of these are consistently correct all the time.

Karl (2007) used oil as an example, claiming that oil exploration has caused many oil rich countries to boom then bust due to over exposure and long term environmental damage. Other scholars note that resource wealth does not cause low economic growth, however resource dependence has a negative effect on prosperity (Ross, 1999). These scholars have used historical data to determine the root causes of the resource curse, while others attempt to explore current explanations as to what correlation there is between resource abundance and economic stagnation (Brunnschweiler and Bulte, 2006). This leaves the question a little open to interpretation.

So what is the correlation between government, resource abundance, and low economic yields? Many scholars argue that the government is the root cause. Brunnschweiler and Bulte (2006) explored the question of the resource curse solely on its economic merit. However, most scholars do agree that having an abundance of resources is not the sole cause of low economic growth (Papyrakis and Gerlagh, 2004; Robinson, et al., 2006; Ross, 1999; Sachs and Warner, 1995).

Mehlum, et al. (2006) used a regression analysis to predict that a dictatorship tends to produce low economic growth in a country with an abundance of natural resources as compared to a democratic country with the same resource wealth. "Our main prediction is that the resource curse – that natural resource abundance is harmful for economic development – only hits countries with grabber friendly institutions. Thus countries with producer friendly institutions will not experience any resource curse (p. 12)." Mehlum first ran a regression analysis with all resource rich countries and GDP growth rate from 1965 to 1990 and determined that while there was a slight negative slope on the graph, there was no significant correlation. After running a regression analysis on resource rich countries that are considered to have failing institutions, he determined that the variables suddenly became highly significant in a negative fashion. Mehlum concluded that the resource curse occurs because of "the dangerous mix of weak institutions and resource abundance (p.16)."

Alkhater (2012) conducted an empirical study which found that democracy can lead to growth in a resource abundant state. Other scholars determine the correlation between resource abundance and economic failure not solely on the label of a dictatorship, but based on the ability of corrupt incumbent politicians to use resource wealth to guaranty reelection (Brunnschweiler and Bulte, 2006). Some scholars offer a detailed account as to how each level of corruption affects economic instability (Sachs and Warner, 1995).

Is there a one-size-fits-all explanation for the resource curse? Papyrakis and Gerlagh (2004) used a regression analysis to show that resource wealth tends to create slower growth patterns, however, upon concluding gave examples of countries that avoided the supposed impending doom of resource wealth. Countries with iron and coal resources, such as Iceland and Norway, saw substantial growth in the 19th century. Many scholars attempt to explain the causes of the resource curse, but often find that they are inconsistent with each country. Stevens (2003) determined that it is impossible to find an easy explanation for all instances, going further to say that each country must be studied on a case-by-case basis.

Although the resource curse has been explored because of its paradoxical flow, scholars have failed to find a comprehensive explanation for the failure of some nations and the success of others. Each body of work finds some type of answer that can cover many of these examples, but often leave out other factors in the development of successful economic growth. These scholars have attempted to find an answer as to why the resource curse exists so that they can create an economic policy solution. Unfortunately, these authors fail to discover why other nations, even resource-rich countries with authoritarian governments, see any growth.

International Maritime Trade

Maritime trade has evolved throughout the twentieth and twenty-first centuries. Are maritime ports a necessity in order to benefit from international trade? Many scholars have studied the relationship between quality ports and economic prosperity. Port security has also been researched in great detail. Ports may also see increased

productivity when built and maintained in closer proximity to other efficient and secure ports. Scholars have spent years painstakingly researching the effectiveness of ports but there is a division among those scholars about the answers to these questions. While there is much work discussing the effectiveness of ports, there is very little discussion about the effectiveness of the geographical location of these ports.

Currently, there are more than 4500 ports worldwide (Figure 2.2), so what effect do these ports have on an economy? Clott and Wilson (1999) determined that ports work as a source of tax revenue and job security in most towns and cities. DeSalvo (1994) stated that because of the direct impact of a port on the local economy, the shutdown of a port would cause all local production associated with that port to cease.

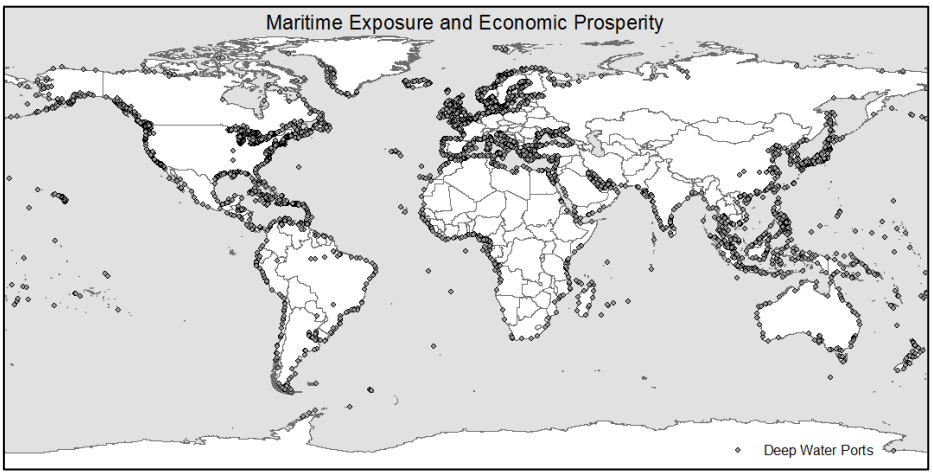

Figure 2.2 *Deep water maritime ports around the world*

Other scholars reported that maritime trade represented a large percentage of all international trade (Helmick, 2008). Frankel and Romer (1999) found that income rose as trade increased. While most scholars agree that maritime ports play a pivotal role in international trading cost (Clott and Wilson, 1999; Coulter,

2002; DeSalvo, 1994; Jacks and Pendakur, 2010; Korinek and Sourdin, 2010), some disagree with the effect that current maritime trade patterns from maritime ports have on the cost of shipping. Jacks and Pendakur (2010) reported that the overall cost of shipping due to technological innovation has decreased significantly since the nineteenth century.

Other scholars have contended that while shipment costs have decreased due to the increased size of cargo ships, the overall cost has increased because smaller ports have had to increase construction to support these larger freights (Coulter, 2002). Some scholars state that trade between two countries with high shipping costs can have an adverse effect on economic stability (Korinek and Sourdin, 2010). Clark, et al. (2004) found that increased port efficiency can lead to as much as a twelve percent reduction in shipping cost.

If ports are important to a country's economy, should that port have adequate security? How has current trends in maritime port security affected the efficiency of trade? Most scholars recommend some level of port security (Banomyong, 2005; Barnes and Oloruntoba 2005; Helmick, 2008), but many disagree to what extent international law should be enacted. Barnes and Oloruntoba (2005) used terrorist data from around the world to recommend that serious steps be taken to implement port security measures, but did not offer much in the way of solutions. Other scholars argue that the increased cost of supply-chain security can adversely affect the efficiency of trade (Banomyong, 2005). Helmick (2008) used recently enacted international law to defend an argument for carefully structured security measures, stating that current law runs the risk of being wasteful.

Is maritime port proximity a key to overall success in international trade? Few scholars have studied this perspective in any great detail. Tinbergen (1962) offered one of the first analyses of geographic location and international trade when he formulated the economic gravity model. This model applies the theory of gravity to international markets. Large economies tend to attract more investment and trade while economies that are closer to one another also attract to one another. This model has seen growing success over the years due to its application in studying trade flows between countries. This model shows that as distance is greater between two

trading partners, the cost of transportation increases and thereby hinders trade flows. Larger economies can bypass this problem due to much a higher monetary balance.

In recent years, some scholars have detailed the importance of understanding geographic proximity of trade patterns in order to make international trade more effective (Hall and Jacobs, 2010). Boschma (1999) outlined an evolutionary change in economic thought. He proposed that economic geography should be the next stage in economic philosophy. Later he argued that spatial proximity was important in understanding the organization of trading patterns (Boschma, 2005). The French School of Proximity Dynamics offered an interesting perspective on market proximity. In this example, there are many different forms of proximity other than geographic locations. Geographic proximity can be explained in terms of location and distance, however, there are other types of proximity that can be grouped in certain dimensions concerning cognition, organization, sociality, institutional, and geographic location (Shaw and Gilly, 2000).

Frankel and Romer (1999) speculated that countries trade more based on their proximity to one another. Other authors reinforced Frankel and Romer's (1999) conjecture, reporting that there is a substantially positive correlation between a country's location, trade value, and domestic income (Irwin and Terviö 2002). Robinson (2002) in particular pointed out how the proximity of maritime ports creates a value-driven chain that becomes essential in the development of prosperous trading patterns. Given these results, the role of maritime ports within the broad field of international trade research is an important field of study that requires much more quantitative research.

How has technology changed this idea of geographic proximity? Technology has helped to increase wealth across the world; however, there is uneven growth between developed and developing countries. According to Jaumotte, et al. (2013), "both financial globalization and technological progress tend to increase the relative demand for skills and education. While incomes have increased across all segments of the population in virtually all countries in the sample, incomes of those who already have higher levels of education

and skills have risen disproportionately more (p. 302).” Other scholars link innovation diffusion with geographic proximity (Kirat and Ling, 1999). In this example, neighboring countries that innovate tend to push technology growth in other regional characters that are close in proximity.

Some scholars have claimed that geography is no longer an issue in the era of globalization and the rise of multinational corporations (Ohmae, 1990). This idea seems to say that in the age of the internet, geography has all but dissipated. Negroponte (1995) argued that as virtual technologies advances, geographic space will disappear and be replaced with virtual space. This idea implies that we will soon live in a surrogate world where experiences are perceived in a virtual rather than a geographic reality. Morgan (2004) put all these theories to rest, however, implying that while claims that technology has forced geographic borders to crumble, technology has also helped to spur easier access to international markets. Because maritime trade is still so important, this theory suggests that as access to international markets increase, access to quality ports and shorelines will become more important than ever before.

Maritime ports are an important hub in international trade and travel. Without this key element, prosperity can never be fully met. Even with railroad travel and increased efficiency of air travel, a large majority of international trade and travel is still using water as its main avenue. Understanding the true value of maritime ports is an integral part in determining the effect that the number of ports has on any given economy.

Import and Export Dependence

Throughout history there has been much debate over the role of imports and exports within a given economy. Should a country be dominated by exports or should that country remove trade barriers on imported goods? Most scholars agree that participation in international trade is crucial in order to be a proficient player in the world economy (Beckerman, 1962; Black, 1970; Caves, 1965; Corden, 1971; Heitger, 1986; Kindleberger,

1962; Lamfalussy, 1963). In the *Wealth of Nations*, Adam Smith proposed a link between economic prosperity and the value of trade (Smith and Cannan, 1937).

Should trade be left to the free market to decide, or should governments promote exports over imports? Scholars disagree as to what extent the government should play a role in import/export ratio. Some scholars defend trade liberalization in the context that the government should play as little of a role as possible (Kravis, 1970; Sohmen, 1959). These proponents argue that the natural marketplace will inevitably workout any kinks that the system might create. Heitger (1986) used a cross-section study of previous research to determine that countries generally benefit from enhanced competition. Kravis (1970) concluded that toward the end of the nineteenth century, the United States had seen substantial growth while seeing massive expansion of imported and exported goods. During the same period, however, India and Ceylon did not see any substantial growth but increased their role in international trade. In his opinion, growth here can be attributed to a combination of internal factors and trade participation.

Other scholars have argued that protectionist policies have provided much needed export growth. Lawrence and Weinstein (1999) examined the role of import tariffs in Japan and found that when the tariffs were strictest, economic growth was at its highest. Other scholars recommend that export-led policies should be implemented in order to see effective growth (Mehrara, et al., 2010). Some scholars offer a more systematic approach to understanding export-led policy.

Marin (1992) compared the terms of trade for Germany, the United Kingdom, the United States, and Japan. He formulated a predictor for export-led economic growth and concluded that these nations, except for the United Kingdom, could benefit from protectionist policies. According to these results, Germany and Japan could see as much as 10% percent growth in productivity while the United States could see substantially more. However, the predictor stayed the same for the United Kingdom.

Other authors mention the need for a case-study approach where each country is studied individually based on its own economic merits (Shafaeddin, 1995). A few scholars also offer disputes against international entities imposing economic policy on developing nations (Wade, 2003). Awokuse (2008) argued that import led economies, based on their lack of natural resources, have been able to successfully turn imported resources into tangible products to be sold in the market.

While most scholars agree that imports and exports both play a pivotal role in the success of a given economy, there is much dispute over the individual value of the two variables. Is an export-led economy the key to economic success? Will it benefit a country to have a market-led approach where imports may overtake exports? These are questions that simply cannot be answered with quantitative research. Every country is different. Research in this particular area is of key importance in order to understand the value of trade on an economy.

Economic Growth Theories

While there is much debate over the importance of trade corridors, import/export value, and public policy, there is also a heated debate over economic growth theories. Scholars have argued for centuries over the viability of the following growth theories: Classical Growth Theory, Neoclassical Growth Theory, and Endogenous Growth Theory. What is the best method for ensuring economic growth in today's world?

The Classical Growth Theory is derived from the works of David Hume and Adam Smith. Some scholars defend this theory believing that the free market is the best place to decide overall economic success (Johnson and Frenkel, 1976). For these economists, Hume and Smith were an inspiration to monetary policy. Other authors have pointed to this theory as having a positive effect on work ethic but spoke little of its viability

in today's markets (Marshall, 2000; Brewer, 1998). Adversely, Letiche (1959) clearly stated that the classical economic model has little relevance in lesser developing countries.

The Neoclassical Growth Theory is based on a theory created by Solow (1956) and Swan (1956) that assumes that if all variables are equal, increased capital will cause a rise in economic growth. Some scholars have commended Solow's theory on economic growth (Mankiw, et al., 1992). Adversely, many scholars argue over the legitimacy of such equations attempting to develop a one-size-fits-all approach. Knight, et al. (1993) used a panel approach to determine that results were often inconsistent with Solow's model. Other scholars found similar results but attributed the inconsistencies to outlying variables such as depression and war (Nelson and Winter, 1974). King and Rebelo (1990) used a policy approach to determine that as welfare investment increased, overall consumption increased, creating a higher tax burden.

The Endogenous Growth theory was developed in the late 1980's to explain the development of technological innovation combined with the value of human capital (Romer, 1986). Some scholars have defended this approach by claiming that this model has offered some explanation of regional growth (Martin and Sunley, 1998). Unfortunately, not much research has been done to test this theory. Pack (1994) suggests that scholars should use empirical research to further test this hypothesis. Others offer policy suggestions using the Endogenous Growth Theory as their foundation (Shaw, 1992). Persson and Tabellini (1994) use the theory as a model for testing the impact of cross-country inequality. One scholar in particular tested the hypothesis and determined that a permanent increase in investment only has a minimal effect on growth (Jones, 1995).

Trade Openness

Trade openness has become the center of discussion between scholars in recent years. The United States saw substantial growth in a deregulated market during the late Industrial Revolution but scholars offer different solutions in a much different world. Should modern developing nations deregulate port economics? Is trade

openness still a viable solution in today's global marketplace? These are important questions for understanding the importance of maritime port dependency in a world that is much smaller than that of previous generations.

Several scholars argue for deregulation as the key for overall trade prosperity (Baird, 1995; Bassett, 1993; Clott and Wilson, 1999; Everett, 2002; Estache and Serebrisky, 2004). So is deregulation the key to success for all institutions? Clott and Wilson (1999) defended deregulation as a whole but used a comparative study with airline deregulation as an example of the negative impacts. This study argued that deregulation positively affected the airliner market as a whole, bringing about lower airfares and helping increase the number of passengers per day. However, at the airport level, deregulation has allowed larger airline companies to become major conglomerates and merge with other companies. The larger airline companies have been able to block smaller competitive companies from providing service at some airports.

Some scholars claim that deregulation in developing countries has increased efficiency substantially (Estache and Serebrisky, 2004). Still others defend deregulation by using Australia as an example (Everett, 2002). According to Everett, deregulation in the Australian transportation sector "has enabled a rapid increase in the number of players in the rail market – from 12 in 1991 to 27 in 1999 (p.26)." With a deregulated transportation market, there is more competition, which has forced prices down and allowed for more innovation.

Giovanni and Levchenko (2009) used an empirical study on trade openness and concluded that if all areas of trade throughout the world were deregulated, than there would be less volatility in international markets. Scholars have also found that there is a converse relationship between trade openness, market shutdowns, and currency crashes. Countries that stop trading with neighboring countries tend to experience sudden economic stagnation and currency crashes (Cavallo and Frankel, 2008).

These scholars did not, however, take into effect trade intensity. Yanikkaya (2003) found that while trade growth in developed and developing nations, both being open to trade, did not differ much, higher

population densities positively correlated with increased trade volume. Tinbergen (1962), who created the Economic Gravity Model, argued that in order for trade to remain efficient, it must remain open. However, free trade was only favorable when sufficient redistribution was present and temporary subsidies were given to newly created corporations, all of which contradict principles of free trade.

In contrast, several scholars point out flaws in deregulation patterns (De Monie, 1996; Goss, 1990; Hershman 1988). Hershman (1988) makes the point that ports are shared between the government and the private sector and must have positive regulation to protect market failure. Other scholars used a comparative study on critics' claims against globalization. Deardorff (2003) found that in a perfect international economy, openness works, but today's world is fraught with political instability, so perfect trade openness could not possibly be achieved. Freeman (2004) claimed that proponents of trade openness want to increase the power of the commercial sector over the government in order to stop the redistribution of wealth. He even went on to say that the whole debate over the value of trade is overworked. In opposition to all of these points, Cullinane and Song (2002) state that no one policy can fit all circumstance.

Other scholars have offered solutions to economic stagnation as well. Khazzoom (1980) and Brookes (2000) independently determined that forced efficiency standards inadvertently caused more energy consumption. Other scholars have used previous models to create newer and more efficient theories (Ashraf and Galor 2011). These theories provide interesting approaches to economic growth. Most of these questions presumably bring about assenting and dissenting opinions. While studies show in many different ways that these factors are important in understanding international maritime trade, the results are often abstract and provide few details on the geography of trade

Geography and Trade

Geographic location has a profound effect on the ability of a nation to participate in international trade. How do geographic location and trade barriers affect the ability of a nation to participate in trade? The study of economic geography within the scope of international trade is still a growing discipline, but until recently has only been a small portion of the study of international trade (Krugman, 1991). Distance is an important factor when determining the overall cost in shipments of goods. The quantity of goods also decrease tremendously across increasing distances (Hillberry and Hummels, 2008).

What barriers exist between potential trading partners? The cost of transporting materials is a major barrier when determining the ability of two nations to trade with one another. Davis and Weinstein (1998) determined that trade costs were the primary reason for the deconstruction of trade over distances. Other more ambiguous barriers exist such as tariffs, time, transportation cost, and information. Language itself can be a barrier to overcome. Hummels (2001) found that distance and freight rates create "implausibly large barriers (p. 3)."

So why is maritime exposure and geographic location the purpose of this study? Access to water provides an avenue for institutions to participate in trade. Christiansen, et al. (2006) developed a strategic plan for shipping in maritime trade after discovering that seaborne transportation of goods and materials had increased by 67% since 1980. Even in an era with expanding technological innovation, we still depend on maritime travel for the transportation of commodities over great distances.

Other scholars determined that with all things equal, lateral trade flows and distance to other markets explained as much as 70% of the variation in median income (Redding and Vanables, 2004). According to Overman, et al. (2003), "the evidence surveyed here strongly suggests the importance of geography in determining international economic interactions, in influencing cross-country income distribution, and in shaping the structure of production across space (p.34)." Other scholars found that as traded goods move farther from the source that the cost of transporting those goods increases exponentially, impacting overall trade

volumes between the two trading partners (Limao and Venables, 2001). Hoffman and Kumar (2010) later determined that new technology has helped to reduce the number of crew members on board ocean liners, thereby reducing the overall cost of maritime transportation.

While all of these studies provide interesting and consistent results about the role of geography in maritime trade, MacKinnon, et al. (2009) expressed concern that the field of evolutionary economic geography lacked "a corpus of detailed empirical research to assess the explanatory quality of its concepts and to inform policy (p. 144)." It will be important to understand the lasting impact of these theories in the international marketplace in order to effectively assess the overall impact of maritime exposure.

There is limited research with respect to the geography of maritime trade in the realm of coastline length and coast/area ratio, however, many scholars have studied the physical aspects of these variables using GIS and satellite imagery (Alesheikh, et al., 2007; Heo, et al., 2009; Smith and Cromley, 2012; Stanchev, et al., 2011; and Xu, et al. 2014). Measuring current coastline lengths and coastline changes over time is difficult due to the seemingly insurmountable task of measuring coastline length in exact terms. Problems especially occur in places with a high number of inlets and fjords. These fractal properties of coastlines make it difficult to measure length in exact detail. When using maps at different scales this problem becomes more pronounced and maps with smaller scales create issues with exaggerated generalization. Vučetić, et al. (2006) determined that when using a map with a smaller scale, the coastline length would be shorter "due to generalization (p. 74)."

Another problem when measuring coastline inevitable changes in length and shape by erosion and natural disasters. Changes in coastal regions effects access to resources and can rearrange natural environments that many animals call home (Cai & Wu, 2002; Minggang, 2006). Xu, et al. (2014) used the box counting method (using pixel-like boxes at a small scale to determine fractal coastlines) to analyze and interpret coastal variations present in northern China regions of Liaoning, Hebei, Tianjin, and Shandong provinces bordering the

Yellow Sea. It was determined that between the years 2000 and 2012, the coastline continually increased, becoming more fractal.

Many of the studies on coastline changes cover small areas due to the difficult nature of measuring coastline over extreme distances (Fenster et al. 2001). Smith and Cromley (2012) used two different methods for measuring coastal changes, transect-from-baseline method and change polygon method, and compared the results. According to Smith and Cromley (2012), "When the results from the transect-from-baseline approach are compared, we can see that the transect-from-baseline approach results are of a higher magnitude than those results produced by implementing the change polygon method (p. 11)." The change polygon method also provided more consistent results. Another method for measuring coastal change was recently created in response to many of the issues associated with the other two approaches. This method uses the buffering method to create a polygon layer placed over the current coastline layer and the previous coastline layer. The buffer is then clipped so that the remainder of the polygon lies between the two coastline layers. The area of the remaining polygon is measured to determine the change in coastline (Heo, et al., 2009). Measuring coastline and historical change in length presents problems when studying coastal access and maritime trade participation. This creates some inherent shortcomings. While the research is limited on the relationship between coastline length and maritime trade, it is important to keep in mind the obstacles present in developing accurate coastal measurements.

Scholars have provided profound insight on the study of international trade. Involvement in international trade is pivotal today in order to remain relevant in the world economy. By participating in trade, developing countries gain access to goods that they would otherwise not be able to produce at home. They also participate in the creation of goods that would otherwise be too expensive to produce in other countries. Because a majority of these goods are transported in cargo ships and tankers over international waterways, the study of maritime trade is critical when establishing sound policy advice for developing and underdeveloped nations.

Chapter 3

METHODS

The research presented here attempts to discover if there is a concrete and lasting relationship between six factors (Table 3.1) that relate to the ability of a country to participate in maritime trade. “Maritime exposure” is used to explain just how well a country is geographically and economically able to participate in the exchange of goods overseas. The process began as a cross-comparison of 229 independently governed entities throughout the world. Due to limited information on many of these countries, data was reduced based on terms of applicability. This study intends to investigate the possibility of an existing relationship between factors of maritime exposure and three common measurements of prosperity.

The most effective way to measure the relationship between several variables is stepwise multivariate regression. Multivariate regression explores the nature and strength of the relationship between six important factors representing maritime exposure and economic prosperity. According to Gomez and Jones (2008), “regression describes the co-variation of two variables measured on an interval/ratio scale. A simple regression means there is only one independent variable (p.301).” However, in the case of multiple independent variables “an interval/ratio scale can be related to many independent variables simultaneously by expressing it as a linear function of several variables (p.304).” The resulting equation created by the model can be used to estimate and predict future results.

The initial model sets began by including all six maritime exposure factors and comparing them to the independent economic variables. After the initial models within the model sets were ran, the highest individual p-value within the equation was removed to achieve a better explanatory model. This process was continued until there were only two independent variables left in the equation. The objective here is to determine which model within each set has the most significant relationship. This “best-fit” model can then be used to define maritime exposure in more concrete terms. Within stepwise regression it is best to use the model with the most

significant p-value that has the least number of parameters. For that reason, the best-fit model chosen within each model set contains two of the original six variables. By reducing the number of parameters, it becomes much easier to explain the relationship. This rule is known as Occam's razor (Crawley, 2015).

To predict the influence of maritime exposure on the economic prosperity of 128 countries across the world, multiple regression models including GDP Purchasing Power Parity, GDP Per Capita, and the UN Human Development Index data along with several factors including coast/area ratio, coastline length, number of ports, merchandise trade numeric values, market access subindex, and total merchant fleet in tonnage were used, and their performances were compared to select the best supported hypothesis. Table 3.1 lists all of the independent and dependent variables.

Table 3.1 *List of included independent and dependent variables*

Independent Variables	**Dependent Variables**
Coast/Area Ratio (m/km^2)	GDP Per Capita
Length of Coastline	GDP Purchasing Power Parity
Number of Ports	UN Human Development Index
Total Merchant Fleet in Tonnage	
Merchandise Trade	
Market Access Subindex	

(Other possible factors were not included because of data limitations or because of limited bearing on the research question.) These factors indicate how geospatially positioned a country is with respect to other locations. By comparing these variables to economic prosperity factors, the results will show just how important maritime exposure is to the economic success of a nation. The following formula was used in this analysis:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_{n-1} x_{i-1} + \beta_n x_i + \Sigma_i$$

$$where\ \beta_0 = y - intercept, \beta_n = coefficient\ estimate\ for\ variable\ x_i$$

This particular research method has been an important tool for scholarly research. Multiple regression allows the researcher to compare multiple independent variables to one dependent variable. The results will not only show if there is a correlation, but it will allow the researcher to make future inferences within the scope of the research. Many scholars have used this to compare geographic features to a particular economic response. Gallup, et al. (1999), used the same method to explore the relationship between productivity, transport cost, and national saving rates to that of economic growth. Polachek (1980), used a multiple regression analysis comparing several policy measures, population density, and trade statistics to conclude that there is a negative relationship between these factors and conflict.

Coast/area ratio is an important variable when determining accessibility to shorelines. This variable is determined by dividing the total number of meters in actual coastline by the area, measured in kilometers, of that given country.

$$\frac{m}{km^2}$$

Coast/area ratio represents the ease of access from inland communities and coastal areas. A country like the Seychelles has a high coast/area ratio because it has a large amount of coastline but not much landmass. Without much landmass per coastline for agricultural production, these countries must depend on maritime trade in order to prosper.

Coastline length is measured in total kilometers. This measure does not include river coastline; however, the usage of deep water river systems is covered by the total number of deep water ports. There are many different types of coastlines such as primary coasts, this includes coastlines created by erosion, and secondary coasts, created by sea currents and marine waves (Stewart, 2005). For the purpose of this study, a comprehensive list of the length of coastlines within the sample area is included without reference to coastal type.

Coastline length gives reference to the ability of a country to participate in maritime trade. In practice, dependent on latitude, when a country has more coastline, its access to water increases. If a country has better access to water and water resources, it has a better opportunity to participate in maritime trade, thus increasing its maritime exposure. Both coastline length and coast/area ratio are factors measured and published by the Central Intelligence Agency's World Factbook.

The *total number of deep water ports* is included to represent the possible maximum capacity of traded goods that a country can hold. This data is limited to the number of deep water ports with no discretion on size or efficiency. This was done in order to provide a comprehensive but simple explanation for port dependency. Deep water ports usually exist on oceanic coasts and sometimes on deep navigable rivers. Deep water ports require the water depth to be 30 feet deep or more at the docking area.

World merchandise export data on *total merchant fleet* was included to show the total amount of trade volume in a given country. Every year the United Nations Conference on Trade and Development (UNCTAD) releases statistics on international business and development. Total merchant fleet includes civilian ships and cargo tankers within a country. The merchant fleet "consists of bulk carriers (bulkers), which are designed to transport unpackaged bulk cargo; tankers, which are designed to transport liquid cargo; and container ships (Heiberg, 2012, p. 85)." This set of data accounts for as much as 85 percent of the total world fleet. Total merchant fleet is measured in entire tonnage within a given country.

Merchandise trade was included in order to interpret how much a particular country depends on trade for revenue. This variable is a direct measurement of the amount of GDP that can be attributed to trade. This is determined by adding both imports and exports and dividing the total number by the gross domestic product in U.S. dollars.

$$\left(\frac{exports+imports}{GDP}\right)$$

Merchandise includes goods imported and exported from a given economy. This does not include trade in services and foreign direct investment. According to the United States Census Bureau (2014), "Exports measure the total physical movement of merchandise out of the United States to foreign countries whether such merchandise is exported from within the U.S. Customs territory or from a CBP bonded warehouse or a U.S. Foreign Trade Zone" and "measures the total physical arrivals of merchandise from foreign countries, whether such merchandise enters consumption channels immediately or is entered into bonded warehouses or Foreign Trade Zones under CBP custody."

The Global Enabling Trade Report is released yearly by the World Economic Forum (WEF). This organization uses data gathered from most of the countries around the world to assess how government policy and infrastructure may affect trade quality and access to markets. A portion of this report is dedicated to the WEF *Market Access Subindex* which is defined as "the extent to which the policy framework of the country welcomes foreign goods into the country and enables access to foreign markets for its exporters (Lawrence, et al., 2012, p. 6)."

This index is grouped into two pillars. Pillar 1 (domestic market access) includes tariff rates, the complexity of tariff index (tariff dispersion, tariff peaks, specific tariffs, and number of distinct tariffs), and share of duty-free imports; pillar 2 (foreign market access) includes tariffs levied and the index of margin of

preference in destination markets. According to Hanouz, et al. (2014), “The computation of the ETI [Enabling Trade Report] is based on successive aggregations of the scores from the indicator level (i.e. the most disaggregated level) all the way up to the overall ETI score. Unless noted otherwise, an arithmetic mean is used to aggregate the scores within a parent component (subindex, subpillar, pillar, or indicator). The mean or aggregated score becomes the overall score for that component (p. 329).”

According to the World Factbook (2014), “GDP (purchasing power parity) compares the gross domestic product (GDP) or value of all final goods and services produced within a nation in a given year. A nation's GDP at purchasing power parity (PPP) exchange rates is the sum value of all goods and services produced in the country valued at prices prevailing in the United States.” This is the most common method for comparing total value of economic output across borders. By using purchasing power parity as a means of comparing different countries, the data can be easily studied and used in further instances. “GDP - per capita (PPP) compares GDP on a purchasing power parity basis divided by population as of 1 July for the same year.” GDP per capita allows for a cross-country comparison of individual economic outputs, or the average household value, within a given country.

Cultures determine prosperity in various ways. For this reason, the UN Human Development Index was included in the analysis in order to uncover the existence of a potential relationship between maritime exposure and prosperity. According to the United Nations Development Program (2013), “The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone.” The Human Development Report indexes factors of life expectancy at birth, the mean of the number of years spent in school, the number of years that students are expected to be in school, and gross national income per capita. The Human Development Index includes the previously stated data and accredits equal weights to all of the included variables. The United Nations Development Program

Office has determined that all of these variables are of equal weight and importance. Precedent for this decision can be attained from research presented by Decancq and Lugo (2009) and Noorbakhsh (1998)

Data were collected from various sources for all countries, resulting in 128 cases where full data was available (see Figure 3.1 and Table 4.8). These statistics were obtained from the CIA World Factbook, the United Nations Conference on Trade and Development, the World Bank, and the World Economic Forum's Global Enabling Trade Report. The data included in this thesis were taken from 2012 in order to be compared. Multiple regression analyses were used to compare maritime exposure with the three previously mentioned indicators of economic prosperity.

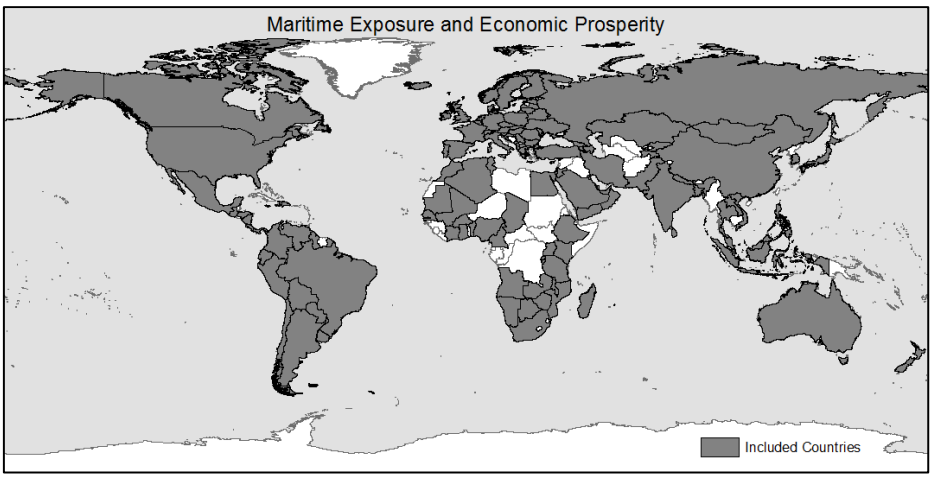

Figure 3.1 *Countries included in the study of maritime exposure and prosperity*

The data presented in this study were reviewed and determined to be the best examples for describing maritime exposure. Three total models were created for each economic indicator (GDP purchasing power parity, GDP per capita, and Human Development Index) at a worldwide scale. The valued performance of each model within a given set was evaluated using Akaike Information Criterion (AIC). At the current scale, the sample sizes were large enough and no null values were present so no adjustments were made to the AIC score. This data was compiled in order of validity. Coefficient estimates and standard errors were compiled and compared to show the significance of each model. Determination coefficients (pseudo-R^2 values) were also included to explain the amount of variation.

According to Gomez and Jones (2008), "Multiple regression is a powerful technique. But it cannot solve inherent problems in either data or careful thinking about causality (p.305)." In the case of multicollinearity, if two or more of the independent variables share half of the total variation, it becomes difficult to determine which one is causing the dependent variable to change. If multicollinearity exists, it is difficult to explain the

causational relationship. Due to this issue, independent and separate simple linear regression analyses were run to determine if any of the independent variables relate to one another.

The number of countries studied within this research present some limitations in the analysis portion. Of the 229 independently governed countries throughout the world, only 128 of them were included in this study. This was due to a lack of information in variables such as the market access subindex. Some countries were excluded due to the absence of any recent GDP information; this can be due to civil war, recent conflict, or limited government oversight. There will be some inherent risk when aggregating the information provided in the analysis, however, this study will provide a good foundation for future research and can be used to approximate future calculations on maritime exposure and prosperity.

Chapter 4

MARITIME EXPOSURE AND ECONOMIC PROSPERITY: WHY LOCATION MATTERS

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ABSTRACT

Maritime trade and access to deep water territory are important when determining a country's economic success. Today, as much as 75% percent of trade is done over water. This thesis examines issues in economic geography such as the landlocked curse, resource curse, maritime port dependency, import and export competition, and trade openness, and attempts to explain the importance of maritime exposure. This study explores the relationship between six major factors in maritime exposure and overall economic prosperity. Findings suggest a positive correlation between maritime exposure and Gross Domestic Product (purchasing power parity and per capita). Interestingly, findings also show a negative relationship between maritime exposure and the United Nations Human Development Index rank score.

INTRODUCTION

Maritime trade is an essential element in the global economy. As technology has developed at a rapid pace, people have become more interconnected than ever before. This growth in technology has spurred the need for better access to goods and services. Just how important is access to navigable water, and especially oceans, for economic prosperity? Is there a relationship between the geographic aspects of "maritime exposure" and economic growth and prosperity, given that today as much as 75% of worldwide trade is done over water (Heiberg, 2012)? This paper explores the geospatial relationship between maritime exposure and economic prosperity. I began by developing a set of variables used to determine how exposed a country is to maritime trade. Multiple regression was used to determine if a relationship exists between "maritime exposure" and economic prosperity.

Scholars have studied the impact of geography on economic prosperity for years and several issues have risen in prominence. Landlocked countries (Figure 4.1) face what seems to be an insurmountable obstacle; how to access the coast without bankrupting the private sector. A debate within this literature is to what extent the

geographic location of a country affects the overall success of that country's economy. Some scholars believe that being landlocked is highly disadvantageous for a country (Arvis, 2005; Arvis, et al., 2010). This argument is known as the "landlocked curse." According to Arvis (2005), "The high logistics cost and the many developmental problems faced by the landlocked countries of the world can be attributed to their geographical fate. The importance of the transit facilitation agenda to these countries and to the countries of transit stem from these circumstances (p. 244)."

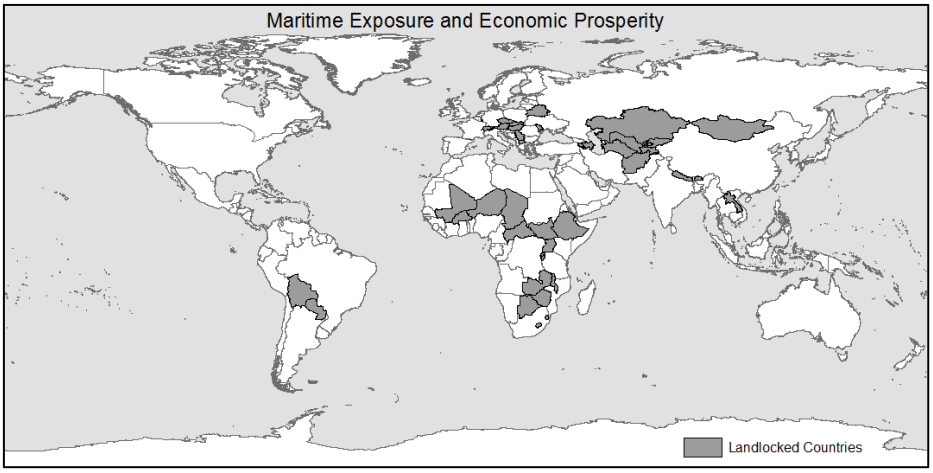

Figure 4.1 *Locations of landlocked countries throughout the world*

Other authors vary in their explanations of the overall causes of low economic output. Some authors conclude that the root cause of economic woes of landlocked countries stem from relationships with neighboring countries, rather than any inherent landlocked geospatial position (Faye, et al., 2004; Srinivasan, 1986). Some scholars have argued that being removed from the interference of main trading powers means that landlocked countries have more freedom to choose their own path (Srinivasan, 1986). Other scholars argue that there is an inverse relationship between the cost of transportation and the number of items transported

(Chowdhury and Erdenebileg, 2006). Their analysis states that as the number of items transported from a landlocked country increases, the cost of transportation for each item decreases.

Another explanatory argument, known as the "resource curse," suggests that a country with a high level of natural resources is inevitably due to fail. Some scholars claim that resource wealth itself is the direct cause of slow economic growth (Ross, 1999). According to Auty (2001), nations with a large amount of a single natural resource have a tendency to place too much weight on the use of those resources, creating a climate of instability once those resources run thin. Nations with fewer resources tend to invest more money and time on industrial development, creating a more efficient economic environment. This theory states that by putting more emphasis on primary labor rather than tertiary labor, the natural resources are mined and shipped off to other countries for manufacturing. Unskilled labor is needed for natural resource mining so more often than not, there is limited growth in median income.

Stevens (2003) studied several different theories on the correlation of low economic growth and resource wealth. Of these theories, the "Dutch disease" and the "crowding out effect" are singled out. According to him, "Dutch disease had a very specific meaning. It referred to the appreciation of the real exchange rate. This was a result of inflation arising from spending the revenues leading to an overheated economy plus an appreciation of the nominal exchange rate as the domestic currency attracted higher demand (p. 13)." The crowding out effect refers to the point where a particular resource project is valued high relative to the economy of a particular country. Because the government must use a large portion of its revenue to refine or mine a natural resource, other industries may find it difficult to receive much needed funds from the governing body. Stevens admits that none of these are consistently correct all the time. Nevertheless, few scholars have found an adequate explanation of why these countries fail to see substantial growth.

Maritime trade has evolved throughout the twentieth and twenty-first centuries. Are maritime ports a necessity in order to benefit from international trade, especially in a world increasingly linked by digital media

and communication systems? Currently, there are more than 4500 ports worldwide (Figure 4.2), so what effect do these ports have on an economy? Clott and Wilson (1999) determined that ports work as a source of tax money and job security in most port towns and cities. DeSalvo (1994) states that because of the direct impact of a port on the local economy, the shutdown of a port would cause all local production associated with that port to cease. Other scholars suggest that maritime trade represented a large majority of all international trade (Helmick, 2008). Tinbergen (1962) offered one of the first analyses of geographic location and international trade when he formulated the economic gravity model. This model determined that economies of great scale tend to attract other economies and countries that are closer to one another tend to trade with each other. In recent years, some scholars have detailed the importance of understanding geographic proximity of trade patterns in order to make international trade more effective (Hall and Jacobs, 2010).

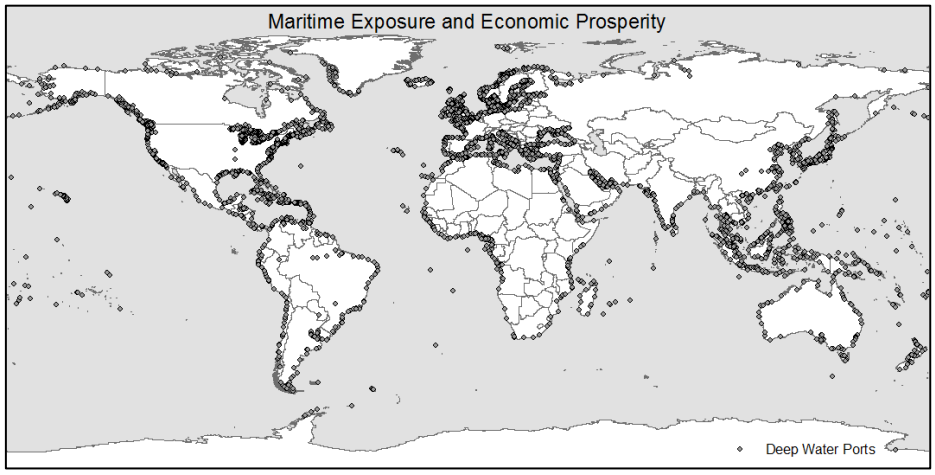

Figure 4.2 *Deep water maritime ports around the world*

Throughout history there has been much debate over the role of imports and exports within a given economy. Should a country be dominated by exports or should that country ease access to imported goods? Some scholars defend trade liberalization in the context that the government should play as little of a role as possible (Kravis, 1970; Sohmen, 1959).

Other scholars have argued that protectionist policies have provided much needed export growth. Lawrence and Weinstein (1999) examined the role of import tariffs in Japan and found that when the tariffs were strictest, economic growth was at its highest. A few scholars have also explained slow growth as largely due to external entities imposing economic policy on developing nations (Wade, 2003). Awokuse (2008) argued that import-led economies, based on their lack of natural resources, have been able to successfully turn imported resources into tangible products to be sold in the market. While most scholars agree that imports and exports both play a pivotal role in the success of a given economy, there is much dispute over the individual value of the two variables.

Access to water provides an avenue for institutions to participate in trade. Christiansen, et al. (2006) developed a strategic plan for shipping in maritime trade after discovering that seaborne transportation of goods and materials had increased by 67% since 1980. Even in an era with expanding technological innovation, the world still depends on maritime travel for the transportation of commodities over great distances.

Other scholars determined that with all things equal, lateral trade flows and distance to other markets explained as much as 70% of the variation in median income (Redding and Vanables, 2004). According to Overman, et al. (2003), “the evidence surveyed here strongly suggests the importance of geography in determining international economic interactions, in influencing cross-country income distribution, and in shaping the structure of production across space.” Other scholars found that as traded goods move farther from

the source that the cost of transporting those goods increases exponentially, impacting overall trade volumes between the two trading partners (Limao and Venables, 2001). Hoffman and Kumar (2010) later determined that new technology has helped to reduce the number of crew members on board ocean liners, thereby reducing the overall cost of maritime transportation.

While all of these studies provide interesting and consistent results about the role of geography in maritime trade, MacKinnon, et al. (2009) expressed concern that the field of evolutionary economic geography lacked "a corpus of detailed empirical research to assess the explanatory quality of its concepts and to inform policy (p. 144)." It will be important to understand the lasting impact of these theories in the international marketplace in order to effectively assess the overall impact of maritime exposure.

These scholars have provided profound insight on the study of international trade. Involvement in international trade is pivotal today in order to remain relevant in the world economy. By participating in trade, lesser developed countries gain access to goods that they would otherwise not be able to produce at home. They also participate in the creation of goods that would otherwise be too expensive to produce in other countries. Because a majority of these goods are transported in cargo ships and tankers over international waterways (Heiberg, 2012), the study of maritime trade is critical when establishing sound policy advice for developing and underdeveloped nations.

METHODS

There are as many as 229 self-governing institutions throughout the world. For the purpose of this study, 128 countries were included in the analysis (Table 4.1 and Figure 4.3). The total number of countries included in this analysis was reduced due to limited data. Data were collected from the Central Intelligence Agency's (CIA) World Factbook, The United Nations Conference on Trade and Development (UNCTAD), the World Bank, and

the World Economic Forum's (WEF) Global Enabling Trade Report. All data included in this analysis were compiled from 2012 demographics.

Table 4.1 *Countries included in the study of maritime exposure and prosperity*

Countries Included			
Albania	Ecuador	Lebanon	Qatar
Algeria	Egypt	Lesotho	Romania
Angola	Estonia	Lithuania	Russia
Argentina	Ethiopia	Luxembourg	Rwanda
Armenia	Finland	Macedonia	Saudi Arabia
Australia	France	Madagascar	Senegal
Austria	Gambia	Malawi	Serbia
Azerbaijan	Georgia	Malaysia	Singapore
Bahrain	Germany	Mali	Slovakia
Bangladesh	Ghana	Mauritania	Slovenia
Belgium	Greece	Mauritius	South Africa
Benin	Guatemala	Mexico	South Korea
Bolivia	Guyana	Moldova	Spain
Botswana	Haiti	Mongolia	Sri Lanka
Brazil	Honduras	Montenegro	Sweden
Bulgaria	Hong Kong	Morocco	Switzerland
Burkina Faso	Hungary	Mozambique	Tajikistan
Burundi	Iceland	Namibia	Tanzania
Cambodia	India	Nepal	Thailand
Cameroon	Indonesia	Netherlands	Tunisia
Canada	Iran	New Zealand	Turkey
Chad	Ireland	Nicaragua	Uganda
Chile	Israel	Nigeria	Ukraine
China	Italy	Norway	United Arab Emirates
Colombia	Jamaica	Oman	United Kingdom
Costa Rica	Japan	Pakistan	United States
Cote d'Ivoire	Jordan	Panama	Uruguay
Croatia	Kazakhstan	Paraguay	Venezuela
Cyprus	Kenya	Peru	Vietnam
Czech Republic	Kuwait	Philippines	Yemen
Denmark	Kyrgyzstan	Poland	Zambia
Dominican Republic	Latvia	Portugal	Zimbabwe

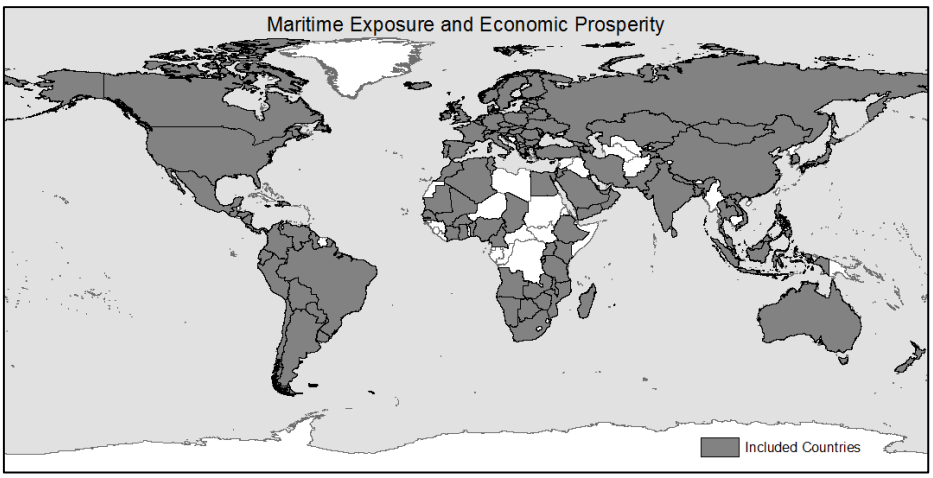

Figure 4.3 *Countries included in the study of maritime exposure and economic prosperity*

To examine the relationship between "maritime exposure" and economic prosperity, several variables were included in order to effectively describe how exposed a nation is to maritime trade (Table 4.2). Multiple regression model sets, including GDP Purchasing Power Parity, GDP Per Capita, and the UN Human Development Index data (independent variables) along with several factors including coast/area ratio, coastline length, number of ports, merchandise trade numeric values, market access subindex, and total merchant fleet in tonnage (dependent variables) were used, and performances were compared determine the best-fit model. These data were determined to be the best examples for describing the "maritime exposure" of a given country.

Table 4.2 *List of included independent and dependent variables*

Independent Variables	**Dependent Variables**
Coast/Area Ratio (m/km^2)	GDP Per Capita
Length of Coastline	GDP Purchasing Power Parity
Number of Ports	UN Human Development Index
Total Merchant Fleet in Tonnage	
Merchandise Trade	
Market Access Subindex	

The most effective way to measure the relationship between several variables is stepwise multivariate regression. Multivariate regression explores the nature and strength of the relationship between six important factors representing maritime exposure and economic prosperity. According to Gomez and Jones, (2008), "regression describes the co-variation of two variables measured on an interval/ratio scale. A simple regression means there is only one independent variable (p.301)." However, in the case of multiple independent variables "an interval/ratio scale can be related to many independent variables simultaneously by expressing it as a linear function of several variables (p.304)." The resulting equation created by the model can be used to estimate and predict future results.

The objective here is to determine which model within each set has the most significant relationship. This "best-fit" model can then be used to define maritime exposure in more concrete terms. Within stepwise regression it is best to use the model with the most significant p-value that has the least number of parameters. For that reason, the best-fit model chosen within each model set contains two of the original six variables. By

reducing the number of parameters, it becomes much easier to explain the relationship. This rule is known as Occam's razor (Crawley, 2015). After the initial models within the model sets were ran, the highest individual p-value within the equation was removed to achieve a better explanatory model. This process was continued until there were only two independent variables left in the equation.

Prosperity can be defined in many different ways, so for the purpose of objectivity, I ran three different multiple regression analyses to determine if there was a correlation between maritime exposure and Gross Domestic Product (GDP) purchasing power parity, GDP per capita, and the United Nation's Human Development Index. These are three common ways of measuring prosperity and provide valuable means-tested numerical values for assessing overall welfare (Kelley, 1991).

The factors listed in table 4.2 indicate how geospatially positioned a country is within the world of maritime trade. By using multiple regression to compare the before mentioned independent and dependent variables, I have been able to effectively describe the relationship between these factors in human economic development. The following formula was used in this analysis:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_{n-1} x_{i-1} + \beta_n x_i + \Sigma_i$$

$$where\ \beta_0 = y - intercept, \beta_n = coefficient\ estimate\ slope\ for\ variable\ x_i$$

The variables included in this analysis provide a very particular description of a country's ability to participate in maritime trade. Some variables such as coast/area ratio and coastline length are geographic features that promote better access to maritime trade. Other factors such as number of ports and total merchant fleet give insight into the infrastructure and current activity within maritime trade, while market access and merchandise trade show economic policy effects and overall dependence on trade.

Coast/area ratio is determined by dividing the total coastline length in meters by the area of landmass in kilometers squared ($\frac{m}{km^2}$). A country with a high coast/area ratio has easier access to coastal areas, making participation in trade more easily obtainable. For the purpose of this study, coastline length is measured in total kilometers. Analysis is confined to the study of deep water maritime coastline; river coastlines were excluded. Larger coastline lengths allow countries to build more ports and increase shipping across greater distances. For that reason, the number of deep water ports per country were also included in this analysis. A deep water port is defined by a water depth of at least 30 feet deep at the docking area (Dasgupta, 2011). This is to allow the transportation of large vessels that travel between different countries. Small shallow ports were excluded in order to limit the number of ports to those that transport goods from other institutions.

Total merchant fleet consists of civilian cargo ships and tankers within a country during the fiscal year of 2012. This variable is measured in tonnage. This was included to factor in the number of goods transported between countries within the study year. The Global Enabling Trade Report is released yearly and analyzes government policy and its effects of trade and market access. The World Economic Forum's Market Access Subindex is included in this report and is defined as "the extent to which the policy framework of the country welcomes foreign goods into the country and enables access to foreign markets for its exporters" (Lawrence, et al., 2012, p. 6). The last independent variable included in this study is merchandise trade. This variable explains a country's dependence on trade within the overall GDP. This statistic is achieved by adding exports to imports and dividing the number by the GDP ($\frac{exports+imports}{GDP}$). Merchandise trade only consists of goods imported and exported and does not include trade in services and foreign direct investment.

These independent variables were compared to GDP purchasing power parity, GDP per capita, and the UN Human Development Index. The GDP purchasing power parity (PPP) "is the sum of all goods and services produces in the country valued at prices prevailing in the United States" (CIA World Factbook, 2014). This allows for an easy and comprehensive comparison of economies across different exchange rates. GDP per capita

takes a country's purchasing power total and divides it by the number of citizens. Some countries are geographically smaller than others so they may have a smaller GDP, but each citizen may be more prosperous due to a smaller population. Because cultures determine success differently, the UN Human Development Index was included in this analysis. The Human Development Index includes factors such as life expectancy at birth, the average number of years spent in school, the number of years that students are expected to be in school, and gross national income per capita. "The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean. (United Nations Development Program, 2013)."

Three total models were created for each economic indicator (GDP purchasing power parity, GDP per capita, and Human Development Index) at a worldwide scale. The valued performance of each model within a given set was evaluated using Akaike Information Criterion (AIC) (Crawley, 2015). At the current scale, the sample sizes were large enough and no null values were present so no adjustments were made to the AIC score. This data was compiled in order of validity. Coefficient estimates and standard errors were compiled and compared to show the significance of each model. Determination coefficients (R^2 values) were also included to demonstrate the amount of variation explained in each model.

RESULTS

One hundred and twenty eight countries were included in this study due to limited data on all aspects included in the research. The coastline length sum of the countries surveyed totaled 663,573.6 kilometers, the number of ports measured worldwide totaled 4,147, and the overall size of the merchant fleet surveyed came to 909,274 tons. The mean of the institutions coast/area ratio was 24.15 and the mean of the market access subindex score was 4.09. The mean score of merchandise trade within the total study area was 77.5. Total sum of GDP

purchasing power parity came to $82,249,465,000. The median of GDP per capita within the sample was $6546.13. Total rank sum of the sampled Human Development Index was 10,791.

The null hypothesis prior to testing assumed that there was no linear relationship between maritime exposure (*coastline length, coast/area ratio, number of ports, market access, total merchant fleet, and merchandise trade*) and prosperity (*GDP purchasing power parity, GDP per capita, and Human Development Index*). Model set one, two, and three showed significant correlations between maritime exposure and each independent variable (GDP PPP, GDP Per Capita, and UN Human Development Index). Testing results show significant relationships in all multiple regression models with at least 95% confidence.

When modeled separately, however, number of ports (NP) showed the only positive linear relationship with GDP purchasing power parity (Table 4.4). Versus GDP per capita, a positive linear relationship remained throughout each subsequent test (Table 4.5). Within this same model set, CAR (coast/area ratio) showed a positive linear relationship once MAS (market access), TMF (total merchant fleet), and MT (merchandise trade) were removed from the model. The final model set compared the Human Development Index against maritime exposure and a negative linear relationship existed between NP and the supported prosperity measurement (Table 4.6). In the same model, MT showed a significant negative linear relationship as COAST (coastline length), CAR, MAS, and TMF are removed from the equation.

The first test ran in model set 1 (Table 4.3) showed a significant p-value equal to 0.007. This test included all of the original independent variables (coastline length, coast/area ratio, number of ports, market access, total merchant fleet, and merchandise trade) modelled against GDP purchasing power parity. After the initial model was ran, the highest individual p-value within the equation was removed ($CAR: p - value = 0.6163$) to achieve a better explanatory model. This process was continued until there were only two independent variables left in the equation (NP and MT).

The best fit model, according to Akaike's Information Criterion, included number of ports and merchandise trade ($AIC = 2290.855$). Each model in this set had a significant p-value < 0.05, however, due to some extraneous variables in the original model, the best fit model (NP + MT) only contained two of the original six variables. This best fit model was determined by subtracting the smallest AIC value from the largest (ΔAIC) to see if there were any significant differences between the model results. This model also showed a highly significant relationship and the r-squared analysis explained 9 percent of the variation ($R^2 = 0.09$).

All independent variables (COAST, CAR, NP, MAS, TMF, and MT) were included in the original model within model set 2 and were compared with GDP per capita. The original test showed a significant relationship between the factors included ($p - value = 0.002$) and the subsequent four tests also showed a significant p-value < 0.05. The same steps were taken in this model set as in the previous model set. The best fit model did not have the lowest AIC score ($AIC = 2905.954$) however the difference between the scores were negligible and showed no significant difference ($\Delta AIC = 0.004$). In this case, the model with the least number of parameters was chosen as best fit (CAR+NP). The p-value was the most significant of any of the other tests within this model set ($p - value < 0.0001$). The r-squared analysis within this model explained 13 percent of the variation ($R^2 = 0.13$).

Model set 3 also followed the previously stated method. Each variable was included in the original equation and were compared to the UN Human Development Index Rank. This test and each subsequent model showed a significant p-value < 0.05. This model set had the lowest p-values of any of the previous model sets. The lowest AIC score was not accepted as the best fit model (CAR + NP + MT). This model was not significantly different that the model with the fewest parameters (NP + MT), so that model was chosen as the best fit. This r-squared analysis within this model explained 15 percent of the variation ($R^2 = 0.15$) and the p-value was the most significant of the five models within this model set ($p - value < 0.0001$) (R Core Team, 2014).

Table 4.3 *Model averaged parameter estimates of Maritime Exposure and three Economic Prosperity measures, from 128 countries, 2012.*

Model Set 1	K^b	AIC	ΔAIC	R^2	$p-value$	***Linear Relationship***
GDP Purchasing Power Parity						
NP + MT	2	2290.855	0.000	0.09	0.001	+
NP + TMF + MT	3	2291.05	0.194	0.09	0.002	+
NP + MAS + TMF + MT	4	2291.981	1.126	0.09	0.003	+
COAST + NP + MAS + TMF + MT	5	2292.516	1.661	0.1	0.004	+
COAST + CAR + NP + MAS + TMF + MT	6	2294.249	3.394	0.09	0.007	+

Model Set 2	K^b	AIC	ΔAIC	R^2	$p-value$	***Linear Relationship***
GDP Per Capita						
CAR + NP	2	2905.954	0.004	0.13	< 0.0001	+
COAST + CAR + NP	3	2905.95	0.000	0.13	0.0001	+
COAST + CAR + NP + MT	4	2907.391	1.441	0.13	0.0003	+
COAST + CAR + NP + MAS + MT	5	2909.291	3.341	0.12	0.0007	+
COAST + CAR + NP + MAS + TMF + MT	6	2911.282	5.332	0.12	0.002	+

Model Set 3	K^b	AIC	ΔAIC	R^2	$p-value$	***Linear Relationship***
Human Development Index						
NP + MT	2	1372.875	0.378	0.15	< 0.0001	-
CAR + NP + MT	3	1372.496	0.000	0.16	< 0.0001	-
COAST + CAR + NP + MT	4	1372.615	0.119	0.17	< 0.0001	-
COAST + CAR + NP + TMF + MT	5	1373.864	1.368	0.16	< 0.0001	-
COAST + CAR + NP + MAS + TMF + MT	6	1375.17	2.673	0.16	0.0001	-

- *Model terms are coastline length (COAST), coast/area ratio (CAR), number of ports (NP), market access subindex (MAS), total merchant fleet (TMF), and merchandise trade (MT).*
- K^b *= Number of parameters in model.*
- AIC *= Akaike's Information Criterion Score*
- ΔAIC *= The difference between AIC value of the best supported model and the successive models*
- *All models in the 95% confidence models set are included*

Table 4.4 *Model Results for Gross Domestic Product Purchasing Power Parity*

Model terms					
COAST	CAR	NP	MAS	TMF	MT
		6.720 (2.154)			-5.460 (3.349)
		6.342 (2.166)		0.006 (0.005)	-5.945 (3.359)
		6.236 (2.169)	-2.544e+02 (2.505e+02)	6.737e-03 (5.199e-03)	-5.182 (3.442)
1.079e-02 (9.109e-03)		**5.279 (2.311)**	-3.000e+02 (2.530e+02)	6.687e-03 (5.190e-03)	-4.633 (3.467)
1.043e-02 (9.166e-03)	1.431e+00 (2.849)	**5.120 (2.340)**	-3.197e+02 (2.569e+02)	6.450e-03 (5.228e-03)	-5.850 (4.238)

- *Where parameter estimates have been omitted in the table, those parameters were not in the model. Models are listed in order of performance (best to worst). Data were collected from 128 countries around the world*
- *Bold parameter estimates are significant at* $p < 0.05$
- *Model terms are coastline length (COAST), coast/area ratio (CAR), number of ports (NP), market access subindex (MAS), total merchant fleet (TMF), and merchandise trade (MT).*

Table 4.5 *Model Results for Gross Domestic Product Per Capita*

Model terms					
COAST	CAR	NP	MAS	TMF	MT
	67.28 (24.78)	**81.95 (23.58)**			
1.386e-01 (9.911e-02)	**6.657e+01 (2.469e+01)**	**6.942e+01 (2.514e+01)**			
0.1492 (0.1)	52.861 (31.0035)	**72.427 (25.5211)**			34.1583 (46.5554)
0.1535 (0.101)	54.318 (31.4745)	**71.454 (25.808)**	-878.4435 (2846.2150)		35.6164 (46.9658)
1.535e-01 (1.021e-01)	5.405e+01 (3.173e+01)	**7.120e+01 (2.606e+01)**	-8.665e+02 (2.861e+03)	5.436e-03 (5.822e-02)	3.544e+01 (4.720e+01)

- *Where parameter estimates have been omitted in the table, those parameters were not in the model. Models are listed in order of performance (best to worst). Data were collected from 128 countries around the world*
- *Bold parameter estimates are significant at* $p < 0.05$
- *Model terms are coastline length (COAST), coast/area ratio (CAR), number of ports (NP), market access subindex (MAS), total merchant fleet (TMF), and merchandise trade (MT).*

Table 4.6 *Model Results for United Nations Human Development Index*

Model terms

COAST	CAR	NP	MAS	TMF	MT
		-0.25244 (0.0597)			**-0.30002 (0.09282)**
	-0.11752 (0.07707)	**-0.23640 (0.06031)**			-0.19511 (0.11514)
-3.372e-04 (2.499e-04)	-1.069e-01 (7.722e-02)	**-2.085e-01 (6.356e-02)**			-2.175e-01 (1.160e-01)
-3.383e-04 (2.502e-04)	-1.013e-01 (7.758e-02)	**-2.025e-01 (6.403e-02)**		-1.219e-04 (1.439e-04)	-2.139e-01 (1.162e-01)
-3.101e-04 (2.529e-04)	-9.152e-02 (7.862e-02)	**-2.086e-01 (6.456e-02)**	-5.751e+00 (7.088)	-1.272e-04 (1.443e-04)	-2.042e-01 (1.169e-01)

- *Where parameter estimates have been omitted in the table, those parameters were not in the model. Models are listed in order of performance (best to worst). Data were collected from 128 countries around the world*
- *Bold parameter estimates are significant at* $p < 0.05$
- *Model terms are coastline length (COAST), coast/area ratio (CAR), number of ports (NP), market access subindex (MAS), total merchant fleet (TMF), and merchandise trade (MT).*

DISCUSSION

Maritime trade accounts for a majority of all international trade today and without quality ports to dock and distribute these goods, countries would find it difficult to prosper (Helmick, 2008). Due to the importance of maritime trade within the international marketplace, a multiple regression analysis was used to determine the maritime exposure of the 128 countries included in this study. The variables originally included within the analysis have varying degrees of significance or no significance at all.

Results from Table 4.3 show that all of the models have a significant positive relationship. After using the AIC^C score to determine which model has the best and most significant relationship between all possible models, it can be determined that the best-fit model includes the total number of ports, merchandise trade score, and GDP purchasing power parity. Of the original factors place in Model Set 1, number of ports and merchandise trade have the most significant relationship with, and effect on, GDP purchasing power parity.

In this first model set, the results show a clear and undeniable relationship between trade dependence, port infrastructure, and total production output. The $p - value$ of the best fit model within Model Set 1 is significant, however the R^2 only explains 9 percent of the variation within the model. The results show a relationship between the variables, however, it is not a perfect fit within the context of the predictor. This shows that while there is a clear and present correlation between the variables, these are not the only variables that determine the outcome of a country's GDP PPP. This shows that while we may use this model to predict the maritime exposure of a given country, the results will be inaccurate.

The best fit model within Model Set 2 shows a positive linear relationship between coast/area ratio, number of ports, and GDP per capita. In the context of this model set and

maritime exposure, geography and port infrastructure have a profound effect on GDP per capita. As access to coastal areas (coast/area ratio) and the total number of ports increase, per capita GDP PPP also increases. Within this model (CAR+NP), the $p-value$ is significant, however, the R^2 only explained 13 percent of the model variation. This again means that when using the regression model predictor, the results may not be accurate. While this model set shows a clear positive correlation between maritime exposure (coast/area ratio and number of ports) and GDP per capita, the predictors cannot be used to estimate future cases.

Model Set 3 shows that the total number of deep water ports and the merchandise trade score is the best explanation for maritime exposure when determining a relationship with the UN's Human Development Index. The best fit model within Model Set 3 is the best explanation for maritime exposure out of all of the models tested within this analysis. This particular model (NP+MT) shows a significant $p-value > 0.0001$ while the $R^2 = 0.15$. In context with this analysis, as the total number of deep water ports and the merchandise trade score increase, the Human Development Index rank (1-184; 1 being the best and 184 being the worst) decreases. This shows a clear negative linear relationship within the context of the Human Development index rank. While this particular model shows a much lower $p-value$ and a higher R^2 that the other models, only 15 percent of the variation can be explained. Results of this model shows that while a valid correlation is represented, the model itself is not an accurate predictor of future cases.

The re-occurring significant variable in each one of these model sets is the total number of deep water ports. The results of this analysis show just how important ports are to a given economy. According to DeSalvo (1994), "In the absence of the local port, local users of noncomparable imports would have to pay higher prices for imports since they would enter

through alternative ports, thereby incurring higher inland transportation costs." In order for countries to import products that cannot easily be produced domestically or export products at a competitive value, ports are a necessary function of a successful institution. Table 4.4 breaks down the multiple regression analysis within Model Set 1 showing that the one consistent and significant independent variable within the function of this analysis is that of deep water maritime ports. Within the context of maritime exposure and GDP PPP, the total number of ports within a country is the only significant independent variable throughout the entire model set.

The breakdown of Model Set 2 shows a slightly different story (Table 4.5). When comparing maritime exposure to GDP per capita, the number of ports remains consistently significant throughout every model tested. However, once market access, total merchant fleet, and merchandise trade are removed, coast/area ratio becomes significant. Model Set 3 results show that the number of ports are once again the only consistent significant independent variable when compared to the Human Development Index (Table 4.6). In this model set, merchandise trade becomes significant once all other variables are removed except number of ports. These model set breakdowns show that while these variables can be tested together and provide a significant $p-value$, the results are skewed by the total number of deep water ports.

All of the before mentioned model sets show that there is a significant linear relationship between the six factors presented in the original tests that were calculated against GDP per capita, GDP purchasing power parity, and the UN Human Development Index. However, some of the variables weighted the entire equation so that the results were not as significant if some variables were removed. Table 4.4 shows a breakdown of each variable included within Model Set 1 (GDP purchasing power parity). Variables with an individually significant linear relationship are denoted in bold type. Not all of the originally included variables were

significant, causing skewed results. For this reason, all of the variables were removed except for number of ports and merchandise trade.

The same criteria was used in Model Set 2 and Model Set 3. Tables 4.5 and 4.6 show different results. As in Table 4.4, the variables with a significant positive relationship are in bold type. Table 4.3 shows that while each model resulted in a significant calculation, the simplest model with the least number of variables provided the best results.

CONCLUSION

In this study, stepwise multiple regression analysis was used to investigate if a relationship between six independent variables (maritime exposure) and three economic prosperity measurements exists. The results show that a definite relationship exists between maritime exposure (the six originally-included factors), Gross Domestic Product purchasing power parity, Gross Domestic Product per capita, and the United Nations Human Development Index. This study provides results that can be used to help promote access to maritime trade.

While many of the variables provided in the initial analysis were removed from the model of best fit, this study has shown a clear relationship between maritime exposure and prosperity. Of the model sets tested, the best explanation of maritime exposure is the negative linear relationship that exists between the total number of deep water ports within a country, a country's dependence on trade as a percentage of its GDP (merchandise trade), and its Human Development Index rank. A negative relationship exists because the Human Development Index ranks countries from 1 to 184; 1 being the highest and 184 being the lowest.

In all three Model Sets, results show that there is a significant relationship between maritime exposure and economic prosperity. Unfortunately, not enough of the variability can be

explained so the regression analysis cannot be used to predict future outcomes. While there may not be a cause and effect relationship between these factors, the results show that there is an interesting correlation between maritime access and prosperity. Participation in world trade and location to water stands as a testament to economic success.

Location is an important aspect of any geographic study. In the study of international trade, an emphasis has been placed in the importance of economic policy. While this is an important aspect of international trade and prosperity, location has a profound impact on the ability of a country to participate in the international market. In order for all countries to succeed and prosper, access to deep water needs to be attainable. International trade is often seen as a competition, a zero-sum game between competing interests. This overlooks the underlying result of international trade: prosperity. If everyone has access to deep water ports and maritime trade, the cost of transporting materials throughout the world decreases. If the cost of transportation decreases, than profits increase and prices decrease. This allows all people to have access to goods from around the world and helps to bring prosperity to every nation participating in trade.

With as much as 75% of international travel and trade still taking place over international waterways, it is easy to see why it is important for a country to be located near deep water (Heiberg, 2012). A more geographic analysis shows that while a few landlocked countries have benefited from technological advances by participating in banking and money markets abroad, access to navigable waterways is still a necessity for most of the world. This study has shown that as the ability of a country to participate in maritime trade increases, it becomes more prosperous. Maritime exposure reflects this idea and shows that there is a direct correlation between location and economic success. While these findings are important, it will be necessary

to collect more data and develop a time study in order to see how this has changed throughout modern history.

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Chapter 5

CONCLUSION

Within the confines of this study, stepwise multiple regression was used to determine to what extent six factors illustrating maritime exposure relate to economic prosperity. Three economic prosperity measures were used to create three separate model sets. Each model set compared the six independent variables to Gross Domestic Product (GDP) purchasing power parity, GDP per capita, and the UN Human Development Index. The results of this test show a linear relationship between several of the factors and economic prosperity. These results can be used in further research and help to provide better access to maritime trade.

While the R^2 values of each model within the three model sets are too low to make any future predictions, there is still a significant correlation between the dependent and independent variable. The best fit model within Model Set 1 (Table 4.3) shows a significant positive linear relationship between the number of ports, merchandise trade, and GDP purchasing power parity. The best fit model in Model Set 2 shows a significant positive linear relationship between coast/area ratio, number of ports, and GDP per capita. The best fit model in Model Set 3 shows a significant negative linear relationship between number of ports, merchandise trade, and the UN Human Development Index rank. The negative relationship between these variables is due to a ranking system where 1 is the highest rank and 184 is the lowest.

Of the p-values in each best fit model, the relationship that exists between the number of ports, merchandise trade, and the UN Human Development Index shows the lowest and most significant value. This is the best explanation for the relationship between maritime exposure and economic prosperity. According to the results, a country with a high number of ports and a large percentage of its GDP attributed to trade should have a higher rank than a country with fewer

ports and a low percentage of GDP attributed to trade. In this best fit model, maritime exposure can be defined by the number of ports and the merchandise trade score of a given country.

Within the context of this study, each test shows an interesting linkage between geography and economic variables and how they affect prosperity. Under the current conditions of globalization and international trade, access to deep water ports and dependency on trade help to stimulate Gross Domestic Product and Human Development. When dealing with GDP per capita, results suggest that a country with a large number of ports and a high coast/area ratio benefits in a significant way. As access to water increases, per capita income also increases. With respect to GDP purchasing power parity and the UN Human Development Index, the results are evenly balanced between economic and geographic factors.

These results show an interesting linkage between economic principles in open trade, the reality of location to maritime coastal areas and prosperity. The anomalous results in Model Set 2 (Table 4.3) show that of all of the variables included in the original test, geography has the most significant correlation with GDP per capita. The total number of ports within a country may be more of an example of infrastructure rather than geography, however, a country or institution cannot have a deep water port if it does not have access to at least 30 feet of water depth. This makes it a very real geographic variable. When combining these results, one can see that location really does matter when determining the per capita prosperity of a country.

All three Model Sets show that there is a significant relationship between maritime exposure and economic prosperity. The variability within each model set explained a limited percentage of the variability. These results limit the understanding of the overall relationship and hinder the ability to predict future outcomes. These results show that while there is no cause and

effect relationship between these factors, there is still an interesting correlation between deep water access and prosperity.

The study of international trade often covers the comparison of economic policy and initiatives. While this is important to the evolution of modern trade policy, it often overlooks the underlying issue associated with the ability of a country to receive goods from the world marketplace: location. If every country had access to deep water ports and implemented free trade strategies, everyone would prosper. As more nations become involved in international trade and globalization, the price of transportation and goods decrease. The excess disposable income is then used to buy other innovative products.

Results in this study show that a larger number of deep water ports and more involvement in trade help to stimulate an economy. Foreign aid should be used to reinforce current ports in lesser developed countries, specifically small island countries. These maritime communities provide docking points for mariners between long hauls. Non-Governmental Organizations and groups such as the International Monetary Fund, World Bank, World Trade Organization, and the United Nations currently provide funds to many developing countries. These funds should be provided to these countries to help improve infrastructure in order to reduce the cost of transporting materials, but more importantly, should be used to build more ports so as to incentivize an increased involvement in maritime trade.

While some scholars argue that the root of economic stagnation in many landlocked countries is due to a poor relationship with neighboring maritime countries (Faye, et al., 2004; Srinivasan, 1986), improved alliances with neighboring countries do not solve the root cause of a torpid economy. An accurate solution to the underlying problem would be the relinquishment or shared responsibility of neighboring port systems. This would allow the landlocked country

access to valuable water resources and the ability to ship goods at a minimal cost. Those same countries would then be able to create and sell products at a cheaper rate. The neighboring maritime country would benefit from more competitive goods closer to home.

Most studies tend to focus on the economic portion of international trade. Many studies provide intriguing details on the effects of free trade and tariffs on economic output. In a more geographic perspective, many scholars have provided research on landlocked countries and resource wealth. While these studies are important, there is limited research in the realm of coastline length and coast/area ratio. Organizations such as the World Bank, the United Nations and the World Economic Forum have provided a wealth of information on economic policy, port structure and security, trade logistics, and government oversight. However, these studies have only looked at these factors individually. This thesis has provided a comprehensive explanation on how maritime exposure and location relate to prosperity.

The next step in the systematic research on maritime exposure will be to create a time study comparing results over the past few decades. This will shed some light on the effects of technological innovation and an ever-expanding trade network overseas. A time study will be able to use the same formula to determine if technology has either led to the decline of maritime trade or helped to stimulate overseas travel.

This study indicates a significant correlation between geography, trade interaction, and economic prosperity. An in-depth geographic analysis shows that while some landlocked countries in Europe have been able to benefit from international banking, the rest of the world finds it necessary to have access to navigable deep water ports and implement sound economic policy. Maritime exposure reflects the idea that as a country's access to maritime trade increases, it becomes more prosperous. While these findings are important, future studies will need to use

these results to determine if there has been any profound changes since the development of many of the technologies used today.

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