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Determining how Tertiary Education and Human Capital Formation Influenced Economic Expansion in Israel, Japan, and Norway from 2000-2010

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by

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Dr. Ryan Guffey, Dissertation Chair	4-11-14 Date
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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

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Signature: _____ Date: 4/11/14

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Abstract

Researchers have calculated the relationship between human capital development and economic output by various means of econometric modeling and by use of numerous indicators under the context of an assortment of human capital theory. This study was conducted to identify new interpretations of the expansion of human capital in the form of tertiary education enrollment in the countries of Israel, Japan, and Norway from 2000 to 2010. The researcher applied an OLS non-linear regression to establish four hypotheses, including modeling with regional dummy variables to generate point estimates for each country in order to analyze each country's educational policy implementation. The researcher collected data from UNESCO UIS, OECD, and the World Bank on tertiary enrollments, tertiary expenditures, and other measures utilized during modeling. Regional dummy variables allowed the researcher to calculate educational returns for five different regions: Africa, Asia, Europe and the United States, Latin America, and Former Communist countries. Optimization of tertiary education enrollment to maximize the real growth rate in each region was estimated and point estimates were computed for Israel, Norway, and Japan. Results indicated that tertiary education did in fact effect economic growth, but whether this growth was positive or negative was dependent on a country-by-country basis. Israel and Norway reported positive returns to tertiary education in terms of economic growth, where Japan exhibited negative returns to tertiary education in terms of economic growth. Government and educational policy recommendations were made based on computed outputs.

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Chapter One: Introduction

Background

Post World War II, governments have created, developed, financed, and supported education systems with political ministries, interest aggregation, and funding in an effort to create a knowledgeable society that can generate economic growth. The time, efforts, and funding spent on government education budgets is consumed with thoughts that the participants will produce a greater return on initially invested funds and that society, as a whole, will prosper. "Human capital accumulation can be an engine of economic growth, and the government as significant roles in providing formal education" (Naito & Nishida, 2012, p. 2). Tertiary educational enrollment is considered a form of human capital accumulation towards economic growth and development and is of particular interest in this research.

Recently, education policy trends have weighted the calculation of this return more heavily and, year after year, governments seem to place more efforts and funding in education systems to help achieve these goals. The Organisation for Economic Co-operation and Development (OECD) report, *Education at a Glance 2013: OECD Indicators*, began by explaining the necessity for governments to pay notice to international country and systems comparisons "as they search for effective policies that enhance individuals' social and economic prospects" (p. 3) in relation to building more effective and efficient education systems and better utilizing resources to cover increasing demands. Woodhall (2007) affirmed that many economists have conducted research and developed models for submission to governmental education departments and ministries, as well as large international agencies, with the intention of creating and

sculpting educational policy framework and offering calculated proposals for further changes. Further, researchers and major research institutions have collected enough data to evaluate whether this initial investment is valuable for different types of economies and are investigating which types of efforts are generating future economic growth. Institutions such as The World Bank, the OECD, and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics (UIS) collect significant amounts of data in order to create a better picture of the global economy and to help policy makers make better decisions regarding educational efforts; these data are collected from a collection of sources, including government agencies, census data collection, official survey responses, and research institutions and universities (The World Bank, About, 2012; OECD, n.d.b; UNESCO, About the UIS, 2012). Historically, researchers such as Schultz (1961), McClelland (1965), Barro and Lee (2010), Hanushek and Woessmann (2010), Krueger and Lindahl (2000), Becker (1993), Barro (2013) and numerous others have speculated upon how effective educational use of government funding is and which factors are more influential in determining how inputs contribute to obtain a certain level of outputs. This research study served to compare three countries' educational inputs and the relationship for generating outputs in the form of economic growth. Prior research (Schultz, 1961; Denison, 1962; Walters & Rubinson, 1983; Becker, 1993; Barro, 2013; Glewwe, Hanushek, Humpage, & Ravina, 2011) has explained this model through the terms of human capital and economic development.

Human capital, broadly, is the accumulation of knowledge and intelligence of an individual that is calculated by that individual's ability to carry out labor in efforts to generate economic value (Becker, 1993). Just as physical capital can be calculated,

human capital can be measured for the purpose of quantifying one's ability to produce labor by his or her knowledge capacity. Human capital theory proposes that the expansion of skills and knowledge creates a form of capital that is definable and valuable to society. This advancement of knowledge towards the benefit to the economy through educational efforts is explained by Adam Smith:

> The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise that of the society to which he belongs. (Smith, 1776/2005, p. 227)

More simply, knowledge acquisition through education contributes towards building economic capital within a society. T. W. Schultz (1961) noted that growth of fixed capital, such as land, labor hours, and physical capital, does not account for the large growth to economies over time, therefore human capital is the missing component in the equation; the productive capability of humans is worth far more than all other forms of capital combined (pp. 1-2). The concept of human capital is closely related to the rationale for the increase in participation in higher education through policy implementation and more extensive international awareness. If societies could learn to utilize human capital by a more educationally targeted and efficient means, economies would reap the benefits of a more knowledgeable society that can confidently and calculably add to economic output. Becker (1993) explained the phenomenal growth of the Asian nations, notably Japan, China, and Taiwan, which, while lacking natural resources, exuded an amazing potential through use of "a well-trained, educated, hard-

working, and conscientious labor force" (p. 24). This cycle of events justifies the exploration of expanding higher education to strengthen knowledge capacity and economic productivity via the medium of human capital acquisition.

Recently, with amazingly rapid expansion, tertiary education has been on track to become more of a universal right, rather than a privilege of few. In OECD countries, the expanding, developing market for tertiary education has become more focused on fostering quality and breeding academic excellence (OECD, 2013b). As internationalism and student mobilization increase, researchers are concentrating greater attention to how this affects everything from economic development to educational systems to classroom operations. Researchers, academics, governments, and Non-Government Organizations (NGOs) are spending much time exploring the roles of tertiary education at the regional and local levels, as well as how it will shape the future in terms of aggregate demand on society and the marketplace. Policy orientations incorporate the development of strategic plans, efficient funding management, accountability techniques, academic and non-academic quality standards, and compilation of data for further analysis and future recommendations. With constant changes in direction of students, mobility of information, and rising economic trends, colleges and universities hold the challenge of keeping up with the rapid pace of change while maintaining a high quality academic atmosphere.

Purpose of the Dissertation

Past research has concluded that there is, in fact, a positive correlation between educational attainment and economic growth, yet this research rarely delves further into this matter to explain how exactly education influences economic expansion and to what

extent does education effect economic output. The researcher conducted this study to identify new insights into the development of human capital in the form of tertiary education enrollment and the analysis of tertiary level educational policy implementation in the countries of Israel, Japan, and Norway from 2000 to 2010. After considering the facts, the researcher chose these three countries on the basis of similarities in educational tertiary enrollment, spending on tertiary education as a percent of GDP, GPD per capita, and government type and on the basis of differences in history of education and preceding cultural educational norms. The OECD report, *Education at a Glance, 2013*, (based on 2011 data) reported the percentage of the population between the ages of 25-64 who have attained a tertiary education, finding 46.4% in Israel (ranked 3), 47.4% in Japan (ranked 2), and 38.1% in Norway (ranked 10; (Table 1) (OECD, 2013b; Sauter & Hess, 2012).

Table 1.

Educational Attainment of 25-64 year-olds (2011)

Country	Educational Attainment of 25-64 year-olds (%)	OECD Rank
Canada	52.3294	1
Japan	47.4000	2
Israel	46.3969	3
United States	42.4484	4
Korea	41.4085	5
New Zealand	40.3327	6
UK	39.4124	7
Finland	39.3182	8
Australia	38.3421	9
Norway	38.0535	10
Ireland	37.7215	11
Luxembourg	37.0348	12
Estonia	36.3181	13
Switzerland	35.2043	14
Sweden	35.1744	15
Belgium	34.6130	16
Iceland	33.8693	17
Denmark	33.7020	18
Spain	31.5711	19
Netherlands	31.5470	20

(OECD, Education at a Glance 2013, 2013)
Note: See Appendix A for complete list of OCED countries and their rankings.

Each county holds varying levels of gross domestic product (GDP) per capita. In 2011, Israel's GDP per capita (current US$) was $31,282 (ranked 29), Japan's GDP per capita was $45,903 (ranked 19), and Norway's GDP per capita was $98,081 (ranked 2; (Table 2) (The World Bank, 2012b).

Table 2.

GDP per capita (current US$)

Country	2011 GDP per capita (current US$)	World Bank Rank
Monaco	171,465.45	1
Luxembourg	114,231.75	2
Norway	98,080.91	3
Qatar	92,501.50	4
Switzerland	83,325.93	5
Macao SAR, China	65,550.50	6
Kuwait	62,664.10	7
Australia	61,789.48	8
Denmark	59,889.01	9
Sweden	57,113.93	10
Canada	50,343.69	11
Netherlands	50,085.06	12
Austria	49,581.46	13
Finland	48,811.77	14
United States	48,111.97	15
Ireland	47,478.13	16
Belgium	46,607.69	17
Singapore	46,241.02	18
Japan	45,902.67	19
United Arab Emirates	45,653.09	20
Germany	44,021.22	21
Iceland	43,967.26	22
France	42,379.26	23
Brunei Darussalam	40,301.22	24
United Kingdom	38,974.32	25
New Zealand	36,253.92	26
Italy	36,130.45	27
Hong Kong SAR, China	35,156.39	28
Spain	31,984.73	29
Israel	31,281.47	30

(The World Bank, 2012b)

Note: GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.
Note: Only top 30 are listed; see The World Bank for the full list.

In 2009, the OECD average expenditure on tertiary educational institutions as a percent of GDP for Israel, Japan, and Norway (with source of funding) was 1.6% (1.0% public, 0.6% private), 1.6% (0.5% public and 1.1% private), and 1.4% (1.3% public and 0.1%

private), respectively, each hovering around the OECD average of 1.6% (OCED, 2012b). Israel functions as a parliamentary democracy, Japan as a parliamentary government with a constitutional monarchy, and Norway as a constitutional monarchy (Central Intelligence Agency, 2012a; 2012b; 2012c); each of these countries hosts a form of a ministry or department of education that is responsible for setting educational policy.

This research tests if it is, in fact, that increased tertiary education enrollment surreptitiously effects the expansion of human capital to eventually create an increase in economic output, most commonly reported in terms of GDP or GDP per capita. By researching three countries that have high levels of GDP per capita and are ranked near the top of the list of best educated countries in the world (based on percent of the population between the ages of 25-64 with a tertiary education), the researcher was able to compare and contrast policies, educational attainment, human capital development, and economic output to discern if these high levels of tertiary education were contributing to an increase in GDP per capita. A historical review of educational systems and policies and cultural educational norms aided in answering the question of how these countries came to have such high rankings in categories aforementioned.

Rationale

The rationale for completing this study was to research many aspects of tertiary education and economic conditions in three particular countries: Israel, Japan, and Norway, from 2000 to 2010. In order to create a better understanding of how Israel, Japan, and Norway have set themselves apart as top ranking educated countries, the researcher aimed to observe how higher education policy in the last ten years has produced education and economic advancements by calculating the relationship between

tertiary enrollments and economic output. The researcher also compared the relationship between educational achievement, tertiary government funding, and economic output in these three countries.

Several researchers have analyzed human capital and economic output, but most focus solely on the United States or the entirety of all OCED countries. For example, Walters and Rubinson (1983) explained the relationship between enrollments (primary, secondary), expenditures (primary, secondary), and economic output (GDP) in the United States. Barro (2013) focused on the relationship between quality (international test scores) and quantity (years of attainment) of education and economic growth (GDP per capita) for all OECD countries. Sheng-jun (2011) compared education and economic growth in Brazil, Russia, India, and China. Krueger and Lindahl (2000) explored the effects of levels of schooling on GDP per capita for all OECD countries, with a focus on the United States. Glewwe, Hanushek, Humpage, and Ravina (2011) studied the effects of resources in developing countries (in Africa, Asia, and Latin America) through educational outcomes. Currently, there are few, if any, studies that have completed a three country analysis of high GDP, high education achievement countries, and no studies to date have compared and contrasted Israel, Japan, and Norway and their linking of higher education to human capital to economic output. Studies with large numbers of countries in comparison provide a broad, overall picture of education around the globe, but do not allow for specific country details (i.e. policies, culture, history) to be compared. This study allowed for a more in depth perspective into how educational policies and cultural differences play a role into development of human capital and what

similarities and differences were realized that set these three countries apart as best educated countries in the world.

Hypotheses

H_1: There is a relationship between real growth rate from 2000-2010, population growth, and tertiary education enrollment, as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \varepsilon$

H_2: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, and GDP per capita in 2000 as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \varepsilon$

H_3: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, an interaction term, and regional dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \beta_{5\ \text{Interaction Term (Tert Edu Enrol 2000 * GDP per capita 2000)}} + \beta_6 D_{\text{Africa}} + \beta_7 D_{\text{Asia}} + \beta_8 D_{\text{Europe+US}} + \beta_9 D_{\text{Former Communist Countries}} + \varepsilon$

H_4: There is a relationship between real growth rate from 2000-2010, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, GDP per capita squared, regional dummy variables, and regional educational dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Tertiary Education Enrollment 2000}} + \beta_{2\text{Tertiary Education Enrollment 2000}^2} + \beta_{3\text{GDP per capita (PPP) 2000}} + \beta_{4\text{GDP per capita (PPP) 2000}^2} + \beta_5 D_{\text{Africa}} + \beta_6 D_{\text{Asia}} + \beta_7 D_{\text{Europe+US}} + \beta_8 D_{\text{Former Communist Countries}} + \beta_9 D_{\text{Africa Edu}} + \beta_{10} D_{\text{Asia Edu}} + \beta_{11} D_{\text{Europe+US Edu}} + \beta_{12} D_{\text{Former Communist Countries Edu}} + \varepsilon$

Note: GDP – Gross Domestic Product, see definition of terms.

Limitations

Data were accumulated for this research from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics (UIS), The World Bank, of which data is collected by each member country that is analyzed and updated by The World Bank Development Group, and the OECD, where data is collected from a

wide reaching set of statistical sources[1]. The data are only as accurate as the collecting member country, which may face difficulties in performing quality data collection. As a generalization, developing country data tend to be less accurate than developed country data, but this is not always the case (The World Bank, Data Availability and Coverage, 2012). The computed information has the potential to contain inaccuracies because of the possible low quality of data collected. Data that is collected improperly in one year tends to be corrected eventually, causing further inaccuracies in calculated models (The World Bank, Methodologies, 2012). Krueger and Lindahl (2000) remarked, "errors in measurement are inevitable because the UNESCO enrollment rates are of doubtful quality in many countries" (p. 18). McMahon (2004) notes that the data for education is not perfect even if using enrollment rates, attainment rates, or spending rates (p. 221). That said, the data presented are the most up-to-date and the most widely accepted; the use of this data is widespread even with potential looming inaccuracies. The researcher trusted that the data were accurate and claimed it acceptable to make assumptions from calculations. Chapter 3 continues the discussion of limitations of the data and of the model.

Definition of Terms

EFA – Education for All is a movement started at the World Education Forum in Dakar in 2000 with a goal to make basic education available for all children and adults; there are six goals that are to be met by 2015 that is headed by UNESCO (Education for All Movement, n.d.).

[1] See http://stats.oecd.org/source/

GDP – Gross Domestic Product

> GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used. (The World Bank, 2012a)

GDP per capita – Gross Domestic Product per capita

> GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. (The World Bank, 2012b)

Gretl - Gretl is an open-source program which stands for GNU Regression, Econometrics and Time-series Library; Gretl is similar to SPSS or STATA, but is a free statistical package found online.

Gross National Product (GNP) – "the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad" (The World Bank, 2012c). The traditional calculation of GNP is currently referred to as Gross National Income (GNI) in present use.

Higher Education – in most countries, it is synonymous with tertiary education, where in others (i.e. Great Britain), higher education includes undergraduate and graduate education, but does not include vocational education. For this study's purpose, it will use tertiary education to align with OECD verbiage. Higher education does not formally include vocational education.

Human Capital – the accumulation of knowledge, particularly from formalized education, expressed as the individual human capability to complete some form of labor that produces economic value to society (Becker, 1993).

Member Country – A country that is a member of the Organisation for Economic Co-operation and Development. There are 34 member countries currently in the OECD.

MGD – There are eight Millennium Develop Goals developed by the United Nations (UN). These eight goals were agreed to by all nations in the UN and reach out to the world's poorest of nations. A target date was set to the year 2015 for these goals (Millennium Development Goals and Beyond 2015, n.d.).

OECD – The Organisation for Economic Co-operation and Development arranges a formal opportunity for governments to collaborate on common issues and to discuss successes and experiences in one forum. The OECD provides policy recommendations in efforts to better the lives of all people living in each member country (OECD, 2013a).

PISA – The Program for International Student Assessment (PISA) is a test that measures skills in math, reading, and science of 15-year-old students and is organized by the OECD (Program for International Student Assessment (PISA), 2012).

Purchasing Power Parity (PPP) –

> Purchasing Power Parity is the rate of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives that show the ratio of the prices in national currencies of the same good or service in different countries. PPPs are also calculated for product groups and for each of the various levels of aggregation up to and including GDP. (OECD, n.d.a)

Tertiary education - broadly refers to all post-secondary education, including but not limited to universities; including public and private tertiary institutions, colleges, technical training institutes, community colleges, nursing schools, research laboratories, centers of excellence, distance learning centers, and many more (The World Bank, Tertiary Education (Higher Education), 2012).

The World Bank Group – provides economic and procedural support to developing countries with goals of reduction of poverty and societal progression. The World Bank Group consists of five organizations with 188 member countries who act as shareholders and policymakers, typically through each country's minister of finance or development (The World Bank, About, 2012).

USD/US$ - United States dollars. Data will be denoted if in this form with USD or US$.

Conclusion

The researcher conducted this study with an ability to replicate the model in mind. Israel, Japan, and Norway were starting points for analysis, where any of the 86 countries in the model could be tested for how tertiary enrollment and human capital drives economic growth. The implications of this model are valuable to governments, researchers, economists, educators, and other organizations that collect data and provide programs to initiate change in education systems. Organizations such as UNESCO, the OCED, and The World Bank offer data that is becoming more complete year after year with better collection processes and computational efforts. As this data becomes more abundant, researchers will be able to build an increasingly clearer picture of the role of tertiary education on a country-by-country basis, as well as creating the ability for governments to make better, more improved decisions on education policy. This study provided a glimpse into the optimization of tertiary education levels that develop into human capital in order to optimize economic growth, as well as providing more comprehensive data and outcomes to help prioritize preferential educational policy.

Chapter Two: The Literature Review

Introduction

Topic. Many researchers, economists, educators, politicians, and scientists have studied the idea of measuring the expansion of education in efforts to increase human capital in search of means to augment economic development. Just as an economy would invest in physical capital, education can be considered as a sound and justifiable decision of investment. In certain economies, this investment is large, in others, it is small, but educators and economists have spent years investigating where this investment best lies and where most efficient gains can be made in the best interest of society as a whole. As Stevens and Weale (2003) remarked, "if spending on education delivers returns of some sort, in much the same way as spending on fixed-capital, then it is sensible to talk of investing in human capital, as the counterpart to investing in fixed capital" (p.1). Governments must examine the positive externalities that create public gains that can be realized both at current times and into future generations. McMahon (2004) wrote often about market versus non-market benefits from education and how the size of different kinds of externalities provides rationale for political backing and government sponsorship. This research will examine tertiary education's role as a form of human capital development, in the economic growth rate regionally and in particular, in Israel, Japan, and Norway. Tertiary education enrollment from 2000 was compared with the real growth rate from 2000 to 2010 in efforts to determine education's function in regional advancement.

Method. When calculating human capital, there are generally two types of returns that scholars and economists assess. Psacharopoulos and Patrinos (2004) explained the first as the rate of private returns, which assesses the cost and benefit of education on an individual level, as one student taking on a personal investment, and the second as the rate of social return which calculates the cost and benefit from an economic view, or that of an entire society (p. 2-3). The rate of private return is measured to explain behavioral conditions, where the rate of social return is computed to prepare and advance educational policy, particularly in developing discussion of enlargement or reduction of different forms and stages of education. This research developed calculations based on social return to analyze past and future policy implementation. This social return, developed as human capital, is calculated as an endogenous variable as it is produced using resources, e.g. education. Knowledge becomes calculable as a positive, synergetic externality to society, permitting output to expand beyond previously measured inputs, such as physical capital. Psacharopoulos and Patrinos (2004) indicated through calculated human capital models that "there might be a social underinvestment in human capital formation" (p. 13).

This research follows in the path of other researchers in developing an aggregate production function in efforts to explain how different educational measures interact with GDP per capita. This method allows the researcher to observe many countries to calculate how tertiary educational measures have developed in the world, and in particular Israel, Japan, and Norway. The researcher used an OLS regression model and the statistical package, Gretl, to calculate tertiary education enrollment's relationship with economic growth. Different indicators were chosen based on previously tested models;

four hypotheses were noted important in explaining the role of tertiary education globally, and then on a regional basis. Point estimates were calculated based on results to give further information into tertiary education's relationship with growth in Israel, Norway, and Japan.

Purpose. In order to better understand the correlation between human capital and economic development, the researcher completed an extensive review of past literature based on this same concept. Hundreds of authors have written on the relationship between education and economic growth; many are unique in their own way and study certain aspects of education or other variables in variable complex manners. Many authors provide a series of indicators that they presume to be important in determining education's role in growth; several different theories are employed, as well as models, equations, and complexity in demonstration. This study reviewed several of these authors' work to evaluate their models and indicators in efforts to determine the most suitable way to compare tertiary educations role in economic growth in Israel, Norway, and Japan. It was beyond the scope of this paper to examine every single article or book on human capital and growth; therefore, major theorists and models were the focus. Each study reviewed gave the researcher insight into how best to model the relationship and how each study has evolved over time to give more understanding into the role of human capital and its effects on economic advancement.

Human Capital and Economic Development

Expansion of the Concept of Human Capital. Schofer and Meyer (2005) explained that fears of "overeducation" in the late 1800s and early 1900s were replaced in the 1960s with the theory of human capital capacity building and a sense of "unlimited progress" (p. 2). This notion was brought upon by a global shift in focus on human rights and building democracies, modern national and global development planning, and the capacity of science as a whole as it pertained to social science (p. 2). These great changes have been happening from the 1960s to current times where the focus has changed in societies and education lays the groundwork for this forward movement.

A great shift in the number of students participating in tertiary education worldwide happened throughout the 20th century in all types of countries, developed and developing, and this growth has not shown any deceleration. For several examples from a variety of regions, growth in tertiary education enrollment from 1970 to 2010 has increased by 10.34 times in Egypt, 19.79 times in Turkey, 20.96 times in Paraguay, 7.39 times in India, 126.14 times in Ethiopia, 5.49 times in Israel, 1.11 times in Japan, and 3.49 times in Norway (UNESCO UIS, 2013c). Many employment opportunities are founded on level of academic achievement, and many rely upon many layers of tertiary education. Expansion of tertiary education has created new courses of life for individuals and a revolution in the structure of the labor markets, which has created an infrastructure sustaining globalization (Schofer & Meyer, 2005, p. 4). Tertiary education has allowed for civilization to push through into the technology age and the global era. The labor markets have opened up to many new opportunities because of an increasing number of people involved in tertiary education, allowing for a more variable, dynamic, diverse, and

efficient work force. Because of this more complex and growing structure, labor markets have been able to proliferate creating massive booming industries that have never been observed previously. Because of proficient use of workers at varying ability levels, companies have made it possible to reach all ends of the world in the new age of globalization.

Schofer and Meyer (2005) observed three prevailing characteristics of the expansion of tertiary education: expansion of tertiary education exceeds any plausible reasonable independent variable at the national level, expansion is homogenous across countries, and expansion is highly concentrated around the time that followed World War II (pp. 12-13). The aforementioned fears of overeducation were lifted, and the static labor society without expansion of human capital was observed as outdated. Connotations of "education for all" and "lifelong learning" had become common language and were on the minds of burgeoning politicians. National logics and the construction of state design "made expansive change, rather than stability, the main focus of social policy" (p. 16). Global ideals concerning human rights and democratization created a substantial shift in the connotation of a more expansive education system that was increasingly more all-inclusive and focused on a broader portion of society. An expansion of the social world coming under the jurisdiction and convictions of scientists and scholars legitimized higher education as science. This concept brought forth the naissance of the novel idea that, perhaps, everyone could benefit in some fashion, particularly as they became more productive, from an increased education.

Definition. Human capital, broadly, is defined as the accumulation of intelligence and knowledge of an individual that is calculated by that individual's ability

to carry out labor in efforts to generate economic value (Becker, 1993). Just as physical capital can be calculated, as can human capital for the purpose of quantifying one's ability to produce labor by his or her knowledge capacity. Human capital theory proposes the notion that the expansion of skills and knowledge creates a form of capital that is definable and valuable to society. This advancement of knowledge towards the benefit to the economy through educational efforts is explained by Adam Smith, "the acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise that of the society to which he belongs" (Smith, 1776/2005, p. 227). More simply, knowledge acquisition through education contributes towards building economic capital within a society. Fisher (1906) stated that "wealth in its broadest sense includes human beings" (p. 51) and Becker (1993) went on to confirm that human capital theory focuses on "activities that influence future monetary and psychic income by increasing the resources in people. These activities are called investments in human capital" (p. 11). Schultz (1961) noted that growth of fixed capital, such as land, labor hours, and physical capital, does not account for the large growth to economies over time; therefore, human capital is the missing component in the equation. The productive capability of humans is worth far more than all other forms of capital combined (pp. 1-2).

The concept of human capital is closely related to the rationale for the increase in higher education through policy implementation and more extensive international awareness. If societies could learn to utilize human capital by a more educationally proliferated and efficient means, economies would reap the benefits of a more

knowledgeable society that can confidently and calculably add to economic output. Becker (1993) explained the phenomenal growth of the Asian nations, notably Japan, China, and Taiwan, while lacking natural resources, exuded an amazing potential through use of “a well-trained, educated, hard-working, and conscientious labor force” (p. 24). This cycle of events justifies the exploration of expanding higher education to strengthen knowledge capacity and economic productivity via the medium of human capital acquisition.

Krueger and Lindahl (2000) spoke to the question of deciphering such an educational equation, “Does it reflect unobserved ability and other characteristics that are correlated with education, or the true reward that the labor market places on education? Is education rewarded because it is a signal of ability (Spence, 1973), or because it increases productive capabilities (Becker, 1964)?” (p. 6). Spence (1973) also recognized that possessing a particular degree or level of education does not necessarily relate to an increase in individual productivity, but rather a unique credential that individual holds. However, Krueger and Lindahl (2000) concluded there is sound confirmation, based on calculations conducted, that investment in education, does, in fact, lead to considerable payoff, particularly for individuals who normally would complete only a low level of education (p. 43). Hanushek and Woessmann (2010) confirmed the use of human capital in economic growth theory; “Human capital has been a central focus of much of the recent growth modeling, and it is a standard element of any empirical work” (p. 5). When determining economic growth models, human capital cannot be overlooked as at least one of the factors of expansion, or potentially, reduction. “Accumulation of human capital as a factor of production can in turn affect the level of output and growth” (Škare**,**

2011, p. 671). Human capital accumulation can lead to innovation and technological advances that may have not otherwise been realized. Understanding the bridge between building human capital and increasing tertiary education is imperative in interpreting this study. Increasing tertiary education increases available human capital, therefore allowing economies to see advancement and evolution, calculable and incalculable, as the world moves forward into the future.

History of Use in Educational Theory. Education was meant to "instill…the virtues of work to encourage enterprise, innovation, and widening horizons" (Sanderson, 2007, p. 430). Sanderson reviewed the history of education and economics as economists' interest in education began to develop during the 1950s and 1960s. Books on education in terms of economic development became popular in the 1960s as Becker first posited the theory of human capital in 1964, and the OECD was founded and immediately established a Study Group in the Economics of Education in 1960 (Sanderson, 2007, p. 431).

An interest in increasing education for "third world" countries became present in efforts to increase industrialization and economic growth. "Growth could no longer be assured by inputs of land, labour and capital, there was a mysterious 'residual' factor – technical change, and the quality and skill of the labourer and entrepreneur created by education" (Sanderson, 2007, p. 432). Older economic thought and newer economic thought are not always in conjunction with one another, especially in the case of education and industrialization. While studies are important, history does not always repeat itself and transforming situations may create different outcomes for the same type of economic investigation.

Prior to World War I, historian and economist Derek Aldcroft voiced his opinion on the faults of the education system in the United States and the economic decline of the times. Sanderson explained that Aldcroft emphasized the lack of return to the economy relative to educational inputs. He contributed this to an academic system that only educated the smartest or the wealthiest, the poor quality of the education system, a disproportionate weight on the subjects of art and social studies in higher education, a lack of business education, and a loss of control to fashion a system that was more industry-oriented (Sanderson, 2007, p. 437). However, many others had alternative ideas about education in general and continued to make a case for human capital development and economic returns from that development.

Kantor and Lowe (2011) recognized Horace Mann's contribution to the study of human capital through the idea that not only would individuals benefit from increased education, but the economy as a whole could reap some benefits (p. 15). Throughout the years, educations role in society has changed as education is seen as a means for students to gain the skills and knowledge they will need in order to create personal opportunities and to enhance the state of the economy through increased production and innovation (p. 15).

Psacharopoulos and Woodhall (1997) and Olaniyan and Okemakinde (2008) explained criteria for investment in educational endeavors to produce positive economic returns:

> (1) Returns to investment, designated by the equilibrium between the opportunity costs of educational resources necessary for implementation and expected or anticipated future benefits;

(2) Indirect returns, in terms of how benefits will affect society;

(3) Individual, public, and private demand and supply of education;

(4) Distribution of wealth and financial burdens. (p. 160)

In economic theory, in order for the rationality of human capital theory to be upheld, the present value of returns to marginal educational investment must be shown to be greater than or equal to marginal educational costs to the individual and to society. This concept relates to previous discussion on quality of education, if policy regulates funding educational systems, returns must be calculated to be greater than costs, solidifying the policy implementation. Careful cost-benefit analysis must be conducted as well as widespread data collection and analysis to ensure rationale for investment in educational developments.

Human Capital Theory: Building Cognitive Stock. In understanding education's correlation with economic development, Olaniyan and Okemakinde (2008) asserted that education is a consumer good and a capital good, in regards to its utilization purposes as well as its function as a production input for goods and services (p.157). Economic and social renovation rely on human resource capacity production through education by expansion of abilities and maturity of knowledge. Olaniyan and Okemakinde (2008) continued, "positive social change is likely to be associated with the production of qualitative citizenry" (p. 157), as education is deemed to improve the quality of citizens, therefore increasing the standard of living, relating to increased economic success and income, in turn, increasing economic growth.

Olaniyan and Okemakinde (2008) defined human capital as "the investment people make in themselves that enhance their economic productivity" (p. 158) and rely

on the assumption that increased education, increased human capital, is essential to advancing a population's production capacity, as well as providing individual returns of achievement and success. "Human capital theory emphasizes how education increases the productivity and efficiency of workers by increasing the level of cognitive stock of economically productive human capability which is a product of innate abilities and investment in human beings" (p. 158). Investment in human capital depends upon the accumulation of knowledge from generation to generation, the introduction of new products and processes, and the innovation of products, ideas, processes, and methods in contribution towards economic development (Babalola, 2003).

Through a more educated and knowledgeable populace, several positive externalities of education are calculated, particularly in the areas of research and development and innovation. Olaniyan and Okemakinde (2008) wrote, "From this perspective, education is seen as an intentional effort to increase the resources needed for creating new ideas, and thus, an increase in education will directly accelerate technological progress" (p. 159). Product, process, and method development have been shown to have a direct correlation with educational levels, where countries with the highest levels of technological output hold the highest level of educated citizens (Van Den Berg, 2001). Alternatively, some countries have been found to not hold the same positive externalities from investment in education, as Olaniyan and Okemakinde (2008) assumed that this educational investment may have gone to unproductive activity, demand for education is very low, and/or a poor education system that has not sufficiently added to the knowledge capacity of individuals and has not increased skills or abilities enough to justify additional schooling.

Introduction of Calculation of Human Capital

Past research has concluded that there is, in fact, a positive correlation between educational attainment and economic growth, yet this research rarely delves further into this matter to explain how exactly education influences economic expansion and to what extent does education effect economic output. Understanding how to measure human capital is often misunderstood and frequently leads to disparities in calculating education's impact on economic growth. Measures of education have constantly been in question, and no one measure is considered the best. Baldwin, Borelli, and New (2011) presented three measures of education that contributed to their analysis, "we argue that thinking of educational spending, attainment, and quality *as different parts of a causal process* linking education to growth is more useful than thinking of them simply as alternative measures of education investment" (p. 227). These authors analyzed not only direct effects of education, but also indirect effects on economic growth.

Schultz (1961) contended that it would be archaic to simply examine land and capital as inputs and affirms that capitalists have not solely made their wealth upon identification and ownership of corporate stocks, but from the foundation and construction of a knowledgeable and skillful workforce who provide economic value (p. 3). Economic growth becomes limited if investment is lacking in the development of human capital by means of increased education and training. Schultz (1961) substantiated that corporate training programs must adjust to overall increased levels of education of employees and global transformations in the demand for essential skills, as well as advanced skills for certain positions, in order to utilize maximum efficiency of educated and trained workers. "In responding to these demands, we are heavily

dependent upon cultural and political processes, and these are slow and the lags are long compared to the behavior of markets serving the formation of nonhuman capital" (pp. 14-15). These political processes of changes in policy were examined and their lag behind the education curve was proven substantial. Schultz (1961) formulated several policy proposals including a change in tax laws to increase human capital, a decrease in unemployment as it causes impairment to acquired skills, a greater investment in human capital over physical capital in the workplace, internal migration to industrial areas, investment in education and health of poorer people (pp. 13-14).

Educational Development and Economic Growth Modeling. Walters and Rubinson were one of the first sets of authors to analyze the relationship between educational development and economic growth in terms of increased productivity as a whole. Previous models by Denison and Schultz were synthesized and altered to create a new model for consideration involving comparing two time periods between 1890 and 1969 with multiple levels of education, including primary, secondary, and tertiary education and their relationship with gross domestic product (GDP). Indications that several studies have been conducted to present the notion that increased education leads to increased salary have been consented upon, yet associating increased education with economic output is the goal at hand. Walters and Rubinson (1983) justified use of a production function because of its historic capability of relating educational expansion and economic production growth utilizing labor and capital as endogenous variables. As economic output historically was shown to grow faster than the combination of labor and capital, other variables, such as education, were drawn into the model.

Walters and Rubinson (1983) built their model around quantifying education separate from salary achieved, as well as including education as a variable in the production function (p. 482). An explanation of sources for data was given, "The data used in this analysis are annual measures of national economic output, labor and capital inputs, and educational expansion" (p. 482). Output was to be defined as GDP in total, labor input was measured as total hours worked per person per year, capital input was a measure of the market value of fixed assets in the economy, and education was measured by enrollment, degrees conferred, attendance, and expenditures (p. 483). The authors believed that if a student spends more time involved the formal education system, he or she will become more informed and capable, therefore eventually will become a more valuable employee. This leads to the conclusion that an increase in educational attainment should increase productivity and therefore economic growth (p. 483). Several measures were computed including primary and secondary enrollments, average attendance, expenditures, high school graduates, BA/BS levels, and masters and doctorate levels.

The authors chose a multiplicative regression model because of its dynamic capabilities as each variable was expected to adjust as different endogenous variables were analyzed; this type of model is called a Cobb-Douglas model. Time lags were not used with variables of labor and capital as these factors' outputs are 'immediate' where time lags were used in education variables as it takes time for educational attainment to permeate economic output (Walters & Rubinson, 1983, p. 484). Lags of ten and twenty years were reported for differing levels of educational attainment. In utilizing the Cobb-Douglas multiplicative regression model, natural logs were taken from both sides of the

equation and estimations were made using OLS regression methods. The authors used the Durbin-Watson statistic to account for first-order autocorrelation. Because of economic instability, specifically the Great Depression period, Walters and Rubinson (1983) predicted that their two basic models will be dissimilar within the two given time periods (1890-1928 and 1933-1969) even after eliminating collected material from 1929-1932 (p. 485).

In Walters and Rubinson's conclusions, they determined that "effects of education are not uniform but have varied considerably by level of schooling and by historical period" (Walters & Rubinson, 1983, p. 490). Findings of increased output based off doctorate level degrees with a ten year lag from 1933-1969 confirmed earlier formulated predictions of a potential increase in economic output from increased quantities of research and technology. Increased levels of doctoral research could lead to enhanced technologies and enlarged university infrastructure, which would in turn relate to increased economic growth (p. 490). When evaluating output changes based on secondary education levels, skilled labor was assessed, as availability of skilled laborers was a component as well as the need for skilled labor in society. "We cannot necessarily assume that the skill levels required for job performance have, in the aggregate, increased as a result of occupational changes in recent decades" (p. 490). Elite schooling versus mass education would be necessary to analyze in order to gain a better picture of how schooling is effecting economic growth. Mass education evolved during each of these specified time periods, as this relates to increased economic output based off of a more educated populace in general. As more people enter further education, testing of this model can prove that increased education is, in fact, contributing towards increasing

economic growth. Walters and Rubinson were one of the first authors to analyze the relationship between educational development and economic growth in terms of increased productivity as a whole. Previous models by Denison and Schultz were synthesized and altered to create a new model for consideration involving comparing two time periods between 1890 and 1969 with multiple levels of education, including primary, secondary, and tertiary education and their relationship with gross domestic product (GDP). Several demonstrated that increased education leads to increased salary, yet associating increased education with economic output is the goal at hand. Walters and Rubinson (1983) justified use of a production function because of its historic capability of relating educational expansion and economic production growth utilizing labor and capital as endogenous variables. As economic output historically was shown to grow faster than the combination of labor and capital, other variables, such as education, were drawn into the model.

Neo-Classical Theory and Endogenous Growth Theory.

Neo-Classical Theory. "There are two main theories with regard to the economic growth: neoclassical or exogenous growth theory and new or endogenous growth theory" (Sheng-jun, 2011, p. 189). Neo classical growth model advocates believe that long-term growth rates are determined by a particular "savings rate (the Harrod-Domar Model) or a rate of technical progress (Solow Model)" (Sheng-jun, 2011, p. 189). Škare (2011) confirmed the neoclassical growth argument in his research results that verify the relationship between human capital accumulation and output quantified in the form of GDP (p. 678). Endogenous growth theorists presume there is another piece to the puzzle

by involving human capital in the model as it improves and increases economic development.

Several models of economic growth theory have been designed and tested when assessing educations impact on the world economy and specific country economies. Each model provides unique output, but none has been deemed the best model for analysis. The most uncomplicated model is the basic aggregate production function, most commonly referred to for the purpose of this research, as a Cobb-Douglas Production function. A production function analysis can be calculated in a variety of ways, including by neo-classical growth theory and endogenous growth theory. Originally, neo-classical growth theory or the Solow growth model (also referred to as the exogenous growth model) examined growth of an economy in terms of production capacity, population growth, and physical capital accumulation. This model was developed from the prior work of Harrod in 1939 and Domar in 1946 as they explained that accumulation of capital (at this juncture, most commonly determined as physical capital) was explanatory in determining economic growth.

Solow added labor to the equation as well as allowing for capital fluctuations. Mathematical calculation of the Solow model is derived from the macro-production function, $Y = AK^aL^{1-a}$, where Y = total economic productivity, A = multifactor productivity, K = capital, L = labor, and a = production elasticity (Stevens & Weale, 2003, p. 6). The Solow model and the Harrod-Domar models were extended for education by means of the neo-classical growth theory and were improved upon by Mankiw, Romer, and Weil in 1992. McMahon (2004) suggested the use of the neo-classical model in order to minimize externalities (p. 228). Neo-classical growth theory

maintains that education is an element of production and therefore growth and it can be accumulated overtime to augment this growth. Accumulation of education has the ability to create different levels of an economy, or steady state output levels. Steady state is referring to the systems theory that as an economy with many moving parts and properties becomes static or invariable over time. Economies in a steady state are usually larger economies carrying a constant population size and remain at or beneath carrying capacity. As education is gained, the economy moves from one steady state level to the next, but once this next level of education is reached, no other growth is to be realized. This model is based on the law of diminishing returns, as assuming new accumulated capital is only covering depreciation losses on existing capital, hence creating a steady state economy. With zero educational accumulation, there is no growth in the economy, but when educational advances are acknowledged, a new, advanced level of the steady state is achieved. Stevens and Weale (2003) contributed that economies lie in different steady states because of differences in educational attainment (p.14). Hanushek and Woessmann (2010) explained that this theory produces the common approach of utilizing the relationship between changes in GDP per capita compared to changes in education as a measurement for economic growth.

Human capital theory states that human capital can increase economic benefits as it is developed into the future. Education is a form of human capital that traditionally positively influences economic benefits by increasing factors such as productivity and income per capita. As educational attainment increases, higher wages are distributed, these wages are spent in the economy and the economy expands as a whole. That being said, as the population increases, “neoclassical theory…suggests that population growth

causes the ratio of capital to labor to fall, therefore diminishing growth rates… and output per worker"; neoclassical theory also informs that income rises as a function of labor and capital as capital increases as a function of savings (Baldwin, Borrelli, & New, 2011). If all of the capital produced is consumed, there is still room for growth if there are reserves of savings held by the population. As this holds true for the exogenous growth model, the endogenous growth theory focuses on growth and innovation within the model, concentrated on by the likes of Lucas (1988) and Romer (1990).

Endogenous Growth Theory. Another model to be reviewed is the endogenous growth theory developed by Lucas (1988) and Romer (1990). Endogenous growth theory emphasizes education and its role in development of ideas and technology to increase the innovative capabilities of an economy; changes in technological capacities are "determined by economic forces within the model" or determined endogenously (Hanushek and Woessmann, 2010, p. 5). Economic growth is determined by investment in human capital and technology as well as the creation of positive externalities by knowledge acquisition and maintenance. Policy enactment plays a large role in the endogenous growth theory, as policy implementation creates enticements for educational subsidies, innovation, and research and development. Growth is determined by investment in human capital and other externalities from accumulation of education and the aforementioned diminishing returns on accumulation of capital are considered reduced. Endogenous growth theory is built upon the AK model, where $Y = AK$, Y = output per capita, A = technology, and K = human capital (Lucas, 1988; Romer, 1990). This theory leads to policy implementations that encourage open trade, competition, and technological advancements in efforts to augment development.

A major difference between the neo-classical growth theory and endogenous growth theory is the use of an exogenous technological variable in the former model and the use of a variable of human capital in the latter. Endogenous theory assumes that positive educational externalities can still produce growth even without a direct increase in education. Hanushek and Woessmann (2010) explained that this theory commonly utilizes the relationship between growth rates of GDP per capita and educational level.

Hanushek and Kimko (2000) rationalized their use of an endogenous growth model as developed by Nelson and Phelps (1966), Romer (1990), and Rebelo (1991), as explained, innovation is the main driver of increased growth rates which is "related to the stock of human capital either through research and development (R&D) activities or through adoption behavior" (Hanushek & Kimko, 2000, p. 1184). Romer (1990) presumed that growth is contingent upon the addition of new ideas and the number of people devoted to materializing those ideas. When a particular country focuses on the development of human capital, output and growth traditionally stay in parallel with this movement. Expansion of human capital requires constant growth of the stock of human capital, which can create complications from within the growth model. Researchers generally interpret human capital development in terms of intellectual capacity and quality in order to determine conclusions that can be less complicatedly interpreted. Investigations of practical uses of the endogenous growth model are exposed to an assortment of uncertainties and prerequisites in relation to the schematic properties of individual economies and to the abstruseness of each economy's foundationally causal framework.

Barro (2013) noted that past empirical studies focused on endogenous growth models where the growth variable in his research was determined from within the model. Barro stated,

> This framework used in recent empirical studies combines basic features and the neoclassical model – especially the convergence force whereby poor economies tend to catch up to rich ones – with extensions that emphasize government policies and institutions and the accumulation of human capital. (Barro, 2013, p. 302)

Understanding a country's ability to continue to grow with an increase in human capital as well as physical capital while still upholding the law of diminishing returns is imperative. Neoclassical theory goes hand in hand with older endogenous models as the former allows for comparison of growth across countries and the latter explains why economic continue to growth. Barro uses a simple equation to develop his theory based on the neoclassical growth model, "Dy=F(y,y*), where Dy is the growth rate of per capita output, y is the current level of per capita output, and y* is the long-run or target level of per capita output" (Barro, 2013, p. 303). Dy is inversely related to y as the former endogenous growth models sustain that diminishing returns allow a country's growth rate to be inversely related to its per capita output. Variables y and y* are generally highly correlated as more prosperous countries with high levels of per capita output often have high long-run targets for per capita output and vice versa. Dy increases with an increase in y* at a given level of y, where y* changes depending on government policy adjustment and the characteristics of the population (Barro, 2013). Changes in policy relate to rises in y, which over time, as y consistently increases, relates to an increase in y*, long-term

levels of per capita output therefore leading to an increase in overall economic growth over the long-term. Barro continued his work on this basic equation with colleague Lee to develop a more complete investigation of indicators that were considered significant in determining human capital and its impact on economic output.

Barro and Barro-Lee. As mentioned previously, it is important to note in detail two specific renowned researchers Barro and Lee in the areas of educational achievement and its relationship with different economic and societal trends. This research mirrored Barro and Lee's work in various ways, so it is important to note details of their investigations. Barro and Lee (2010) have included aggregate country data for analysis with the exploration of 146 countries from 1950 to 2010. Barro and Lee (2010) conferred that many well-educated people within a certain area will create a highly productive labor force for the alike area. Much research has attempted to precisely calculate economic outcomes and social effects of increased educational attainment, but Barro and Lee extend beyond traditional means of measuring gross enrollment ratios, similar to the research presented in this paper, as these do not accurately gauge the aggregated stock of human capital present concomitantly with production inputs.

Barro and Lee (2010) extended upon previous studies (1993, 1996, and 2001) by adding 41 countries to total 146 and add expanded data, disaggregated by age and gender (p. 1). This data was compiled from census data and is fashioned to create the Barro-Lee data set from which several other researchers now export data, such as Hanushek and Woessmann in 2010. With each new study, Barro and Lee updated this data set by comparing estimations of previous data with new data; correlation coefficients are used to compare the data. This construction of data allows for new estimates of mortality rates

and educational completion ratios by age. Barro and Lee (2010) utilized a simple production function approach, "measured by overall years of schooling as well as by the composition of attainment of workers at various levels of education" (p. 2). Major findings included the estimated rate of return on one further year of schooling is greater at the secondary and tertiary levels, over that at the primary level (p. 2). The researcher's model tested this conclusion, specifically examining Israel, Norway, and Japan, to see if the same holds true in these particular countries.

Barro and Lee (2010) summarized their findings as they computed that the global population aged 15 and over had an average of 3.2 years of formal education in 1950, 5.3 years in 1980, and 7.8 years in 2010 (p. 8). Developing countries have a much lower level of average years of schooling, calculated to have 7.1 years of formal education, as compared with developed countries at 11 years (p. 8). As expected, secondary and tertiary attainment levels account for most of the improvements to educational attainment in developed countries, where primary and secondary attainment improvements were noted at the developing level. Barro and Lee (2010) noted that the largest advancements in average years of educational attainment was logged during the years of 1970-1990 in both developed and developing countries (p. 9). Developing countries have increased literacy rates and developing countries have significantly reduced gender inequality in the last 60 years.

That said, there are still other educational concerns that need to be addressed; "The gap between developing and advanced countries in average years of schooling among the overall population over age 15 remains high (3.94 years in 2010) as it has narrowed by only less than 1 year in the past 40 years" (p. 10). However, this is most

likely happening because as students in developing countries increase their levels of schooling, students in developed countries are doing the same, as entrants into tertiary education in developing countries are multiplying precipitously. Based on calculations centered around determining outcome effects from an additional year of schooling, Barro and Lee found that world economic output would increase by about 2%; regionally, they determine that an additional year of schooling will produce the following increases in economic output: North Africa and Middle East, 7.8%; Sub-Saharan Africa, 6.6%; Latin America, 6.5%; East Asia, 10.3%; South Asia, 11.3%; and Europe and Central Asia, 8.5% (p. 17, 37). Tertiary educational rate-of-return was calculated as a 17.9% increase to economic output (p. 37). Barro and Lee concluded that their calculations and estimates provide much information on the link between education and many economic variables such as growth and political freedom. This research employed several econometric and variable building techniques from Barro and Lee's studies, as well as extended discussion of tertiary education and its specific role in the expansion of economic growth.

For the last 30 years, governments have focused much attention on the analysis of educational policies and their long-term effects on economic growth. If a country's economy grows quickly, is has been shown that it is more likely to be prosperous over a country with slow growth designation. In 2013, Barro produced work that further extended upon the focus on human capital and its role in creating long-term economic growth. Barro (2013) defined human capital to include education, health, and "social capital" and concentrates on educational attainment (quantity) and its relationship with international test scores (quality) (p. 301).

In the aforementioned study in 2010, Barro applied his neoclassical growth theory equation to 100 countries in calculation of effects from several government policies. Barro (2013) stated that several issues arose with the use of this large amount of data including inconsistent measurement of data from country to country across time and amplified measurement error in less developed country data (p. 304). Issues arose with "sorting out of directions of causation" as most government movement comes after the fact; a governments response to economic events often brings policy change rather than the opposite (p. 304). In this work, Barro considered three different periods, 1965-75, 1975-85, and 1985-95, where growth and ratio of investment to GDP were calculated in efforts to determine long-term growth rates of 100 countries collectively, then broken down into an OECD sample, rich country sample, and poor country example (pp. 305, 322). Panel regression data was used for growth rate data and investment ratio data where multiple independent variables are considered. Models were tested using three stage least squares where each observation was weighted equally.

Barro and Lee have been complimented for their innovative work by Hanushek and Woessmann (2008) in developing internationally comparable data by use of available data, as well as calculated enrollment data to fill gaps in census information; however, Hanushek and Woessmann discussed the use of enrollment data as deficient under the assumption that one year of schooling implies the same amount of knowledge from country to country, irrespective of the education system (p. 629). That said, this assumption is difficult to overcome, as data is widely available on enrollments and attainment, but is very irregular, incomplete, and potentially unreliable when considering other measures of quality or substance.

Barro (2013) considered many variables in his analysis in efforts to confer an overall picture of growth and economic development in countries across the globe. Barro (2013) found that although the relationship between growth rate and initial level of per capita GDP centered around a large group of countries is negligible, when all other variables were held constant, a strong relationship was noticed between growth rate and level of per capita GDP.

An increase in international trade traditionally was expected to increase growth within a certain country. This increase in trade promotes competition between nations and was therefore expected to create a more efficient system, a term referred to as "openness" where the ratio of exports plus imports is compared to GDP (Barro, 2013, p. 15). This ratio is generally smaller for larger nations and larger for smaller nations as larger nations can carry out more trade within their borders. Barro calculated that openness was statistically significant in the model and computes that as a country gets richer, openness was less of a determination of growth (p. 16).

Several other factors were analyzed in relation to economic growth in Barro's study including a focus on education. Education at each level is often heavily financed by governments therefore concluding that policy changes eventually cause changes in overall levels of human capital (Barro, 2013, p. 19). If a country has a higher human capital to physical capital ratio for a set GDP, the initial higher level of human capital "facilitates the absorption of super technologies from leading countries", but accumulation of human capital is much more difficult than the accumulation of physical capital (p. 20). It is also found that international test scores, an indicator of quality of education rather than pure educational attainment, indicate a greater increase in economic

growth over educational attainment, even as each relate to positive, significant increase in economic growth (p. 24).

Barro (2013) reported on the major findings of his research, "The data reveal a pattern of conditional convergence in the sense that the growth rate of per capita GDP is inversely related to the starting level of per capita GDP, holding fixed measures of government policies and institutions, initial stocks of human capital, and the character of the national population" (pp. 30-31). Barro created a detailed written presentation in his research of the rationale behind ratios, statistical outcomes, and creation of an understanding of how each variable or ratio works to create a whole picture regarding education and economic growth, which was vital to the research study presented.

Calculation of Human Capital and Economic Growth. Many other attempts have been made in using different types of variables to calculate the returns to education to society, but the challenge is ever present of which variables are best suited and provide the most information for the intended audience. McClelland (1965) observed that in the past many researchers have made attempts to quantify increases in Gross National Product (GNP) with a so called "'x' factor" by attributing this factor to increases in education, health, research, or otherwise. Notably when describing this factor with education, researchers can straightforwardly calculate educational outlay minus income forgone to compute the cost of education, but fail to gauge associations of the college-educated population such as socioeconomic status or increased parental intelligence (p. 258). A query is posed, "did increases in educational investment precede rapid rates of economic growth, or were rapid increases in wealth followed by increased spending on education?" (p.259). As well as the fact that often quantifiable demonstrations only prove

that richer countries spend disproportionately more on education that poorer countries (p. 259).

McClelland set out to understand the static relationship between education and economic output and to discern the dynamics of the ensuing changes. The author began with a valid discussion of the use of income per capita (or GNP per capita) as a measure of economic development and its particular downfalls. McClelland cited that not only is the calculation of GNP weak, as equating currencies while correcting for inflation and exchange rates and lack of precisely measures figures, but that economic development, in itself, "is a multivariate concept" (p. 260). A particular country's GDP, GNP, or GNI can be grossly exaggerated or under exaggerated based on resource availability and distribution of income. Examples were cited in countries such as Kuwait and Algeria (and more recently Qatar) which have vast natural resources, in said cases, rich oil reserves, or in other instances other precious metal resources that have been purportedly exploited by foreign countries (p. 260). Instead, McClelland used electricity consumption as an indicator for rate of economic development. Data on electricity consumption was more accurately available, can be computed with internationally analogous units, and was used in all countries in some varying fashion. McClelland generated this point in 1966, which may have been appropriate at the time, but given more recent trends in the decrease in the consumption of energy, particularly in highly developed countries, this indicator would most likely give insufficient results in the current global time.

McClelland (1965) continued with his discussion of calculating stocks, "the number of people in a country of a given age group at a particular time with" a particular

level of education, and flows, “a change… in enrollment ratios between one period of time and another” of education (p. 262). He attributed lag as an important function of his equation and after analysis concludes, “education is a long-term investment from the economic point of view” (p. 266). In discussing reliability of data, McClelland suggested that higher education data (or tertiary data) is much more reliable than other data sets. This reliability builds on the fact that available data for higher education is more wide spread, there is less ambiguity as to what ages qualify for tertiary education, and time lags are much shorter in determining impacts of this level of education. He finds that higher education is more closely related with measured achievement levels and technological growth over secondary education in the 1950s. McClelland (1965) computed a rough estimate of the economic return from a single year of higher education is two and a half times, or 12% (with compounding interest) more than the cost of education in 1950 (p. 276). Conclusively, it is determined that although these calculations show greater economic returns to education through comparison based on electricity consumption, the data is inherently wrought with errors and provides somewhat questionable results.

In discussing further modeling, Walters and Rubinson (1983) utilized a production function analysis to study the effects of education on the economy. “In a production function, economic output is modeled as a function of inputs into production, the two most basic of which are labor and capital” (p. 481). Cited materials from Schultz indicated that economists began examining education as a major economic factor when production functions were used to show that economic output increased more quickly than the rates of labor and capital (Schultz, 1961). Denison (1962) utilized a production

function to assess the impact of education on output by observing education levels of laborers. Additionally, Denison created an educational index "measured in terms of earnings differentials by years of schooling completed within occupational groupings" (Walters & Rubinson, 1983, p. 481). Denison's work deduced that education annually raised the quality of labor by .93% from 1929-1957, which in turn relates to a 23% contribution of education on production, the largest factor of production ever measured, as a 2.93% growth rate was observed during this time (Denison, 1962). Walters and Rubinson (1983) found several issues with Denison's research including estimates based on inferences about education and earnings, calculations based off inferences about educational returns affecting productivity aggregates, and an overall model based off assumptions rather than fact (p. 481-482). Basic human capital production models often over emphasize educations role in production differentiation. Proficiencies learned during years of schooling cannot be fully realized in production as well as decreased job availability and necessity could result in a decrease of production without a decrease in educational achievement. Recently, this issue has caused more problems in this sort of method as technology increases and skill levels necessary decrease.

Hanushek and Kimko (2000) have produced much research in the field of education and economics and stated, "If education is viewed as a direct input into production, then growth rates would be related to growth in the different inputs, and changes in the human-capital stock would be the relevant explanatory factor in growth" (pp. 1188-1189). In their study, the authors utilized two gauges of labor-force quality to measure interaction with initial per capita income, quantity of schooling, and annual population growth. The authors found three factors that are important in ascertaining

distinctions in labor-force quality: (1) enrollments at the primary level compellingly effect performance, (2) greater population growth rates generate lower work-force quality, and (3) distinctive variations between regions, particularly in Asian countries, have a relationship with performance (pp. 1193-1194). Labor-force quality was found to have a steady, significant, and positive relationship with economic output, as the endogenous growth theory is placed into practice in determining the role of increased stock of human capital to increase and stabilize rates of growth and income levels. These findings hold true for the three countries in review in this study, as Japan, Norway, and Israel rank 4th, 5th, and 26th, respectively, in terms of the calculated quality index (*QL2*), based on the testing of 150 countries (pp. 1206-1207). These quality measures can be further explored in Hanushek and Kimko's 2000 work, "Schooling, Labor-Force Quality, and the Growth of Nations."

Hanushek continued his work and paired with Woessmann in 2008 to research countries as a whole with variable levels of schooling. Hanushek and Woessmann (2008) attempted to uncover uncertainties encompassed in the development strategy of boosting schooling levels of entire populations of specific countries, particularly held in the approaches of UNESCO's Education for All (EFA) and the Millennium Development Goals (MDG). Ambiguities of this approach included that schooling levels vary widely in comparison of developed and developing countries, and many times these countries have expanded overall attainment levels without seeing associated economic gains. In developing countries, often educational policies are implemented with little or no gains observed based on projected student outcomes. Hanushek and Woessmann (2008) anticipated alternative measures of determinates of results and conclude that the

advancement of cognitive skills is the main issue in determining the relationship between education and economic output (p. 608). They claimed the use of educational attainment or enrollments may lead to misleading results as one year of education in Guatemala is not the same as one year of education in Japan; considerable disparities between countries may be substantially understated in the literature and may be painting a false picture of where the world stands today educationally, hence the rationale for Hanushek and Woessmann's use of cognitive skills in their modeling. The authors contended that including measures of cognitive skills provides a model that accounts for three times the variation of economic growth models utilizing school level attainment, including considerably more robust estimates to variations held within the model specifications (p. 609). Issues with this estimation included the widespread unattainability of this type of information on cognitive skills.

Barro and Lee (2010) commented upon Hanushek and Woessmann's research, as they explained that educational attainment lacks calculation of skills and experience, particularly after formal years of schooling, and does not take into account levels of varying quality from country to country. Barro and Lee (2010) concluded that human capital quality was rather varied in relationship between countries with similar quantities of educational attainment, even as human capital quality an educational attainment were highly correlated (p. 14).

Hanushek and Woessmann (2008) verified that cognitive skills have a significant and positive effect on economic growth as well as individual earnings, as they focus on policy implementation based on cognitive skills research over educational attainment as the main endogenous variable; "but it is not appropriate simply to presume that any

spending on schools is a productive investment. It is instead necessary to ascertain two things: how various investments translate into skills and how those skills relate to economic returns" (p. 616). The authors recommended that policy makers shift focus from attempting to increase number of years of schooling and concentrate on policy that strengthens quality and improvement of skills, particularly by providing incentives for improvements in student accomplishments.

Resource Allocation and Economic Growth. Education, as Harbison and Myers (1965) affirmed, "is both the seed and the flower of economic development" (as cited in Krueger and Lindahl, 2000, p. 44). Sanderson (2007) noted the relationship between education expenditures and growth cycles and found that in the United States, after 1945 public expenditures on education grew with economic expansion and these expenditures were seen as a producer of economic growth, rather than a correctional variable (p. 440). "This ingenious matching by various scholars of the statistics of education and economic growth over the long term has much to yield in throwing new light on the subject and all tend to confirm education as a significant contribution to growth" (p. 440). As noted in Sanderson (2007), Perkins measured GNP per capita, the percent of population involved in service and the percent of a particular age group in higher education and then measured these between low, middle, and high-income countries. Arguments have prevailed between researchers that even though higher levels of higher education generated higher GNP per capita in particular instances, potentially only countries with higher GNP's could afford to invest in higher education and therefore more of the population was involved in higher education therefore creating greater economic growth (Sanderson, 2007, p. 441). These arguments are ongoing, but studies

delve into this question with examination of resources and capacity of production of human capital.

Countries with minimal resources but substantial stock of human capital have been able to utilize international trade as well as educational gains to produce high economic growth rates, as seen in the case of Japan. Researchers study relationships between physical capital development and wage growth, educational rate-of-return, and correlations between educational attainment and many forms of economic progress in order to understand the underlying structures created by world economic systems. Škare (2011) identified seven factors that were observed in developing countries that shared similar growth rates of about 5%: (1) high net investment share in GDP, (2) low inflation, (3) trade balance, (4) highly educated population, (5) low population growth rates, (6) political stability, and (7) strongly independent central banks (pp. 668-669). These traits led to rapid growth; an emphasis was centered on the formation and maintenance of wage policies and large investments in education. Škare (2011) determined that, in Croatia, most economic growth was contributed to increased employment and that inadequate investment infrastructure has caused the country to be unable to realize its potential gains in growth from the amassing of human capital. That said, he still found that in the period 1950-2009, 30% of growth of GDP was contributed towards human capital increases in Croatia. He noted that it is better to study aspects of former socialist countries in making determinations of calculating human capital because of a determined "time lag before human capital becomes part of the total capital stock" found in previously socialist countries (p. 682). These results are important when considering other countries in

transition in determining how the role of human capital may be different, or the same, in these countries versus fully developed countries.

Countries around the world spend billions of dollars on educational expenditures, many without conclusively knowing about the outcomes of educational attainment and the individual's gain of human capital, particularly in developing countries. Mincer (1974) was the first to determine the correlation between years of education and increase in income at the individual level. Hanushek and Woessmann (2008) concluded there is a relationship between years of education and rate of economic growth; logically concluded as income levels rise, traditionally economic output grows concurrently. Glewwe, Hanushek, Humpage, and Ravina (2011) attested to these findings and pointed out that developing human capital within a country gives extant incentive to continue to invest in education and encouraging its citizens to further participate in educational efforts (p. 1). However, as international test scores (i.e. PISA) have occasionally shown, students' scores have tended to level off, or even decline, in some regions, even as enrollments have stayed even and expenditures per student have continued to rise (Glewwe, Hanushek, Humpage, & Ravina, 2011, p. 3). Hanushek and Woessmann (2008) stated that merely increasing time spent in school without regard to increases of quality in learning and achievement, holds little to no value. In high educationally achieving countries, increased enrollments do not necessarily correlate with increased test scores or achievement levels, and often times; the opposite is observed (Hanushek, 2008). "Again, however, there is little overall evidence to support a strong positive impact of school expenditures, a repeated finding in a wide range of review for developed countries" (Hanushek, 2003). Glewwe, et al. (2011) found that "In contrast to teachers'

education and experience, more direct measures of their competence, their knowledge of the subjects that they teach, shows very strong positive effects [on students test scores]" (p. 30). These results bring awareness to educational policymakers, who must be cognizant of up-to-date research and movement within the field. An interesting trend in research has led to considerations of organization within schools and within educational systems in efforts to improve student outcomes.

Universality, Loss of Educational Advantage, and Excess Supply. Covaleskie (2010) stated two important principles; one is that education is beneficial to the general economy and two, that education is good for the individual involved in gaining that particular education. The author stated that he found falsehood in the idea that the public supports funding of education because it believes that a more educated population will lead to a healthy economy, as a large group of students attend school for an extended period of time, those students will eventually create economic growth and the idea that individuals attend school and further education in hopes of an increased economic gain in their personal lives. It is argued that even if everyone had an equal education, some jobs would still pay more than others and education is only worth what it is relative to everyone else's level of education. Covaleskie (2010)

> argue[d] that what schools cannot do, should not be tasked with doing, and should not promise to do, is reduce inequality in the context of a broad socio-economic matrix designed to produce inequality; nor can it much reduce inequity when the means used to distribute inequality are themselves unjust. (p. 84)

Olaniyan and Okemakinde (2008) agreed in their discussion that an excess supply of education persons in a society has the potential to lead to unemployment and/or depressed wages and could limit economic development. Structural reforms are necessary in order for education to be more fully recognized to its potential in creating economic gains (Olaniyan & Okemakinde, 2008, p. 160). How much education is attained is only as importance as the relevant levels of education of surrounding employees in a particular work place. If a particular level of education becomes, in essence, universal, its advantage is voided as everyone holds at least that level of education and the corollary, if one particular education level is considered nearly universal and an individual happens to not meet that level of education, it is extremely disadvantageous for that individual in that setting. The Law of Last Entry implies that a particular educational level must be saturated by upper and middle class individuals before lower class citizens will attain this achievement. Therefore, when these lower class individuals enter and complete the particular educational level, the level becomes "universal" and no advantage will have been gained by the last group to enter and complete that level.

Covaleskie (2010) stated that the

> policy solution to the 'dropout problem' has been to expand educational opportunity, to make as least a high school diploma universal, when the problem is great inequality of both wealth and opportunity. As a solution to the problem of economic inequality, expanded access to education is useless because the high school diploma becomes worthless when it is universal. (p. 85)

As the last group enters and completes a particular level of education, considered a "target" of a certain level, that target shifts to become a higher level. This poses the issue that at every level of education, the target continues to be set higher and higher and lower degrees become universal and therefore worthless. Covaleskie (2010) admitted that the key to higher economic success in gaining a particular degree is to enter into an elite college, as seemingly these numbers will be restricted with attendance policies and strict entrance guidelines.

Covaleskie (2010) remarked upon Adam Smith and Karl Marx's idea that a lack of educational attainment is not what keeps wage rates low, it is the excess of labor in lower wage jobs that keep wage rates low (p. 87). This is a simple issue of supply and demand, with excess supply of any particular job wages are driven down until there are no more excess workers. The economy sorts out the supply and demand for a particular position rather than educational attainment determining supply and demand. The supply of jobs that pay under living wage ranges will still exist because there will still be a portion of the population willing to take these particular jobs.

A Nation at Risk: The Imperative for Education Reform (1983) is a policy document that makes the case that the overall level of educational attainment determines a particular country's wealth and continues the case that more and better education generates a more economically advanced society. Covaleskie (2010) goes on to explain that increased education is a positive at the individual level, but it does not alleviate the poverty situation in a society; in order for individuals to actually gain from an increase in education is to educate themselves even more so that they are more highly educated than the general population (p. 89). Individually, education will increase earnings potential,

but collectively, society stands at the same level because of the overall level of education has been raised, therefore the lowest standard has been raised, but poverty is still present.

"While it used to be we understood that more wealth led to more schooling, today it is thought that more schooling leads to more wealth," this changes the very definition of education (Covaleskie, 2010, p. 90). Education has traditionally be defined as schooling that is completed in order to train a person for his or her particular job field, but it is necessary to stop and think about this concept. This may have not been the case the early years of higher education and has become not the case in the present. The definition of education must again be redefined, and society must learn to modify their present notions on what education is to offer to society. Schools must remind the public and policymakers that education is the mission of the school and must be able to identify the purpose of schooling and the "nature of education" in order to build a more effective education system as a whole (pp. 93-94).

Economic and Government Policy. In order to understand the purpose of schooling and the nature of education, economic and government policy must be in alignment with current needs of the markets. Kantor and Lowe (2011) declared that constant economic struggles originate from weak labor markets, poor tax policies, and social disparity much more than the quality and quantity of education provided to students (p. 19). Kantor and Lowe (2011) go further to state that increased financing of schools is not the answer to the woeful educational predicament, but if governments could focus their efforts on creating an environment inside and outside of the classroom that would induce true intellectual learning, this could create a change in the academic environment and an increase in human capital in efforts to promote economic growth.

In terms of costs, Levin (2009) assessed the idea that increased graduation rates would contribute towards increased tax revenues and decreases in costs of public support in efforts to increase economic returns. Levin's focus was not only calculating educational contributions to society, but detractions from society based on insufficient education. The author considered access to education a subject of justice and fairness as well as a concern of investment. The notion of detractions from society was calculated in the form of higher costs to the general tax paying public, reduced tax revenues, and potential lost productivity from a particular individual as well as his or her personal loss of educational attainment (Levin, 2009, p. 5). Additional sources of economic funding include tax revenues and reductions in public assistance and public health costs. After compiling information on increased tax revenues, health savings, crime savings, and welfare savings, Levin calculated that every new graduate would generate, on average, economic benefits of $209,100 over his or her lifetime (Levin, 2009, p. 15). Reforms in current policy are necessary in order to realize these benefits and realization must happen across the board. Costs and benefits vary across different levels of government, but can be realized at each level; therefore, it is important to local, state, and federal government to conduct reforms. Increased access to education provides an opportunity for a greater abundance of students and can eventually lead to increased productivity, employment opportunities, better health, and less criminal activity in society at large (Levin, 2009, p. 16).

There is a growing problem between the practice of education and governmental policy. By defining human capital in terms of education, government investments in education can be compared to external returns from those investments. Tipenko (2005)

analyzed the return that the individual student receives from government spending and the impact on the macro level as a better educated workforce is in place that can lead to modifications in the economic environment (p. 8). The author claimed there is an additional financial benefit to gaining more education, but only after gaining a certain level of education is this seen as an "investment resource" (p. 8). He concluded that tuition should only be paid to achieve a post-secondary education if there is additional income expected as well as concluding that basic education should be offered to everyone equally throughout a particular country. Cost-benefit analysis and computing net present value are offered as sources to determine the correct weights for personal contributions to education.

Glewwe, Hanushek, Humpage, and Ravina (2011) focused on local decision making and the reduction of overarching policy implementation at the national or international level; contextually, policies carry different weights and outcomes in varying circumstances and it has been shown that more positive effects can be realized from local autonomy (along with accountability) in decision making efforts (p. 43). Local capacities and knowledge should be determining factors when policy is established. On a local level, policies must weigh the costs and benefits, particularly in developing countries, where resources are limited, yet maximization of positive outcomes can produce important results (p. 45).

In discussing the establishment of growth policies in developed countries, Hanushek and Woessmann (2010) explained that researchers have determined that few long-term growth strategies have been successful and most growth has been driven by short and medium term growth policies driven by major economic institutions (p. 1).

They explore the relationship between OECD countries and PISA test scores in order to determine the cogency of long-term growth policies in these countries. Results from the analysis show a robust effect of cognitive skills on economic growth, yet a much stronger relationship is determined between basic skills acquisition and growth and a weak, negative relationship is determined between higher skills procurement and economic growth (p. 3). Hanushek and Woessmann considered three components of the dynamic relationship between educational programs and economic growth, (1) cognitive skills improvement requires time, (2) the impression of these improved proficiencies cannot be comprehended or calculated until students enter the work force, and (3) innovation in technology causes economic vicissitudes (p. 3). In combining the aforementioned endogenous growth model and augmented neo-classical growth model, Hanushek and Woessmann considered the equation, "$growth = a_1\, human\ capital + a_2\, other\ factors + \varepsilon$" (p. 6), where endogenous theory explains that "rate of technological change and productivity improvement is directly related to the stock of human capital of the nation" (p. 6). By use of an initial income variable, thus creates the convergence of the two major theories.

In 2010, Hanushek and Woessmann revisited the idea of openness to trade and its significance on long term growth in developed countries and found that differentiations in developed countries is not as distinct as these types of countries have all reached high levels of openness to international trade and property rights security (p. 12). In measuring openness to trade, several factors are involved, including "tariffs, quotas, exchange rate controls, export controls, and whether or not a socialist economy" (p. 12). Overall, educational effects are much more significant than an included institutional

variable as a source of long-term growth in terms of developed, OECD countries, but inclusion of an openness factor when discussing solely developed countries, does not cause influence on long-term economic growth.

Discussing long-term growth of developed countries, Vadenbussche, Aghion, and Meghir (2006) discussed the innovation process versus the imitation process, in that the innovation process leads to greater advancement of economic growth in developed countries rather than the imitation process. This innovation process suggests that technological advancements are important in the growth of developed countries. In testing policy improvements, policy makers have frequently questioned whether efforts should be placed on primary, secondary, or tertiary educational efforts; Vadenbussche, Aghion, and Meghir (2006) found that developed countries who are employing the innovation process and who are near the technological frontier should focus on tertiary education to establish increasing economic growth. Hanushek and Woessmann (2010) verified that it was somewhat useless to analyze primary education's impact on growth in developed countries as it is considered universal for the most part.

When discussing how education specifically relates to growth in the economy, it is important to note that increased performance of students lead to a more skilled labor force (as new labor force entrants replace older, less skilled workers) which leads to an increased economic state in which advancements are made due to a more productive, more capable labor force. Hanushek and Woessmann (2010) executed different scenario analysis regarding increased PISA scores and found that in each type of scenario, GDP growth rose significantly due to increased PISA test scores. Results suggest the "net

present value of the education reform is between $164 trillion and $406 trillion [in OECD countries]" (p. 31); long-term reform is necessary to see the full impact of modifications.

Tertiary Education

Mobility of Human Capital. Education is determined as "both the main channel for socioeconomic reproduction and the main avenue for socioeconomic mobility" (Torche, 2010, p. 85). Highly ranked universities rely on the mobility of students and professors to create a culturally and intellectually diverse environment that lends a hand to maximization of an "institutions' knowledge networking capacity" (Salmi, 2009, p. 7). Olaniyan and Okemakinde (2008) commented upon tertiary educations ability to increase societal output and increase one's earnings potential, therefore improving employment opportunities, allowing for pecuniary (and non-pecuniary) returns as well as employment mobility and transferability (p. 160).

Family background heavily influences educational attainment, commonly known as inequality of educational opportunity. More recently, in many countries, family background has played less of a role in educational opportunity, and expansion of the overall education system has more heavily influenced more people to reach higher levels of educational attainment. Recent reforms in tertiary education have made it less expensive for students to attend school and have reduced class size "therefore equalizing educational opportunities" (Torche, 2010, p. 86). During an economic crisis unemployment increases, real wages decline, and income becomes more unstable, therefore decreasing a family's ability to be flexible with educational funding. Torche stated, "An economic downturn may also alter the opportunity cost and the (perceived) economic returns to education" (Torche, 2010, p. 86). This trend is found in developing

world countries and leads to the belief that an economic crisis can lead to long-term disparity in amassing human capital.

Global Trends in the Advancement of Tertiary Education. Many organizations have been analyzing trends in tertiary education with objectives to advocate for different types of educational needs. Walsh (2009) explained the role of education in an increasingly global economy and realizes the power of education over economic and social problems. "Embedded in all of these concepts and, it could be argued, emerging from them is the belief that access to knowledge and learning is a universal right, one of the key rights of the global community" (Walsh, 2009, p. 3). Ensuring global education creates an opportunity to harvest great knowledge and experience inbound wealth that can help originate a shift in global mentality and focus. Certifying a platform for higher education provides an arena of cultural respect, economic opportunity, equitable access, and an overall increase in the knowledgebase of the world. Educators must understand the complexities and challenges posited when contemplating access for all ages of students involved in higher education. "Globalization, defined as the flow of technology, economy, people, values, and idea across borders, is having a profound impact on most aspects of society and is a significant factor impacting the nature and function of higher education" (Walsh, 2009, p. 5). As learners in general are exposed to more international experiences, a new connection is created from student to educator and student to student, that must also be realized in higher education. These connections help increase knowledge flow and with overall conceptualization for those students who are entering formal and non-formal learning environments more than ever before. In many countries

such as the United States, Canada, and the United Kingdom, levels of older adults as students in higher education are increasing significantly (Walsh, 2009).

With this increase in demand for education by learners at all levels, education is evolving to become seen as a universal right, rather than a privilege of few; higher education systems are aiming to provide education to a much more substantial portion of the population to foster the movement towards mass education and to provide outlets for lifelong learning opportunities for adults (Walsh, 2009, p. 14). That said, this portion of the population remains underrepresented in the higher education arena. Universities are working towards goals of strengthening numbers of adult learners within the institution in efforts to provide increased local economic growth and future development of the local population. Many adults are searching to reposition their career, acquire current position modernizations, or to gain employment by involvement in continuing education. As global populations transform and evolve, worker skills will adjust with modern inventions and technology. These skills will need to be fulfilled by the current adult population in order to maintain the most efficient working population in efforts to maintain or increase economic progress. Many economies are experiencing increasing adult population levels and the necessity for further education, particularly tertiary education, for these individuals it is apparent (Walsh, 2009). These types of students will increase the diverse set of needs of learners in and out of the classroom where greater connections between studies and work must be formed, as well as an increased opportunity for self-directed learning that is found inherent to adult learning. Personalization and self-direction are imperative in all facets of education, including on

ground, distance, and online learning, and will eventually, if not already, be demanded by students across the globe.

Due to limitations of higher education systems in home countries or the perceived opportunities of an education abroad, traditional aged students are seeking opportunities abroad at higher rates than ever before (Mazzarol & Soutar, 2002). This increase has been driven by supply and demand factors within the education markets (Altbach & Knight, 2007). According to Van Vught, Van Der Wende, and Westerheijden (2002), given the transnational organizational precipitation of the supply side economics of cross border education, a growing trend exists in "international competition in higher education and an enhanced economic rationale for internationalization, as compared to the political, cultural and academic rationales which were the main driving forces for internationalization until recently" (p.105). With the liberalization of foreign markets, state regulatory environments and systems of education, the globalization and internationalization of higher education is being perpetuated by institutional agreements between local, state, and transnational organizations (Altbach & Knight, 2007).

Global Acceleration of Competition. The universities' role in knowledge accumulation towards advanced economic development is an important relationship to explore. With an increasing trend towards expansion of higher education, universities and colleges play a large part in the acceleration of competition between nations and global economic growth. Salmi (2009) affirmed the necessity of a robust human capital base, in conjunction with an apposite institutional system, a dynamic infrastructure, and a functioning structure for innovation, in the progression towards a knowledge-based economy (p. 2). Universities and colleges create a platform for competition,

development, and innovation that drive society forward. "Tertiary education helps countries build globally competitive economies be developing a skilled, productive and flexible labor force and by creating, applying and spreading new ideas and technology" (p. 2). Two international ranking systems were considered, the Times Higher Education Supplement (THES), basing judgment on research, teaching, international outlook, and knowledge transfer (World University Rankings, 2013) and Shanghai's Jiao Tong University (SJTU), which utilizes indicators such as Nobel Laureates on staff, citations of researchers, articles published, and per capita performance (About Academic Ranking of World Universities, 2013). In 2006, THES, ranked countries by institutions, with Japan at number six, Israel at number 24, and Norway at 27; where SJTU prepared the same research, with Japan at number three, Israel at number 12, and Norway at number 13 (Salmi, 2009).

Top education ranking countries, such as Israel, Japan, and Norway, hold highly ranked tertiary education systems that thrive on an elevated level of talent (students and professors alike), a plethora of resources available, and constructive governance (including space for flexibility) along with political infrastructure that encourages edification and the development of the education system in its entirety (Salmi, 2009, p. 5). According to Salmi (2009), these types of institutional systems traditionally rely upon four types of financing, including government budgeting, public and private research funding (e.g. grants), endowments and charitable donations, and tuition and fees (p. 7). As markets change, these streams of funding are relatively sound and continue to provide the financial backing necessary for the operations and expansion of these institutions. Countries with high levels of tertiary educational awareness have built in the capacity to

efficiently utilize funding as well as created the flexibility to respond to market shifts and necessitations. Often, leading tertiary education institutions hold qualities of "inspiring and persistent leaders, a string strategic vision of where the institution is going, a philosophy of success and excellence, and a culture of constant reflection, organizational learning and change" (p. 8). High level institutions thoroughly understand the power of competition, constantly balance and exchange academic capital, and fully comprehend, not only the vision of the university, but the value of cognizance of market trends and future forecasts.

Israel

Demographics and Educational Structure. Israel is found in the Middle East situated between Egypt, Jordan, and Lebanon and has been in constant religious struggle with the region for thousands of years. As of July 2012, Israel hosts a population of 7,590,758, a total land area of 20,770 square kilometers, and a population growth rate of 1.541% (Central Intelligence Agency, 2012a). Israel's resources are shifting from that of agricultural products, metals, and minerals to a more industry and technology based society. "Israeli research expertise, particularly in science and technology disciplines, receives worldwide recognition and has helped spur the development of a robust technology sector in the Israeli economy" (Heller, 2008, p. 2). Although Israel's economy held relatively strong through the current economic downturn with a sound fiscal policy, its inability to maintain peace in the region may be its own worst enemy. The tense geopolitical state of affairs the region is in has created a stressful environment for the economy and the education system alike (Volansky, 2007). In 2011, Israel's GDP was $239.8 billion, real growth rate was 4.6%, and GDP per capita was $31,500; the

preponderance of the labor force was employed in the services sector (82%), with the remaining 16% in industry and 2% in agriculturally related positions (CIA, Israel, 2012). In 2012, educational expenditures were situated at the OECD average of 5.9% of GDP, the literacy rate at 97.1%, and, according to the OECD report, *Education at a Glance 2012*, Israel was ranked one of the most educated countries in the world in 2012 (CIA, Israel, 2012; OECD, 2012b). Volansky (2007) explained that every university in the country was "included in the list of the world's 500 leading research institutions for 2005" (p. 2). In the mid-1990s, Israel's traditional structure of seven major research institutions and one Open University was expanded to form a more pluralistic structure with 65 institutions (Volansky, 2007, p. 11; Menahem, 2008, p. 507). This radical transformation of the education system also included the instituting of private universities and much greater diversification of the public university sector (Menahem, 2008). In the 2010/11 school year, the Israeli Central Bureau of Statistics cites there were 66 higher education institutions with 290,600 bachelors, masters, and doctoral students, and increase of 5.9% annually from 1990 (Higher education in Israel, 2012b).

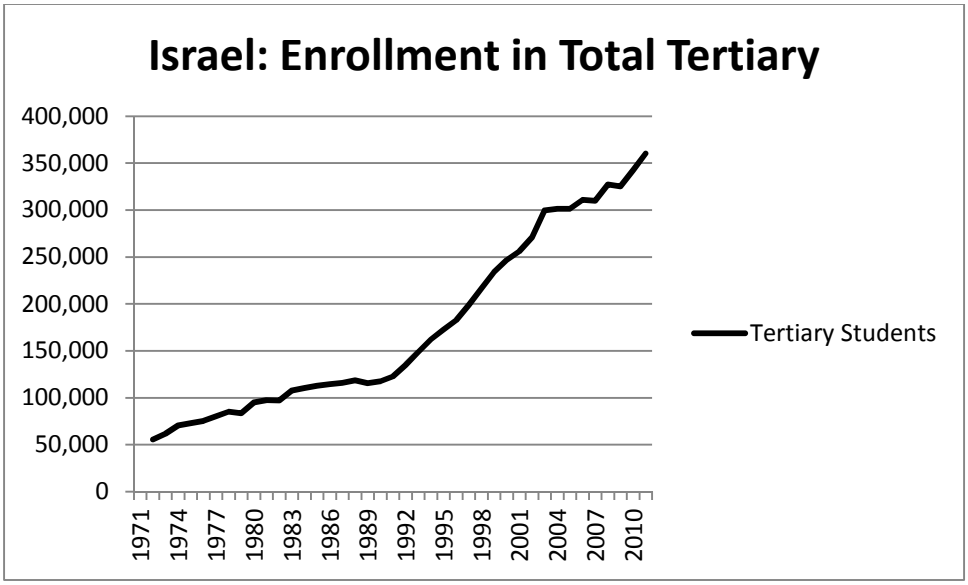

Figure 1. Israel: Enrollment in total tertiary.

Note: Public and private. Full and part time. Total. Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

The report also notes that the original seven major research institutions and one Open University have been expanded upon with 35 academic colleges (21 academic colleges and 14 private colleges) (Higher Education in Israel, 2012a) and 23 teachers' colleges. In the 2010/11 school year, 13% of students studied at a private university (compared to 75% in Japan and 8.2% in the E.U.) and 18% of students studied at the Open University; popular degrees included social sciences, management, and law and salary levels were 70% higher for higher education degree holders (Higher Education in Israel, 2012b).

<table>
<tr><th>Age</th><th></th><th colspan="3">Structure of the Education System: Israel</th></tr>
<tr><td>24</td><td rowspan="7">Higher Education</td><td rowspan="7">University</td><td rowspan="7">Open University</td><td rowspan="7">Post-Secondary Institutions</td></tr>
<tr><td>23</td></tr>
<tr><td>22</td></tr>
<tr><td>21</td></tr>
<tr><td>20</td></tr>
<tr><td>19</td></tr>
<tr><td>18</td></tr>
<tr><td>17</td><td rowspan="3">Free Education</td><td colspan="3" rowspan="3">Upper Secondary School</td></tr>
<tr><td>16</td></tr>
<tr><td>15</td></tr>
<tr><td>14</td><td rowspan="14">Free and Compulsory Education</td><td colspan="3" rowspan="3">Lower Secondary School</td></tr>
<tr><td>13</td></tr>
<tr><td>12</td></tr>
<tr><td>11</td><td colspan="3" rowspan="7">Primary School</td></tr>
<tr><td>10</td></tr>
<tr><td>9</td></tr>
<tr><td>8</td></tr>
<tr><td>7</td></tr>
<tr><td>6</td></tr>
<tr><td>5</td><td colspan="3" rowspan="4">Public Kindergarten</td></tr>
<tr><td>4</td></tr>
<tr><td>3</td></tr>
<tr><td>2</td></tr>
</table>

Figure 2. Structure of the Education System: Israel.

Note: Adapted from the Israel Ministry of Foreign Affairs, 2010.

Education Policy. Education has continued to play a major role in Israeli society as its founding universities focused on engineering and the sciences and is seen by the people to be an instrument to guide the country into the future. Since 1958, all higher education institutions operate under the Council for Higher Education (CHE), instituted in accord with the Council for Higher Education Law 5718-1958, which was put in place to ensure an outside party, beyond the ruling party, could counsel government officials in

educational development and financing affairs (Council for Higher Education Law 5718-1958, 2013; Israel Ministry of Foreign Affairs, 2010; Menahem, 2008; Sprinzak, Bar, Segev, & Levi-Mazloum, 2004). The formation of the CHE was brought upon by the Council for Higher Education Law, passed in 1958, as the universities commanded more autonomy and the government mandated greater control (Menahem, 2008, p. 507). The goal of the CHE was to launch an independent organization to act as a liaison between the government and all Israeli institutions of higher education; the CHE was initiated to assist in policy concerns with expert conversation, ensure independence of the education system, and preservation of the diversity of the student population in Israel (Council for Higher Education Law 5718-1958, 2013). The CHE is responsible for new development and expansion of all universities. This CHE is defined to execute the following tasks:

> To make proposals for the advancement of scientific research and regarding the establishment of further institutions of higher education; to accredit an institution as an institution of higher education subject to government approval; to grant permits for the opening and maintenance of higher education institutions; to empower recognized institutions to award academic titles; and to make proposals for the enlargement, improvement and mutual cooperation of higher education institutions in the field of teaching and research. (State of Israel– owl – Ministry of Education, 2006; Council for Higher Education Law 5718-1958, 2013)

All budget proposals must go through the Planning and Budgeting Committee (PBC), which operates as an intermediary between institutions and the government, and this committee makes funding allocation decisions; funding for higher education comes from

70% public funding, 20% tuition, and 10% private sources (Israel Ministry of Foreign Affairs, 2010; Sprinzak, Bar, Segev, & Levi-Mazloum, 2004). Students are charged a uniform tuition rate for all fields of study and foreign students are charged 25% more than domestic students (Tuition, 2012); in the 2011/12 academic year, tuition was approximately $2,620 USD (Higher Education in Israel, 2012a) Students at private universities are not legally allowed to be charged more than 25% in excess of tuition at a public university (Menahem, 2008, p. 508; Higher Education in Israel, 2012a). In 2010, a new six year budget was endorsed by the PBC in efforts to recruit leading researchers and professors and to improve diversification of minorities in universities and colleges (Higher Education in Israel, 2012a).

Historically, Israel has been observed as a self-regulated and a highly unitary government. With these high levels of regulation, government expenditures were highly standardized and the Israeli economy was favorably protected from foreign competition as it maintained a high level of monopolistic dominance (Menahem, 2008, p. 508). Clashes between reforms have been documented, as some citizens viewed higher education as a public good, while others preferred a more non-institutionalized organization with focus on individual access to tertiary education. Israel went through three phases in the education system, diversification, with the great expansion of the number of universities, privatization, with the introduction of private institutions, and internationalization, with the emergence and the sanctioning of foreign institutions (Menahem, 2008, p. 510). The diversification stage was brought upon by an increasing number of students aspiring to attend university, a demographic increase in the population, and an influx of immigrants from Arab and Russian states. Privatization

allowed for private institutions to be overseen by the CHE, but not funded, and to allow degrees to be granted; the internationalization stage was introduced by the induction and accreditation of foreign universities into the higher education system (Davidovitch, 2011, p. 127).

Political Educational Structure and Challenges. Israel has a distinct avenue that every person must go through at the age of 18. Men must serve an obligatory military service for three years and all women must serve for two years. Presently, students are engaging in higher education in search for a career, where previously, students' intent was purely of knowledge acquisition; in 2010, over 50% of the current 20-24 year old population was enrolled in a post-secondary institution (Israel Ministry of Foreign Affairs, 2010). As of 2012, 46% of 25-64 year olds had attained a tertiary education, placing Israel third out of 41 countries surveyed (OECD, Education at a Glance: Israel Key Facts, 2012). Israel has eight universities with many colleges under university control and each of the university programs is under strict control of the Ministry of Education in forming programs and setting academic courses (State of Israel–owl – Ministry of Education, 2006). Each of these universities must attempt to lead their students into a modern age of thought for the country. Israel's people and government are focused on building a strong, equal, and forward-thinking assemblage of students, who are inherently culturally diverse, and must learn to become globally sophisticated and progressive intellectuals amidst a region of sporadic hostility and vague insecurity. "Israelis live in constant uncertainty emerging from the unstable political context, accompanied by anxiety caused by the absence of peace and security" (Eilam & Ben-Peretz, 2006, p. 28). Israel's population is one that has been in constant change for many

years, with a strong influx of immigrants and a resilient union with religion. After the establishment of the State of Israel in 1948, there was a mass immigration of people of Jewish heritage "from a Sephardic (North African or Asian) background" that created considerable changes in the country's demographic construct; this was followed by another wave of immigrants from the former Soviet Union and Ethiopia that formed a Jewish educational sector, which spoke Hebrew, and an Arab educational sector, which spoke Arabic (Eilam & Ben-Peretz, 2006, pp. 30-31; Volansky, 2007). Not only did this create multiple sectors, but most immigrants did not speak the native tongue, severe social disparities emerged, and difficulties arose in maintaining high educational expectations at the national and international levels (Volansky, 2007, p. 3). Immigration into Israel has been substantial, creating a challenge in educating students in betwixt many clashing cultures and customs (Davidovitch, 2012, p. 30). The fusion of these groups has created governmental, religious, and ethnic clashes that seem to persist through years of attempted collaboration and external evaluation. Education has not escaped this conflict. Further controversies arise pertaining to one's personal views of education as supporting economic growth, versus education's role in observance of societal equality where all students maintain a uniform advantage (pp. 31-32). Davidovitch (2012) stressed the need for the facilitation of equal opportunities and the preservation of cultural authenticity and unique features to preserve the historical importance of education (p. 31).

Eilam and Ben-Peretz (2006) go on to explain three educational needs that Israel must meet in order to alleviate the abovementioned tensions: (1) The need to achieve greater unity and equity within Israeli society, (2) The need to attend to diverse

perspectives and modes of learning and instruction due to differences in individuals ethnic and cultural backgrounds, and (3) The need to cope with social tensions concerning educational issues that evolve from diversity (pp. 32-33). Israel has constituted themselves as a country set on values of collectivism and social justice, yet as globalization become increasingly important, a shift to a more capitalistic society is in place. Eilam and Ben-Peretz (2006) believe that Israel must close educational gaps that cultivate from economic gaps created by capitalism in order to grant equal access to education and to match job market requirements, the authors also believe universities should focus on building and maintaining science and technology programs to meet the growing demand of the job market into the future (p. 35). With present tensions high and uncertainty looming about the future of Israel, it is difficult to foresee what will be in store for students currently involved in higher education. That said, a compelling commitment to the education of society and the preservation of organization amidst chaos appears to keep Israel's education system among the best in the world.

Liberalization and Privatization. The future of Israel's higher education system lies in its recent transformation towards liberalization and privatization, driven by entry into the competitive, market-driven economy. This shift has propelled Israel into a "competition state", where "the new vision recommends privatization and the import of foreign institutions of higher education" (Menahem, 2008, p. 514). The Council for Higher Education has emphasized a decrease in the number of undergraduates at public institutions and an increased representation from private and foreign institutions on the CHE (Menahem, 2008). The government has stepped in to further regulate the financial stabilization of the system with efficiency building measures, most notably in the Maltz

Report. These altercations and amendments to the higher education system are constantly evolving and expanding within the Israeli system. The struggle between government position and institutional position is ongoing, yet both attempt to set a more diversified and internationalized system in place. These educational struggles persist in several areas, including funding, unregulated growth, quality, access, and policy infrastructure (Heller, 2008). Governmental infrastructure set for higher education institutions has been lacking, particularly in the funding region, but the CHE has made changes towards becoming a more operational member in developing the relationship between the government and higher education institutions (Heller, 2008).

Davidovitch (2011) questioned whether the government should intervene in higher education with stricter regulation and control. Davidovitch (2011) noted many changes that have been taking place within the higher education system that may create an issue with an unregulated academic market. Changes include an escalating numbers of students, modifications in legislation, alterations of regulatory policy, and transformations of the "defined goals of higher education" (p. 125). The substantial growth of the Israeli higher education system has created a commotion of accessibility and regulation.

> A lack of clear, uniform policy on the relationship between market forces and governmental supervision creates tension between the government, the universities, and the private institutions in Israel, which concurrently seeks to endorse globalization and extend access to higher education, yet continues to discriminate among the different classes of higher education institutions. (Davidovitch, 2011, p. 130)

Higher education institutions seek to become more self-sustainable in efforts to preserve some self-control and maintenance of current academic capacity of students. Options of increased governmental control versus deregulation are still main issues in the Israeli higher education system today, increased access and equality remains a concern at large, but movement towards privatization, capitalism, and institutional control seem inevitable.

Japan

Demographics. Japan is located in Eastern Asia to the southwest of China and Korea, situating it in a prime location for trade and developing authority. Japan has matured into a world economic power through its growth in the manufacturing industry and its capacity to produce innovative products and innovative minds. Japan has realized tumultuous financial and economic conditions in the past two decades due to rapid expansion after World War II and traditionally has concentrated on research and development as well as exports of products in the areas of science and engineering to counteract a severe lack of natural resources on the meager island. Japan has a population of 127,368,088 (July 2012), a total land area of 377,915 square kilometers, and a population growth rate of -0.077% (CIA, Japan, 2012). Japan's GDP in 2011 was $5.773 trillion with a real growth rate of -0.8% and $34,700 GPD per capita with 69.8% of the population employed in the services sector and 26.2% employed in industry (CIA, Japan, 2012). A negative real growth rate raises a red flag regarding the future of the country and how the government will continue to cover its expenditures, particularly educational expenditures. In 2012, educational expenditures were 3.5% of GDP, ranking as one of the countries with the lowest percent of GDP spent on education expenditures in advanced nations, but still holding one of the best education systems in the world

(CIA, Japan, 2012; Kitagawa, 2009, p. 257). A negative growth rate and expanding public spending coupled with an aging population will require additional investment from outside sources beyond governmental financing if Japan continues on its current fiscal trajectory.

Educational Structure – MEXT. Japan's higher education system is organized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) who aims to accomplish high levels of academic rigor and extensive development of knowledge. The higher education system aims to supplement the government's efforts in areas of science, engineering, research, and development. This high-level research is meant to increase human knowledge and to enhance economic development and innovation throughout the country (Overview, n.d.).

> MEXT seeks to guarantee the quality of universities and improve educational ability, while at the same time supporting the reforms taking place at various universities, including the development of universities based on individuality and unique character, and enhancements to international competitiveness. (Overview, n.d., p. 1)

The Japanese education system, as well as the economy, thrives on this ability to create inventiveness and uniqueness that drives the nation forward in economic prosperity and educational ranking. A quality assurance support system has been constructed to check for quality in the system through the Standards for Establishing University, the Establishment-Approval System, and the Quality Assurance and Accreditation System in efforts to improve international recognition and to keep up with the competitive nature of education abroad and to create an increasingly efficient system (Overview, n.d.).

Currently, students begin their track in higher education in Japan after completing 12 years of primary and secondary education. Nearly "one third of high school students attend private institutions" creating a highly stratified group of students entering higher education (Teichler, 1997, p. 281). Students study extensively for a comprehensive, extremely selective entrance exam that will determine if the student will attend a national, public, or private institution, considering passing. Teichler (1997) explained the five examination subject areas as "Japanese language, foreign language, social studies, mathematics, and science" (p. 282). As can been noted, clear-cut concentration is focused on the languages, science, and math, the areas that have driven, and will continue to drive, the Japanese economy into the global forefront. This is a "one chance" examination that differentiates students "on the basis of status of institution" (Marginson, 2011, p. 594). The examination leads to entrance at an institutional level or certain students attend an examination "cramming school" to prepare to take the entrance examinations again (Teichler, 1997, p. 282). Marginson (2011) described this process, "The examination mediates social competition in education and focuses the investment by families, while legitimating the university hierarchy and harmonising [sic] educational/social outcomes on behalf of the state" (p. 594). Once admitted, traditional degrees of bachelor's, master's, doctorates, and professional degrees are offered with other specialist's degrees and certificates available; 70% of the 18 year old population bracket were enrolled in universities, junior colleges, colleges of technology, and specialized schools placing Japan in 2011 into a stage of near universal access to higher education (Higher Education in Japan, 2012).

<table>
<tr><th>Age</th><th></th><th colspan="3">Structure of the Education System: Japan</th></tr>
<tr><td>24</td><td rowspan="8">Higher Education</td><td rowspan="7">University</td><td rowspan="7">Junior College</td><td rowspan="7">College of Technology</td></tr>
<tr><td>23</td></tr>
<tr><td>22</td></tr>
<tr><td>21</td></tr>
<tr><td>20</td></tr>
<tr><td>19</td></tr>
<tr><td>18</td></tr>
<tr><td>17</td><td rowspan="3">Upper Secondary School</td><td rowspan="3">Specialized Training College Courses</td><td rowspan="3">Part-time Correspondence Courses</td></tr>
<tr><td>16</td></tr>
<tr><td>15</td></tr>
<tr><td>14</td><td rowspan="12">Compulsory Education</td><td colspan="3" rowspan="3">Lower Secondary School</td></tr>
<tr><td>13</td></tr>
<tr><td>12</td></tr>
<tr><td>11</td><td colspan="3" rowspan="6">Elementary School</td></tr>
<tr><td>10</td></tr>
<tr><td>9</td></tr>
<tr><td>8</td></tr>
<tr><td>7</td></tr>
<tr><td>6</td></tr>
<tr><td>5</td><td colspan="3" rowspan="3">Kindergarten</td></tr>
<tr><td>4</td></tr>
<tr><td>3</td></tr>
</table>

Figure 3. Organization of the school system in Japan.

Note: Adapted from "Higher Education in Japan," 2012, Higher Education Bureau, Ministry of Education, Culture, Sports, Science and Technology, p. 4.

Of the academic degrees awarded, standard time periods to attain a degree are as follows: bachelor's, four years, master's, two years, doctor's, five years, professional, two years, and associate's, two to three years (Higher Education in Japan, 2012). This near universal access to higher education is particularly remarkable as Japan provides a unique scenario for extended research.

National, Public, and Private Institutions. Private household investment and private enterprises cover most educational expenditures not supplied by the government (Maruyama, 2012, p. 19). Most families are willing to invest large percentages of their

income to support their children's education. "In 2006 the proportion of tertiary education funded by households in Japan in 2006 was 51%... This compared to 3% in Norway" (Marginson, 2011, p. 596). 3.22 million students attend 1,200 universities and colleges in Japan and nearly 80% of these universities are private, creating an ability for each school to focus on a specific, unique educational path for each student where research has been a focus ubiquitously (Higher Education in Japan, 2012).

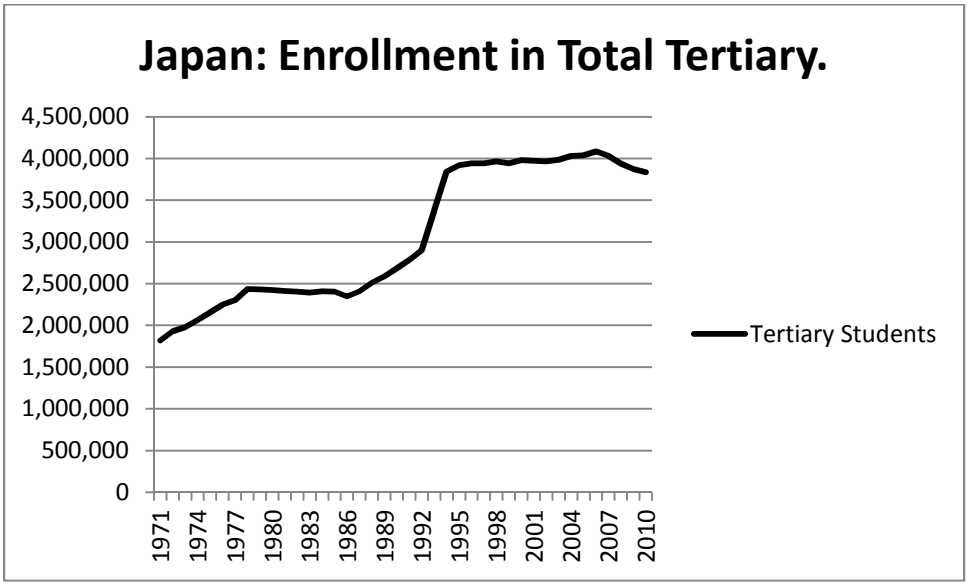

Figure 4: Japan: Enrollment in total tertiary.

Note: Public and private. Full and part time. Total. Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

During the 1960s and 70s, Japan confronted a great demand for higher education and in efforts to alleviate this issue, the MEXT relaxed regulatory policies to foster the establishment of many private universities (Maruyama, 2012, p. 14). This demand was created by a rapid expansion of the economy and a sharp increase in household income as well as a greater need for more highly skilled workers (Kariya, 2011, p. 247). Currently, private universities are still housed under state control and must abide by all policies of the MEXT. The Japanese government and the Japanese people for the most part agree

that it is the role of the government to provide higher education to the people. Private universities provide education to the majority of people, where national institutions operate as leading educational centers for the brightest of elite students (Maruyama, 2012, p. 16). These institutions serve to create a diverse and complex population that helps drive Japan to its prominence in the global economy. National institutions have tended to create the most highly sought after employees as large conglomerates and multinationals tend to prefer graduates from the most prestigious universities and have been charged to "take the reputation of the institution into account more than the competence the students actually reach" (Teichler, 1997, p. 288). Kariya (2011) explained that creation of a system with selective and elite institutions as well as lower tier institutions, high standards can be met as well as extended access availability (p. 244). By creating a system with many types of institutions, arranged for many levels of people, the majority of the population can participate in higher education.

National, public, and private universities are established as "corporations" and these corporations are required to disseminate selected documents to the MEXT; all national universities are referred to as National University Corporations and are designated as independent bodies of the state (Kaneko, 2010, p. 15). Kitagawa (2009) explained the quintessence of these corporations is "to promote increased independence and entrepreneurialism, as well as to foster institutional diversification and efficiency" (p. 264). As of 1949, certain former imperial universities were bereaved of their elite status and all three types of universities, public, private, and national, were to be considered as equal under Japanese law (Kitagawa, 2009, p. 263). There are still seven major universities that serve as flagship institutions in Japan, the most esteemed being the

University of Tokyo (Maruyama, 2012, p. 13). These institutions are considered very prestigious globally and have fierce competition from Japanese students and abroad.

During the 1960s and 70s the government concentrated its efforts on the educational expansion of engineering and natural science programs at each national university in efforts to drive the technological boom that was expanding rapidly in the country (Saito, 2011, p. 2). As aforementioned, during this time private universities were being deregulated to open higher education to a greater portion of the population. This created a rapid expansion of private universities and a rapid decrease in quality of education; Maruyama (2012) explained that because private universities did not receive government subsidies and became overcrowded with students, financial difficulties and shortage of facilities led to lower quality schooling at the private level contrasted to the public and national level institutions (p. 2; Saito, 2011, p. 3). Kaneko (2010) explained that massive expansion of higher education generated bleak conditions that prompted questioning of the system and the social consideration of how to improve the quality (p.14). In more recent endeavors, the government has been working with private institutions to increase this level of quality and to alleviate financial burdens with increased subsidies to increase the overall level of quality for all Japanese and foreign students. Marginson (2011) believes that the cultural aspect of the Japanese model lends itself to the populations desire for the state's contribution to "educational supply" (p. 595). These undertakings in investment in human capital have directly related to the future demand for skilled labor in Japan and continued economic expansion.

In efforts to promote private institutions to equalize with public and national universities, the Japanese government has placed action to decrease financial burdens on

students by subsidizing operating costs, tax reductions, improved support for management, and students' loans provided by The Promotion and Mutual Aid Corporation for Private Schools of Japan (Higher Education in Japan, 2012). With such a large populace involved in the private sector, the MEXT strives to place private education in a similar educational quality as national universities. Kaneko (2010) explains, "The arguments that expenditure of higher education should be considered an investment, and therefore should be born by the society as a whole, urged the government to increase revenues for the private institutions" (p. 16). In other extended efforts, the MEXT has placed strict quality assurance measures in place aforementioned in order to meet mounting student needs, diversity of the student body, and escalating international higher education competition. Maryuama (2012) states that MEXT's ability to learn to utilize third-party evaluation and self-evaluation are critical in building long-term quality assurance (p. 7). The MEXT has many enrichment programs in place for Japanese institutions including undergraduate policy implementation, graduate schools as centers for high-level research, clarification of educational purposes and an amplified sense of sovereignty, creation of shared research facilities, a goal of accepting 300,000 international students by 2020, and development of 30 universities as centers for internationalization known as the "Global 30" (Higher Education in Japan, 2012; Kitagawa, 2009, p. 265). The MEXT has doled out financial support through the Scholarship Program of the Japan Student Services Organization where interest-free scholarships are granted up to certain amounts for undergraduate and graduate students and scholarships are granted to certain international students with specific quotas and assistance amounts set by the Japanese government (Higher Education in Japan, 2012).

This program is meant to ensure students remain in the country as institutions desire substantial enrollments, yet, as aforementioned, population growth is decreasing. Japanese higher education institutions have been greatly influenced by this decreasing population as the mood of competition is fierce (Kitagawa, 2009, p. 259). The MEXT must encourage institutions to meet the considerable quality assurance measures, maintain its forward movement in light of hefty global educational competition, and find ways to maintain concentration on innovation and unique capacities that will continue to carry Japanese education into the forefront of higher education. As the government system has realized this call for origination, it has sought to embrace the "entrepreneurial university" as well as the service side of institutions in efforts to invigorate economic growth (Kitagawa, 2009, p. 266).

Challenges and Policy Implementation. While government efforts strive to expand and develop the higher education system in Japan, dissatisfaction in certain areas have been an issue. Maruyama (2012) and Teichler (1997) explained that professors and staff were found to spend too much time on research and not enough on teaching efforts. Institutional reforms were developed to increase concentration on teaching at all levels, as well as to maintain research efforts. Global competition from all areas in the world has put pressure on the MEXT to enhance higher education, particularly graduate research programs, in efforts "to secure international validity and reliability" and to ensure the prominence that Japan currently holds in the global economy (Maruyama, 2012, p. 18). Kaneko (2010) described another issue has been the lack of dispersal of information regarding institutional activities, as this information is purely academic and above the understanding of the average citizen, as the public has begun to prompt for

more information with the advancement of the social importance of higher education (pp. 18-19). This initiates the need for greater transparency and increased dispersal of information. Financing has become a critical issue as financial rigidity and reductions in government disbursements have arisen recently; each institution will be challenged with assembling its own strategic financial plan (Kaneko, 2010, p. 19). Depending on the financial security of Japan, the MEXT will need to determine the best resource allocation to uphold the current educational path in the country. Higher education in Europe and in the United States has focused on driving international competition and on resource allocation through achievement of institutions rather than solely based on number of students in the door. Japan is also implementing these policies, but because of the dissimilar type of government and future mixed fiscal outlook, the future will hold how higher education policy will affect institutions.

The MEXT is part of the government system of Japan, listed as a constitutional monarchy with a parliamentary government where the Emperor is characterized as a state symbol and there is no federal system, simply 47 prefectures that depend on the central government for financial assistance (U.S. Department of State: Bureau of East Asian and Pacific Affairs: Japan, 2012). GDP growth has been stagnant or even reversing and recent earthquake and tsunami disasters have struck Japan in a very tough economic time. Slow nominal GDP growth is causing fiscal adjustments to be challenging and resolving this financial predicament with proper policy and strategy is paramount to the continuation of the current educational system (OCED, 2013c, p. 2). As Japan's government is trying to support the goals, specifically financial goals, of the MEXT, economic conditions will play a large role in the direction of the higher education system.

This system is upheld by grants, loans, and scholarships that may not be plausible if current fiscal conditions are not rectified. Japan is committed to building a fervent and intellectual society that is based on a unique set of characteristics, but must be able to uphold spending with concrete economic foundations and sound underlying pecuniary principals.

More recently, the MEXT worked with the Central Council for Education to develop the report "A Future Vision for Higher Education in Japan" to present a long-term design for higher education and elaborated on ways to measure improvements (Saito, 2012, p. 5). Overall, fundamental considerations include the current "age of the 'knowledge based society,' in which higher education is exceedingly important in personal development as well as national strategies," the importance of the governmental role in higher education, and designation of future visions for policy and regulation (Saito, 2012, p. 5). The MEXT is constantly working to internationalize and globalize with programs such as the "Global 30" and targets of admitting 300,000 international students by 2020. These strategies and policies aim to keep the Japanese higher education system on the forefront of global education and competitive in the current economy while expanding upon their current population's abilities and educating a near universal portion of the populace.

Norway

Demographics and Educational Structure. The Kingdom of Norway resides in the eastern portion of Scandinavia as part of Northern Europe with a population of 4,707,270 (July 2012), a total land area of 323,802 square kilometers, and a population growth rate of 0.327% (CIA, Norway, 2012). Norway is a region containing abundant

natural resources and has been practical and reserved with use of its considerable stash of funds. For the year 2011, GDP was listed at $477.6 billion with a real growth rate of 1.5% and GDP per capita of $53,400 with the majority of the population employed in the services sector (76%) and the remainder in industry (21.1%) and agriculture (2.9%) (CIA, Norway, 2012). Education is deemed considerably valuable for Norwegians, where advanced levels of participation and completion are sought after and achieved. 6.8% of GDP is spent on educational expenditures, ranking one of the highest percentages in the world (OECD average is 5.9%) with 25% of the population holding a tertiary level of education and 100% of the population being literate after the age of 15 (CIA, Norway, 2012; *Education - from kindergarten to adult education,* 2007).

The Norwegian Parliament along with the Norwegian Government set all rules and regulations for the education system, including funding, legislation, goals, and curriculum. The Ministry of Education and Research created and conducts all national education policy, as each university and university college is directly subordinate to the Ministry (Universities and university colleges, n.d.). Within each university and university college, each is responsible for which academic studies will be offered and courses may be altered at the will of the institution. Oversight by the Norwegian Agency for Quality Assurance in Education and the Norwegian Centre for International Cooperation in Higher Education provide governance over each university and university college (*Education - from kindergarten to adult education,* 2007). One hundred ninety five thousand students attend seven universities, seven specialized universities, 24 state university colleges, and 31 private institutions where, after three years of secondary schooling, students concentrate nearly entirely on research or the education of research

(*Education - from kindergarten to adult education*, 2007). Most tertiary level students sit within traditional age range of 17-24, yet students over the age of 25 can qualify for access to higher education through a series of competency tests. About 90% of students attend public universities and university colleges, but some 10% do participate and pay for private higher education, which is regulated by the Act of June 11, 1986 (*Education - from kindergarten to adult education*, 2007).

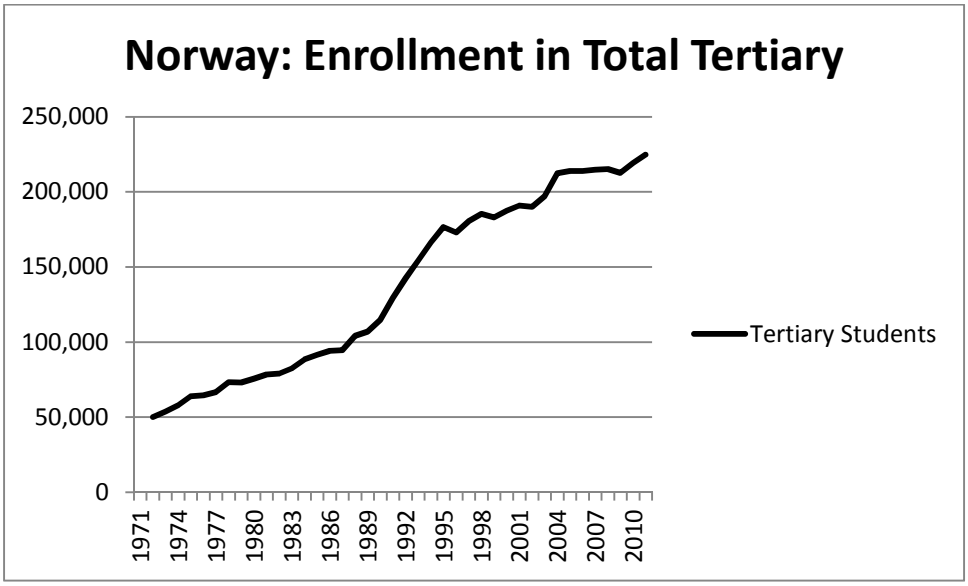

Figure 5. Norway: Enrollment in total tertiary.

Note: Public and private. Full and part time. Total. Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

Norway prides itself on offering equal access to all education by making all primary, secondary, and tertiary education free to all citizens, while still providing one of the best education systems in the world.

<table>
<tr><th>Age</th><th></th><th colspan="3">Structure of the Education System: Norway</th></tr>
<tr><td>24</td><td rowspan="6">Tertiary Education</td><td rowspan="6">University</td><td rowspan="6">University College</td><td rowspan="6">Apprenticeship Training</td></tr>
<tr><td>23</td></tr>
<tr><td>22</td></tr>
<tr><td>21</td></tr>
<tr><td>20</td></tr>
<tr><td>19</td></tr>
<tr><td>18</td><td rowspan="3">Follow-up Service</td><td colspan="3" rowspan="3">Upper Secondary School</td></tr>
<tr><td>17</td></tr>
<tr><td>16</td></tr>
<tr><td>15</td><td rowspan="11">Compulsory Education</td><td colspan="3" rowspan="4">Lower Secondary School</td></tr>
<tr><td>14</td></tr>
<tr><td>13</td></tr>
<tr><td>12</td></tr>
<tr><td>11</td><td colspan="3" rowspan="7">Primary School</td></tr>
<tr><td>10</td></tr>
<tr><td>9</td></tr>
<tr><td>8</td></tr>
<tr><td>7</td></tr>
<tr><td>6</td></tr>
</table>

Figure 6. The Norwegian education system.

Note: Adapted from "Education – from Kindergarten to Adult Education," 2007, Norwegian Ministry of Education and Research, p. 25.

The Bologna Declaration and The Lisbon Strategy. From 1389 to 1814 Denmark owned the land that now is Norway and much of the original education policy was set by religious governance of the state Lutheran Protestant Church and the King of Denmark, notably The Education Act of 1739 stating that primary education was mandatory (Welle-Strand & Tjeldvoll, 2002, p. 674). As political parties shifted towards a more socialist view, focus was set on equality of access and cohesive learning by all members of society. The Labor Party ruled from the 1930s to the 1960s and made many changes within the education system towards a more equal, but competitive market. Welle-Strand and Tjeldvoll (2002) noted governmental ambitions "to increase attention

to goals and achievements relevant for Norway as an equal member of the global knowledge society" (p. 7). These intentions created a demand for an amplified concentration on mobility, knowledge acquisition, and accountability which was met by signing The Bologna Declaration between European nations in efforts to increase strength of the Norwegian education system.

The Bologna Declaration was signed into effect in June 1999 by 29 European countries' education ministers (of which today 46 of out 47 European countries are members) to create the Bologna Process and the European Higher Education Area in March 2010, of which Norway was an original member, as a revolutionary assemblage founded to increase collaboration in European Higher Education as the system was perceived as antiquated and outmoded (The Bologna Process– towards the European Higher Education Area, 2012; Lehre, Hansen, & Laake, 2009). The Process was established to reacquaint Europe with its fundamental, antecedent roots in higher education governance, research, attraction, quality, and competition by "foster[ing] student mobility and employability" through the use of undergraduate and postgraduate work that would meet the needs of an increasingly complex and global environment (History, 2009, ¶ 2).

> In the Leuven/Louvain-la-Neuve Communiqué, of 2009, the main working areas for the next decade were set, with emphasis on: social dimension, lifelong learning, employability, student centered learning and the teaching mission of education, international openness, mobility, education, research & innovation, as well as data collection, funding of the HE and multidimensional transparency tools. (History, 2009, ¶ 9)

This process was meant to reduce barriers for students and faculty in higher education settings as well as reinforce the international competitiveness of higher education in all European nations. In addition to the Bologna Process, The Lisbon Strategy (Lisbon Agenda) was passed by the Lisbon European Council in 2000. The Lisbon Strategy developed goals for the European Union to reinforce the commitment to "employment, economic reform, and social cohesion" through policy shifts due to globalization and the broadening of the knowledge driven economy; the report states, "The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" (Lisbon European Council 23 and 24 March 2000: Presidency Conclusions, 2000). The Lisbon Strategy has placed the European Union ahead of all other regions in terms of educational efforts by establishing specific policies regarding educational reform, specifically higher education, innovation, employment, workforce development, communications infrastructure, integrated research efforts, as well as many other micro- and macro-economic foci.

The Bologna Process instigated the Bachelor/Master/Doctorate (3+2+3) degree structure (for most degrees with the exception of medicine and dentistry) in efforts to change the university sector to fashion a more efficient system with shorter study programs (Vabø & Aamodt, 2009, p. 61). In 2003, Norwegian Higher Education embraced changes introduced by the Bologna Process; Quality Reform legislation on higher education, the first step in applying the Bologna Process, reestablished a degree structure, system for grading, and a quality assurance system, the Norwegian Agency for Quality Assurance in Education (NOKUT) (*Education - from kindergarten to adult*

education, 2007; Lehre, Hansen, & Laake, 2009). NOKUT is a government agency that was developed to stimulate quality enhancement, build a more complete and directed controlling unit, as well as to foster communication with the Norwegian society to preserve trust in its higher education system (*About NOKUT*, n.d.). NOKUT is also responsible for accreditation of all higher education institutions. Vabø and Aamodt (2009) explained that Norway embraced these changes as they endeavored to create a more "formal relationship between higher education institutions and the state as well as in the structure of institutional governance" as well as efforts to increase research publications by means of an altered funding system (pp. 58-59). NOKUT provides all tertiary educational accreditation and remains independent of the Ministry of Education and Research, yet the Ministry still maintains the ability to authorize statutes and regulations (About NOKUT, n.d.). The Ministry of Education and Research must recommend budgeting proposals to the National Assembly, which in turn regulates admission levels at each institution (Higher Education Finance and Cost-Sharing in Norway, 2008). The Research Council of Norway (RCN) and the Norwegian Centre for International Co-operation in Higher Education, along with NOKUT, make up the three governing bodies for tertiary education in Norway.

Recently, Norway has realized a dramatic shift in enrollments at the tertiary level with an increase in technology as well as a shift in the labor structure from industry-oriented to service-oriented has established a recent demand for higher education in efforts to meets the demands of society and to supply the market with a competent, academically inclined, progressive labor force. According to Vabø and Aamodt (2009),

> Norway is still highly dependent upon a raw material based economy (oil, gas and fish). The concern with the future role of higher education in Norway has to be understood against this backdrop; the natural resources are expected to come to an end within the next two generations and it is therefore crucial to remodel the business structure accordingly. (p. 62)

This creates an actualization for the Bologna Process, as its efforts to increase research, increase mobility and efficiency, and to decrease time spent in the system become imminent. Education and business are expected to collaborate on a more global scale in efforts to consummate research to augment educational enrollment and extension. Science and research are "perceived as central to the needs of the expanding knowledge society in which there is closer collaboration between higher education and industry" (p. 65). Along with government efforts, educational institutions are working towards building systems that meet the increased needs of society and industry that will help propel Norway and its European neighbors into the next generation of research initiation, financial stability, and economic prosperity that has been unsettled in current times. The education system is fashioned to have "a permanent role as social and economic contributions in terms of supplying the market with an appropriate labor force" (p. 61). This relationship is still being cultivated to augment human capital capacities, strengthen the knowledge society, and enhance the association between economic needs and academic outputs.

Government and Student Mobility. The government system of Norway is increasingly entwined with the Nordic education system, and this relationship provides a central backbone to the growth of the country as a whole. Norway operates as a

hereditary constitutional monarchy, where the king is seated mostly as a ceremonial figure, the prime minister is the head of the government, and Norwegian Parliament, known as the Sorting, formulates major political decisions and is formulated by a proportional system of representation of the parties in the country (U.S. Department of State: Bureau of European and Eurasian Affairs: Norway, 2012). Economic conditions hold positive for the region despite increasingly bleak economic conditions throughout Europe and abound. With an average GDP per capita of $98,103 (World Bank, Norway, 2012), Norway is considered one of the world's wealthiest economies with emphases on natural resources, oil, and gas production as major contributors towards increasing economic prosperity. Unemployment in Norway is the lowest of all of the countries in the world, at 3.60% (world unemployment sits around 6.15%) (World Bank, Norway, 2012), contributing further towards the acceleration of economic development. Financial regulation is strict, and high prices for oil maintain a growing economy amidst financial turmoil in Europe and abroad. The OECD Economic Survey of Norway (2012) affirms, "Norway's economy…should escape relatively unscathed from the current euro area turmoil. This resilience owes a lot to the improvement of terms of trade and the prudent management of petroleum wealth" (p. 5). Norway is not currently a member of the European Union (EU), yet it trades freely with all countries in the EU under the European Economic Area where the four freedoms of the EU – goods, persons, services, and capital – are applied (U.S. Department of State: Bureau of European and Eurasian Affairs: Norway, 2012). The OECD Economic Survey (2012) goes on to state that the Norwegian egalitarian society has contributed towards high social cohesion and inclusiveness as important points in such a strong fiscal policy (p. 5). Because of this cohesion, strong

education policy urges students in certain directions to maintain a balance of knowledge within the society. Students are urged to participate in the sciences, mathematics, and agriculture and are awarded extra "points" when applying for admission to university (Regulations Concerning Admission to Higher Education, 2009). These studies are means to focus on maintaining a strong emphasis on natural resource expansion; additional funding from meticulously managed petroleum revenues has allowed Norway to reap financial, social, and capital benefits that is driven by a focus on research and development (OCED, 2012a).

Students travel freely from country to country in the EU and Scandinavia, often transporting intellectual knowledge and human capital that is desirable to maintain within boundaries. Norway is one of the only European states that still offers free education to all students, including non-Norwegian citizens. The Ministry of Education and Research stands by its assurance of equality of education, regardless of nationality; this led to increased applications to Norwegian universities (e.g. University of Oslo) over recent years as neighboring countries of Sweden and Denmark have discontinued this policy (Grove, 2011, p. 2). There is a high level of mobility between students in Scandinavian countries, as student grants are accepted in many countries and because of the ease of credit transfers created by the Bologna Process. Norway hopes to entice top researchers because of its free graduate and PhD programs, but must maintain high standards for students and faculty alike in the current competitive environment in Europe. "Through an internationally oriented academia, we educate students who are competent for work in a globalized world, and researchers who can benefit from and contribute to the global community of knowledge" (North America Strategy for Higher Education Cooperation

2012-2015 of the Norwegian Ministry of Education and Research, 2010). Norwegian institutions and government must maintain and create new means to compete globally for enlightened, progressive students, who are academically inclined and can contribute towards the growth of society.

The North America Strategy for Higher Education Cooperation 2012-2015 of the Norwegian Ministry of Education and Research (2010) explains that Norway not only intends on capitalizing on mobilization of Scandinavian and European students, but has paved the way for a "knowledge collaboration" between Norway, the U.S. and Canada (p. 1). This collaboration was supported by the Strategy for Norway's Scientific and Technological Cooperation with North America in 2005 and the North America Strategy for Higher Education Cooperation for 2008-2011; these policies were implemented to create models of best practices and to promote institutional collaboration at the government level and network arenas (p. 1). The Norwegian Ministry of Education and Research aims to focus on research cooperation, particularly in the areas of Masters and PhD level students. Arnesen (2000) explained that policy has also been implemented to develop support for research in more sparsely populated areas "through a very active regional policy and a strong welfare state" (p. 225). Policy implementation is grounded on an output-based system, as certain objectives are met; resources are allocated accordingly based on expected output and performance measures.

Historically, universities are one of the most prevailing and lasting social institutions in all of Europe, "As such the university has shown a remarkable institutional dynamics of change that allowed it to maintain a flexible and rather effective balance between internal continuity and external responsiveness" (Maassen & Stensaker, 2012, p.

757). In understanding the efforts of the Bologna Process and the Lisbon Strategy in Norway, it is important to note that these policies were implemented to increase employment, economic advancement, and social cohesion, as education was considered the cornerstone in solidifying these policy aspirations. The urge towards science-based areas of focus are highlighted by Maassen and Stensaker (2012) in explaining that the Lisbon Agenda is a socio-economic model "with an emphasis on science-based innovation as the engine of economic development and education as a necessary investment in human capital" (p. 760). Norway continues to aim to increase student capacity and knowledge through local policy and greater European policy implementation. As educational equality is seen as an important factor in educational policy, reliability on natural resource management and successful fiscal policy have been key in Norway's flexibility in their educational structure.

Comparison of Economic and Educational Data

In efforts to build a greater understanding of the similarities and differences between Israel, Norway, and Japan, the researcher created several visual comparisons based on UNESCO UIS data. As the population data shows, Japan has a much larger population than the other two countries and grew more rapidly from the 1970s to around 2000. Japan's population growth rate slowed through the 2000s from 125,720,310 in 2000 to 126,551,705 in 2009, then actually started decreasing to most recent population reports of 126,434,653 in 2012 (UNESCO UIS, 2013b). As shown, Israel and Norway's populations were 7,694,670 and 4,960,482, respectively, in 2012 (UNESCO UIS, 2013a; 2013c). Each of these countries has had relatively stable, yet small, population growth each year since 1970. This graph shows the considerable difference in population

between Japan and the other two countries and may provide valuable insight into differences in policymaking choices or rationale for differences in tertiary education enrollments or tertiary educations enrollment role in economic growth.

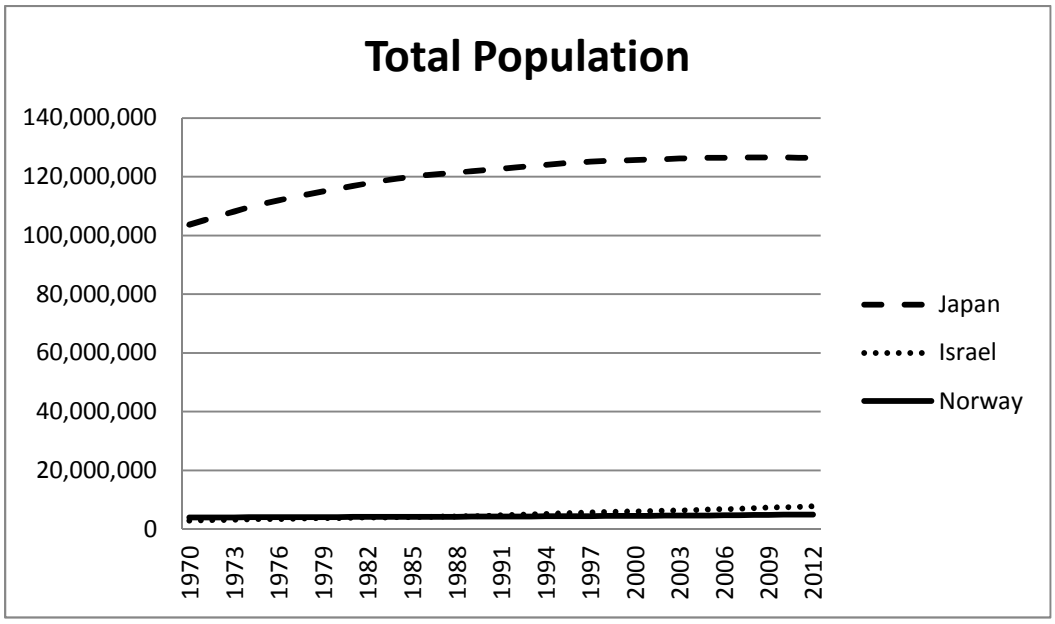

Figure 7. Total Population (Japan, Israel, Norway).

Note: Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

In comparing GDP per capita in current US dollars, Israel, Japan, and Norway all have higher GDP per capita's than the world average. Norway saw a sharp decline with a hard hit from the financial crisis in 2008-2009. Norway had the third highest GDP per capita in the world in 2011, as they rebounded favorably after the crisis. Japan realized a smaller blow from the crisis, but had been oscillating since the mid-90s; Japan also observed significant growth in GDP per capita from 1980 to 1995 through the aforementioned technology boom, but has had slower real GDP growth since recent tsunami and earthquake disasters. Israel has seen steady GDP per capita growth with a small decline in the early 2000s due to the technology bubble, as Israel's industry and

technology based society suffered slighty.

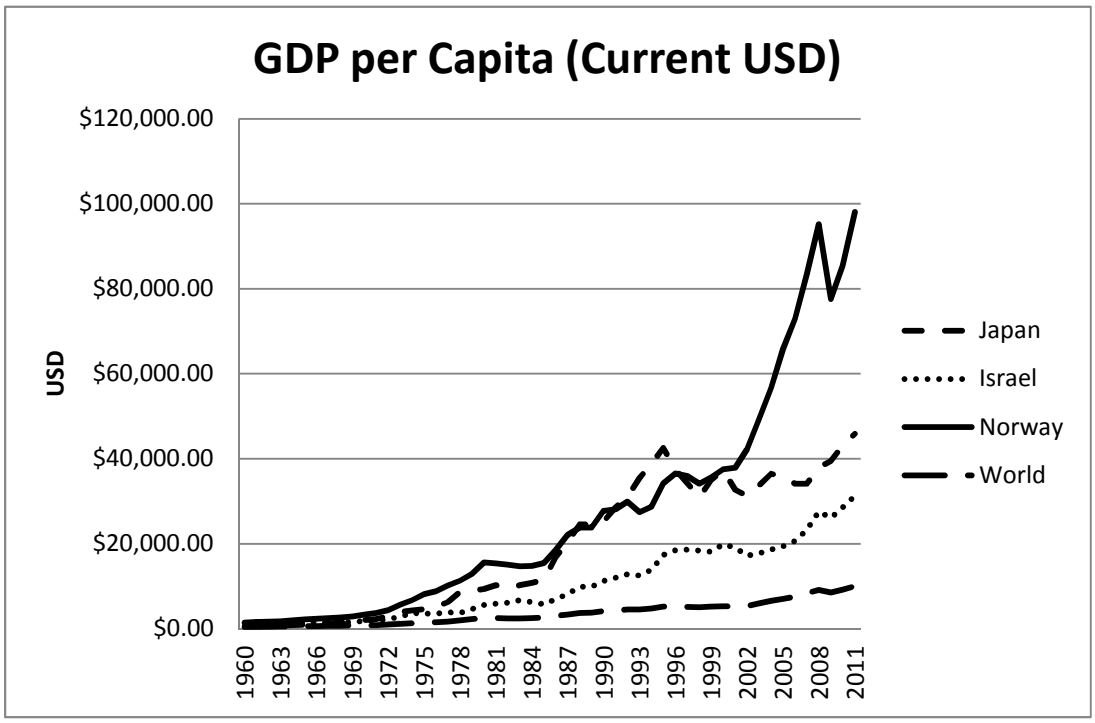

Figure 8. GDP per Capita (Current USD).

Note: Data procured from The World Bank, retrieved from http://data.worldbank.org.

When measuring enrollment in tertiary education, the researcher based Figure 9 on total population to display a level comparison. Enrollment in total tertiary over population gives the percent of the population that was currently enrolled in tertiary education for the particular year in question. This graph indicates that Japan's tertiary enrollment per population slightly decreased from 2006 to 2010. As Kaneko (2010) stated previously, the massive expansion from the mid-1980s to the mid-1990s initiated a lacking education system with reduced quality institutions that have been slow to recover, particularly with a slowing population growth rate. Israel and Norway have been on a steady and significant increase in tertiary enrollments, around 5% in 2010, and are much higher than the world average, around 2.5%. Again, as the population in each country

varies, enrollments are somewhat deceptive as enrollment could be increasing, but at a slower rate than the population is increasing, or enrollment could be increasing, but the population could be decreasing and vice versa.

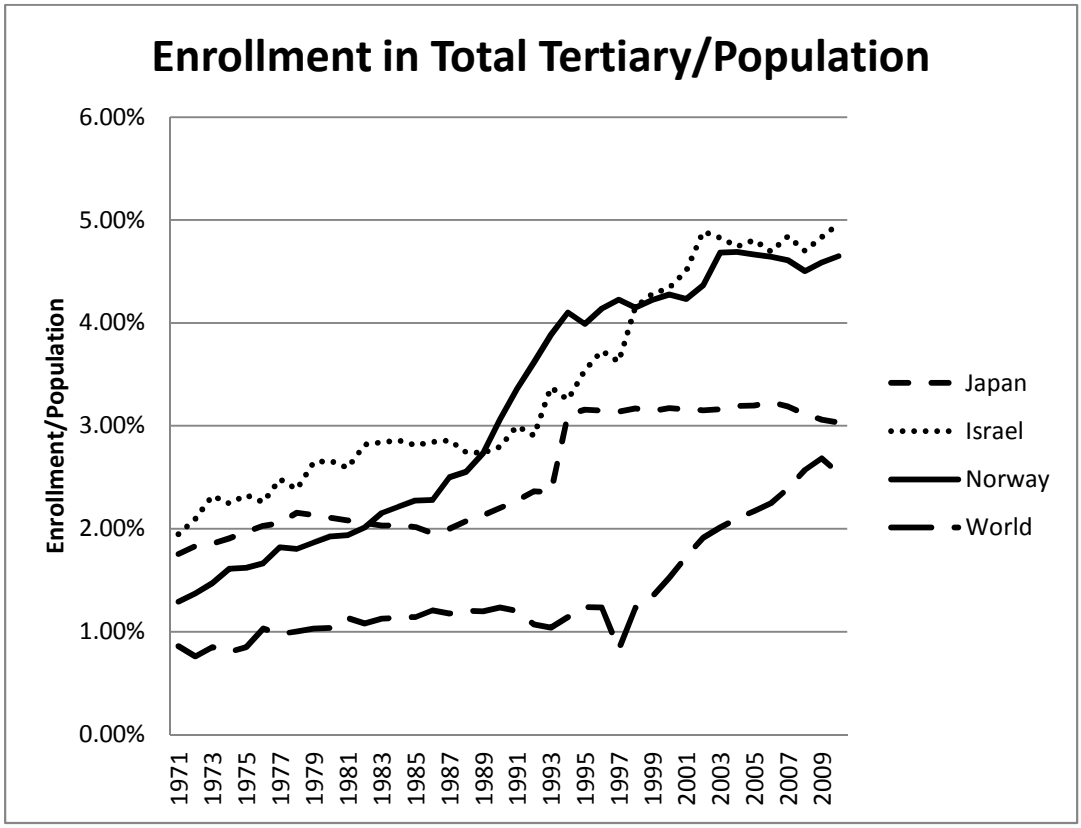

Figure 9. Enrollment in Total Tertiary/Population.

Note: Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

World average expenditures on total education as a percent of GDP has held relatively steady for the past 40 years, averaging around 4.5%. Large spending cuts were observed in Israel from 1985 to 1988, most notably from the expansion of private universities and the lack of public funding to these types of institutions. Since the mid-1990s, Israel has maintained declining public expenditures on education as a percent of GDP, which partially was from increases of privatization and decreases in government control of universities, but also from primary and secondary educational expenditure

reductions that are outside of the scope of this research. Japan observed decreases in public expenditures on education from 1988 to 1992 with a steadily increasing GDP (USD 3,015,393,553,892 to USD3,852,794,371,594), due to similar factors as Israel of increasing numbers of private institutions that were not funded by the government. Japan has held steady in their levels of expenditures on education while GDP continues to rise, yet tertiary enrollments have fallen since 2006. That said, the population has also started to decline as of the late 2000s. Norway's rate of expenditure has oscillated through the years, but remains very high, around 7% in 2010. The OECD average educational expenditure in 2012 was 5.9% (OECD, 2012).

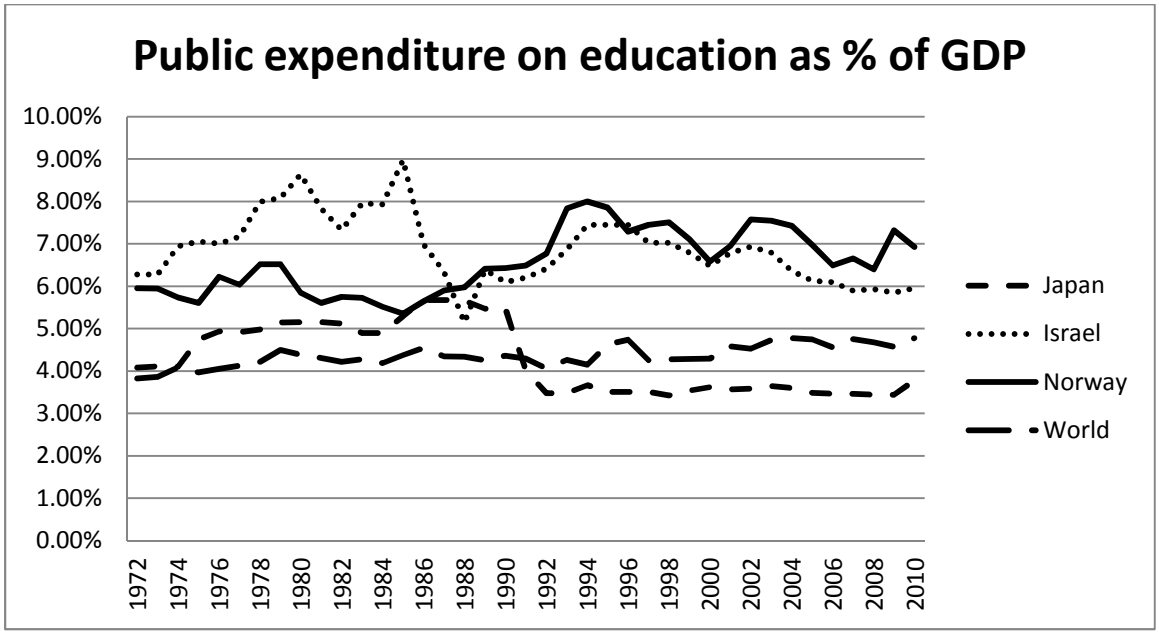

Figure 10. Public expenditure on education as a percent of GDP.

Note: Data procured from The World Bank, retrieved from http://data.worldbank.org.

A deeper look into public expenditures per pupil as a percent of GDP per capita for tertiary education in the three countries' reveals a more detailed picture of federal funding. Expenditures per pupil for tertiary education carried much higher percentages, ranging from around 18% to over 50%. The World Bank website explained,

> Tertiary is the total public expenditure per student in tertiary education as a percentage of GDP per capita. Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other privates entities). (The World Bank, Public expenditure per pupil as a % of GDP per capita. Tertiary, 2013)

This figure explains much about how important the country of Norway believes public spending is on tertiary education, even though there was a slight decrease from 2009 to 2010. Japan increased spending while Israel has consistently decreased public expenditures per student as a percent of GDP per capita.

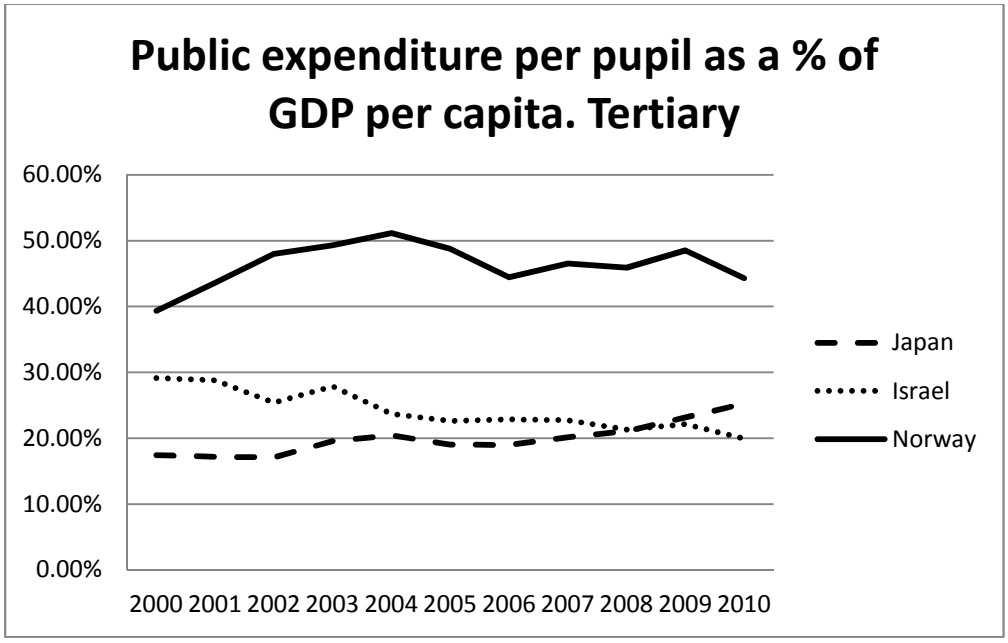

Figure 11. Public expenditure per pupil as a percent of GDP per capita. Tertiary.

Note: Data procured from The World Bank, retrieved from http://data.worldbank.org.

Conclusion

Conduction of previous studies has led to improved dissemination of data and enhanced quality and reliability of educational data for all countries. As researchers

further collect data and form models, superior data collection methods will be formed and, ultimately, better decisions will be able to be made. Barro (2013) concluded that wide-ranging samples should be tested in order to make precise extrapolations from data about policy implementation, despite concerns of quality of data (p. 327). Krueger and Lindahl's (2000) work was in agreement with Barro in that they recommend exploring regional growth from countries with reliable data first, then using econometric modelling to correct measurement errors and fill gaps in the data (p. 44). There are many means to test and model educations effect on growth; previous research has shown that there are hundreds of methods, means of calculation, ways of interpreting the data, theories, means to correction, methods to correct errors, and indicator experimentation that can produce results of all varieties. This research was derived from several other previous researchers' models, with proper adjustments made where the researcher deemed appropriate. The literature on human capital development continues to expand and only will become enhanced and of better quality over time. Data collection plays a large role in building reliable and valid results and as more research is conducted, these data tables will only become more complete and more extensive over time to help build better research, models, and outcomes. Further discussion of previous models and data compilation can be found in Chapter 3.

Chapter Three: Methodology

Theoretical Framework

The attempt to link educational inputs and economic outputs has been constantly contemplated as researchers around the world have sought a model that would accurately describe the relationship between these two variables. Beginning with Schultz and Denison, econometric equations have been built, tested, altered, analyzed, modified, and transformed repeatedly as the world's understanding of statistical analysis advances and the ability to collect large amounts of valid data expands. With this expansion of data, variables to consider has increased dramatically. The original models of Shultz, Mincer, and Rubinson and Walters considered a much smaller amount of variables on a considerably broader basis, where more current models of Barro and Lee and Hanushek rely on a much more detailed measure of variables that were thoroughly analyzed for actual, valid input into the model (i.e. increasing R^2). Not to say that earlier models were not thorough, but the capacity of which data is available about each individual country has expanded radically in the last fifty years has led recent researchers to be able to more precisely define which factors are actually contributing towards economic advancement versus more theoretical options that have gone untested.

In the following section, the researcher will give an overview of several previous econometric models used in understanding the relationship between educational and economic factors by many leading researchers. These studies range from simple linear analyses to complex and extensive models. The researcher used what was believed to be the most encompassing and important indicators when building the model for this study, taking into account data available through the previously listed databases. Previous

research studied has been published and cited by thousands of other researchers and is assumed to be mathematically and statistically valid.

Previous Models

In examining previous models, it was the aim of the researcher to begin with original models fashioned in the 1960s and to explain further equations that have been constructed from these initial models. It is beyond the scope of this research to cover every educational model constructed over the past fifty years; therefore, concentration on central theories and hallowed researchers was the focal point. Because of the complexity of each model, a brief outline of variables is given as well as equations used when determining specific relationships contemplated.

Mincer. Mincer (1974) aimed to explain the relationship between amount of schooling and an individual's particular earnings in what has become known as the Mincerian wage equation, as follows: $\ln W_i = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X_i^2 + \varepsilon_i$ where $\ln W_i$ is wage for individual i, S_i is years of schooling, X_i is experience, and X_i^2 is experience^2 which can also be written in the form $\log y = \log y_0 + rS + \_2X + \_3X^2$ where y is earnings, y_0 is an individual with no education or experience, S is years of schooling, and X is potential years of experience in the labor market (Mincer, 1974; Krueger & Lindahl, 2000; Lemieux, 2006). Mincer found that the relationship between experience and earnings was mostly concurrent between groups with varying levels of education as he also found that time spent in school is the main determinate of earnings, rather than degrees earned, which allows for comparisons between countries with various educational systems and years to complete a particular degree. Heckman and Klenow

(1997) aggregated this equation across individual countries in, as deemed, the "Macro-Mincer" wage equation:

> $\ln Y^{g}_{jt} = \beta_{0jt} + \beta_{1jt}S_{1jt} + \varepsilon_{jt}$ where Y^{g}_{jt} is the geometric mean wage and S_{jt} is education, as well as in a follow up Macro-Mincer differentiation equation of $\Delta \ln Y^{g}_{t} = \beta'_{0} + \beta_{1jt}S_{1jt} - \beta_{1jt-1}S_{jt-1} + \Delta\varepsilon'_{jt}$ where β'_{0} is the mean change in intercepts and $\Delta\varepsilon'_{jt}$ is the deviation between each country's intercept change and the overall average. (Heckman & Klenow, 1997; Krueger & Lindahl, 2000)

Here, individual countries were compared between GDP equations and the micro-Mincer model to gain insight into educations role in the wage equation. Stevens and Weale (2003) used the Mincer equation to find the effect of education on economic growth at the individual level created an increase in income by 10.1% for all countries, but only 6.5% in advanced countries (p. 6,8). The full extent of the Mincerian wage equation is beyond the scope of this research, but it is important to note that this equation is used as a basis for several other studies, including Krueger and Lindahl (2000) (e.g. $\ln W_{ijt} = \beta_{0jt} + \beta_{1jt}S_{1jt} + \varepsilon_{ijt}$ for country j at time t) and Psacharopoulos and Patrinos (2004) (e.g. $\ln W_i = \alpha + \beta S_i + \gamma_1 EX_i + \gamma_2 EX_i^2 + \varepsilon_i$) as well as many others. Psacharopoulos and Patrinos (2004) explained that this "semi-log specification" years of education is the average rate of private return to an additional year of education, irrespective of which year of education being referred to. These particular researchers utilize dummy variables to escape this issue.

In continuing to look at Krueger and Lindahl's (2000) work, they examined whether varying levels of education were related to a particular country's consequent

GDP growth rate, as formulated from a "log-linear earnings-education relationship" that earnings are increased by 10% for each addition year of schooling in the United States, but to varying levels in countries worldwide (p. 1). Krueger and Lindahl estimated a model that proves that, typically, countries that are at or above their unique stable income average grow more slowly than countries that are below (p.13). This is explained in the following equation:

> $\Delta Y_j = \beta_0 + \beta_1 Y_{j,t-1} + \beta_2 S_{j,\,t-1} + \beta_3 Z_{t,t-1} + \varepsilon_j$ where ΔY_j is the change in log GDP per capita from year t-1 to t, Y_{t-1} is the log of the initial GDP per capita, S_{t-1} is average years of schooling in the population in the initial year, and Z_{t-1} includes inflation, capital, and "rule of law index" as this equation is typically estimated with data for a cross-section or pooled sample of countries spanning a 5, 10, or 20 year period (p. 13).

In this equation, it is anticipated that countries with higher levels of income generally have populations that are more educated, have more access to capital, and hold the capacity to expand the workforce and to derive benefit from increased access to technology (Krueger & Lindahl, 2000, pp. 14-15, 24). That said, countries with lower levels of income have the capacity to expand human capital at a greater rate and could potentially utilize technological gains at a greater rate, however, countries with higher levels of income are generally expected to realize a higher GDP growth rate as aforementioned.

Potential bias of coefficients on capital may be observed because the measurement of capital is a derivation of investment flows, where GDP per capita is a direct function of investment and countries with rapid economic growth typically realize

increased levels of investment (Krueger & Lindahl, 2000, p. 17). Krueger and Lindahl's research shows that a statistically significant increase in the average years of education has a positive effect on economic growth in the long term (10-20 years), but not in the short term (5 years and less) (p. 25). The researchers were cognizant of the high level of correlation between men and women in regards to education levels, as they prefer to use an average of men and women for econometric analysis (p. 28).

Psacharopoulos and Patrinos (2004) measured private returns as well as social returns for three levels: low income, middle income, and high-income countries. They found that Latin America and the Caribbean held the highest returns to education, including mostly low and middle-income countries, but overall, an increase in educational supply has led to a decrease in educational return, ceteris parabis (p. 16). This research is often contrary to alternative studies, but the regional study conducted is extensive.

Glewwe, Hanushek, Humpage, and Ravina (2011) aimed to understand how expenditures on school resources effect educational outcomes in varying regions of the world. Glewwe et al. cite the positive, significant relationship between increased worker productivity as a result of increased education and increase in income (Mincer, 1974) as well as the positive, significant relationship between increased education and economic growth (Hanushek & Woessmann, 2008). When attempting to understand the impact of availability of school resources (beyond the scope of money) in developing countries, Glewwe et al. utilize the following production function:

> A = a(S, Q, C, H, I) where A is skills learned (achievement), S is years of schooling (Endogenous), Q is a vector of school and teacher

> characteristics (inputs that raise quality) (Exogenous), C is a vector of student characteristics (including "innate ability") (Exogenous), H is a vector of household characteristics (Exogenous), and
> I is a vector of school inputs such as daily attendance, textbooks, etc. (Endogenous). (pp. 6-7)

Parents will choose S and I in efforts to maximize household utility, where "Policymakers are primarily concerned with the impact of school and teacher characteristics (Q) and prices related to schooling (P) on years of schooling (S) and eventual academic achievement (A)" (p. 7). The authors measured these variables against PISA test scores in efforts to determine the sought resource relationship. It was found that operating a school that has full resources available, including a roof, floor, walls, desks, and chairs impacts schools learning and test scores positively, as well as features such as greater teacher knowledge, availability of tutoring, and an lengthened school day (pp. 41-42). Policy implementation established upon these recommendations would support increased test scores in developing countries, as well as a focus on increasing the amount of schools in a particular region in efforts for students to spend more time in the classroom.

Cobb-Douglas Production Function. Walters and Rubinson (1983) utilized measures of economic output, labor, capital, and educational expansion. In developing an estimation model of the effects of educational attainment on economic growth, Walters and Rubinson utilized a multiplicative model or Cobb-Douglas model to estimate the dynamic relationship between these two components in the following equation: $Output_t$ =

A $LAB_t^{\alpha}CAP_t^{\beta}ED_{t-x}^{y}e_t^{\varepsilon}$ where A, α, β, y, ε are constants, t is time (p. 484). The variables were defined as follows,

> Output: The value of all goods and services produced in the private domestic economy (gross private domestic)….Labor Input (LAB): …total person-hours worked per year in the private domestic economy….Capital Input (CAP):…Kendrick's capital input index, a measure of real net capital stock (land, structures, equipment, inventories) in the private domestic economy and ED as varying educational levels. (Walters & Rubinson, 1983, pp. 482-483)

Barro and Lee (2010) estimated the Cobb-Douglas production function in the following equation, "$Y= AK^{\alpha}H^{1-\alpha}$ where *Y* is output, *K* is the stock of physical capital, *H* represents human capital stock, and *A* denotes a measure of total factor productivity" (p. 14). Škare (2011) evaluated impacts of human capital in Croatia using the Cobb-Douglas production function in the equation, "$Y_t = A_tK_t^{\alpha}H_t^{\beta}N_t^{1-\alpha-\beta}$, where Y_t = GDP for Croatia…; A_t= Total factor productivity (TFP) or technology; K_t = Capital stock. . . .; N_t = size of the labor force; [and] H_t = Human Capital" (p. 675). He then furthered this calculation from level-level to log-log, $\ln Y_t = \ln A_t + \alpha \ln K_t + \beta \ln H_t + (1-\alpha-\beta)\ln N_t$. Basic use of the Cobb-Douglas production function was found in a variety of forms, but the underlying economic construct is the same. Walters and Rubinson (1983) aimed to substantiate that students who spend an increased amount of time in school would gain greater knowledge and therefore become more productive and valuable employees, therefore economic productivity as a whole would increase to establish an expanded economy or increased growth. In their first model, enrollments, expenditures, and attendance were used as

measures of educational achievement as the relationship between these factors, primary and secondary schooling, and time lag (10 and 20 years) was established. In the second model, two time periods were utilized, 1933-1969 and 1890-1928, as LAB, CAP, and number of degrees awarded (High School, BS, MA, PHD) were listed as endogenous variables; the same time lag was utilized (10 and 20 year) and R^2, Durbin-Watson, and rho hat were each analyzed. Walters and Rubinson found that secondary education had an impact on GDP with a ten year lag, but not twenty, as attributed to the massification of secondary education, and PhD degrees awarded had a positive, significant relationship with GDP with a ten year lag from 1933-1969, as attributed to policy changes such as the New Deal and the Progressive Era as businesses in the United States "began increasingly to turn to more capital-intensive production" that would require an increase in research and development infrastructure (p. 490).

Schofer and Meyer. Schofer and Meyer (2005) employed a quantitative pooled panel data analysis with a dependent variable of enrollment per capita in higher education (p. 32). Many world-level and national-level dependent variables were considered that are encaptured in aforementioned hypotheses. Findings included that education expands with greater enrollments during periods with more prevalent systems of democracy and that nations that previously lacked tertiary education systems expanded more rapidly than those that had more developed systems (pp. 37, 40-41). More surprising and pertinent to this research are findings that effects of ethno-diversity, referred to as "ethno-linguistic fractionalization" are significant and negative in relation to "ethno-linguistic diversity; tertiary enrollments grow more slowly in diverse societies and faster in homogenous ones" (p. 40). Based on the ethnic makeup of Israel, Japan, and Norway, these three

countries are considered highly homogenous as this could account for a portion of their heightened academic achievements. Schofer and Meyer conclude with a discussion of strengthened education systems standing as a platform for cultural amalgamation and as a means to promote structure and collaboration between countries worldwide.

Hanushek and Woessmann. Hanushek and Woessmann (2008) commenced building their model based on a simple earnings model where "individual earnings (y) are a function of the labor market skills of the individual (H), where these skills are frequently referred to simply as the worker's human capital . . . $y = \gamma H + \varepsilon$" (pp. 609-610). A common goal of researchers utilizing this equation is to reach an unbiased γ term while inserting additional terms that interpret the capacity of cognitive skills on human capital. These skills are further examined in the equation "$H = \lambda F + \square Q(S) + \delta A + \alpha X + v$" (p. 610), where ($F$) is family inputs, ($S$) is school attainment, $Q(S)$ is quality and quantity of school provided inputs, (A) is individual ability, and (X) is other factors, such as experience or health (p. 610).

Hanushek and Woessmann (2008) commented upon modeling with educational outcomes, as years of schooling were forecasted to create the same outcomes, regardless of country or region, and more specifically, of quality of education. The concluding error term was systematically based on varying aspects of a particular country; Hanushek and Woessmann found that educational rate of return is about 10%, where higher returns were realized in lower income countries, with reduced levels of education, and for women (p. 615). The authors concluded that under several variations of models, samples, and labor market conditions, "cognitive skills are directly related to individual earnings and, moreover, there is a consistency even in the point estimates" (p. 626). Policy

implications include understanding the causal relationship between cognitive abilities, specifically through calculated differences in test scores (i.e. PISA scores). Hanushek and Woessmann (2008) found that indicators of openness to international trade and security of property rights are the most significant determinants of institutional policy framework, a principal determinant of economic development (pp. 639-640). Significant results were observed when testing the theory of introducing blanketed education policy to be more inclusive of the entire student population of a country, as well as when testing the significance of directing efforts on concentrated education of the top performing students in the country; each were found to have a positive, significant relationship with economic growth (p. 645).

Škare. Another study that employed Schultz's original model was that of Škare, who utilized a growth accounting model to test the impact of human capital on economic development in the country of Croatia. Croatia was selected because of its former existence as a socialist country and its societal structure as a country in transition. Škare (2011) employed the following equation, H = *f* (E,S,P), where E = forgone earnings (average income*number tertiary students); S = social expenditures on education; P = private expenditures on education; H = human capital (p. 673). Škare (2011) conducted a marginal effect analysis to test the robustness of his human capital model and to derive elasticity coefficients to calculate changes in human capital, physical capital, and labor in relation to GDP (p. 678).

Barro and Lee (2010). Barro and Lee (2010) gathered data from UNESCO and Eurostat, with certain data separated by decomposition methods. Barro and Lee (2010) used five-year intervals from 1950 to 2010 from this gathered data. The authors denoted,

"h^a_{jt} as the proportion of persons in age group *a*, for whom *j* is the highest level of schooling attained- *j*=0 for no school, 1 for primary, 2 for secondary, and 3 for higher at time *t*" (p. 4). Barro and Lee (2010) employed a forward extrapolation method where "the distribution of educational attainment of age group *a* at time *t* is the same as that of the age group that was five years younger at time *t*-5: $h^a_{j,t} = h^{a-1}_{j,t-5}$" (p. 4). Greater detail was drawn upon for variations in mortality and survival rate calculations where results indicated that higher education rates yielded lower mortality rates and vice versa.[2] Barro and Lee (2010) developed forward and backward-flow estimates to calculate missing data and then regressed these values against actual census values, which was important in their calculations of educational attainment by age group, utilizing the aforementioned equation (pp. 5-6).[3] Barro and Lee (2010) constructed reliably ratios, as prior used by Krueger and Lindahl (2001), as "the reliability ratio gauges the fraction of the variability of an (unobserved) true variable in the total variability of the variable measured with error" (p. 13). As calculated against other prior models (e.g. Cohen-Soto (2007) and De La Fuente and Domenech (2006)), Barro-Lee estimates more accurately represent true levels of reliability and convey more signal in level and in changes over alternatively compared models (p. 13).

Based on alterations to the Cobb-Douglas production function, Barro and Lee (2010) quantified the relationship between human capital and output in the equation "$\log(y_t) = \beta_t + \beta_1 \log(k_t) + \beta_2(s_t) + \varepsilon_t$. The coefficient β_1 is the share of capital in total output (α) and β_2 is the marginal rate-of-return to an additional year of schooling"

[2] See Barro, R. J., & Lee, J. W. (2010). A new data set of educational attainment in the world, 1950-2010 for a full discussion of calculation of their use of the forward and backwards extrapolation models. Appendix Note 1.A gives detailed methods and equations used.
[3] *Ibid.* See Appendix Note 1.B for a detailed explanation of forward-flow and backward-flow estimates.

(p. 15). Panel data was collected from the Barro-Lee data set, as well as the Penn World Table for 127 countries from 1970-2005. This equation is subject to potential omitted variable bias as certain economic variables that have the capacity to influence human capital and output per worker concurrently may have been excluded, that said, Barro and Lee affirm that the use of a country-fixed-effects variable removes endogeneity bias in this instance. A second possible bias is that of simultaneity, where endogenous and exogenous variables are jointly determined; "The significantly positive effect of education on output may reflect reverse causality" (p. 16). Barro and Lee suggest controlling for this bias with the use of proper instrumental variables, potentially using the Mincer-type regression. Utilizing random-effects and fix-effects estimation techniques, Barro and Lee (2010) found that each additional year of schooling would increase output of the world economy by about 2% (p. 17).

Barro (2013). Barro's 2013 research model was built upon the general empirical construction of the extended neoclassical growth model, of the equation "Dy = F(y,y*) where Dy is the growth rate of per capita output, y is the current level of per capita output, and y* is the long-run or target level of per capita output" (p. 3). The variable y is commonly highly correlated with y*, as wealthier countries (high level per capital output) generally carry high target levels as well; as y* increases, Dy increases with changes in government policies, particularly in this research in relationship with educational policy (pp. 3-4). As target level per capita increases, governments implement policy changes, and, over the long-term, y increases. Barro focuses on broad policy changes to predict direction of causation on long term growth rates through the analysis of broad panel data.

"Dy is inversely related to y; Dy rises with y*. The value of y* depends… on government policies and institutions and on the character of the national population" (Barro, 2013, pp. 3-4). This equation lies as the basis for Barro's framework, where he runs a panel regression (in efforts to reduce measurement error) on all OECD countries, extending over three periods, 1965-75, 1975-85, and 1985-95. The eleven explanatory (or independent) variables are as follows:

> Log (per capita GDP), log (per capita GDP)^2, male upper school, ratio of government consumption to GDP, rule-of-law index (factors of capacity of the legal system, efficiency of the bureaucracy, likelihood of expropriation, and extent of official corruption as measured by Political Risk Services), openness ratio (ratio of exports plus imports to GDP), openness ratio*log (GDP), inflation rate, log (total fertility rate), ratio of investment to GDP, and growth rate of terms of trade (ratio of export prices to import prices (pp. 10-19, 35-38).

Other factors of education, years of schooling, quality of education (test scores rather than years of attainment), health variables (life expectancy at birth and infant mortality rate), OECD country versus non-OECD, and policy influences on growth and investment were also considered (pp. 20-30, 39-43). Barro found "that the growth rate of per capita GDP is inversely related to the starting level of per capita GDP", as well as finding that the growth rate has a significant, positive relationship with educational attainment levels in males in secondary and higher education (pp. 30-31). Barro concludes with several observations about developed versus developing nations, but cannot make any precise

assumptions about policy implementation in either group specifically because of a lack of accurate observations.

Research Methods and Design

Data collection, processing, and analysis: Overview of the data. The researcher collected data from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics, the OECD, the Barro-Lee Databases, and The World Bank, of which data were collected by each member country that was analyzed and updated by The World Bank Development Group. The World Bank Development Group is responsible for the collection and maintenance of The World Bank data in efforts to create an international statistical system that member countries can use to gain particulars, as well as to create a bigger picture by the use of data analysis and beyond. The data are utilized by teams in member countries "to prepare Country Assistance Strategies, poverty assessments, research studies and other forms of economic and sector work" (The World Bank, Data Overview, 2012, ¶ 2). The quality of the data depends on the statistical data collection system of each member country and The World Bank Development Group interact with the data collectors in member countries to ensure improvements in collection and reporting. Developing countries often face difficulties in performing quality data collection, The World Bank aims to assist these countries by means of several actions plans implemented to support the progression of statistical infrastructure in each region.

Data inconsistencies may occur because of collection methods; The World Bank publishes data with World Development Indicators and Global Development Finance that help to ensure that data is collected from official sources (The World Bank,

Methodologies, 2012, ¶ 3). The World Bank uses a General Data Dissemination System framework to measure member country's statistical systems to:

> (i) encourag[e] countries to improve the quality of official statistics; (ii) provide a framework for evaluating need for data improvement and setting priorities for statistical development; and (iii) guide participating countries in the public dissemination of comprehensive, timely, accessible and reliable economic, financial and socio-demographic statistics (The World Bank, Data Quality and Effectiveness, 2012, ¶ 2,).

The World Bank is accepted as a valid source of data and provides a massive amount of data to corporations and individuals alike (The World Bank, Data Quality and Effectiveness, 2012). This data was used by the researcher to formulate an examination of the three countries using specific indicators chosen by the researcher produced by The World Bank.

The World Bank's databank collection for each member country consists of approximately 1800-2000 indicators for each country (The World Bank, Data Overview, 2012). The indicators are of a wide variety of topics, including information on GDP and tertiary education statistics and are reported in the intention of disseminating as much information as possible about each member country. Statistics are presented on each country from 1960-2012; some indicators have complete data for this time range and others have significant gaps in the data.

By utilizing an ordinary least squares (OLS) regression analysis, the researcher estimated how various causal factors influenced a single variable of interest. This estimate implies a true relationship, but an unknown exact relationship; the causal factor

determines the relationship between the causal factors and the constant. A multiple regression analysis allows for use of simultaneous consideration of multiple factors to explain variation in the dependent variable (Richards, 2009). The researcher has chosen the following indicators for use in the OLS regression analysis: real growth rate (dependent/endogenous variable), population growth, tertiary education enrollment in 2000, tertiary education enrollment in 2000 squared, tertiary education enrollment in 2010, GDP per capita in 2000, GDP per capita in 2000 squared, GDP per capita in 2010, an interactive variable consisting of tertiary education enrollment in 2000 times GDP per capita in 2000, and several regional dummy variables. Regional dummy variables included Africa, Asia, Europe and the United States, Latin America, and Former Communist countries.

This study will utilize an ordinary least squares regression analysis to create a human capital model to assess the hypothesis of the impact of human capital development, in the form of tertiary enrollment, on economic output in the form of the real growth rate. The researcher chose this model after Walters and Rubinson (1983), Barro and Lee (2010), and Škare's (2011) uses of this model to estimate the relationship between human capital and economic growth.

Data Collection Instrumentation. The researcher also utilized educational and economic data assembled annually by UNESCO's Institute for Statistics (UIS); "The UIS collects educational statistics in aggregate form from official administrative sources at the national level" (UNESCO, Background, 2012, p. 1). The researcher focused on public and private tertiary information, human factors, financial matters, participation, and completion. The UIS collects its data through the distribution of three surveys to member

countries, OECD countries, and countries involved in the World Education Indicators (WEI) program, where each countries' ministry of education or national statistical office submit responses to distributed questionnaires, in efforts to confront emergent statistical trends, both positive and negative, and to continuously improve upon data available and extended access of this information (UNESCO, Background, 2012, pp. 1-2). After surveys are collected, the data are reviewed for errors by use of automated systems and through analysis of time series data. The UIS then distributes the information to each participating country, where errors and issues are highlighted and countries are asked to present corrected and complete data for comparative uses. If the country in unable to complete the dataset, the UIS will calculate missing or incorrect information, engender estimates (through use of statistically correlated indicators or previous years approximation), and venture to create a more complete dataset; this dataset is sent back to each country in question for review and if each agree, the dataset is published (UNECSO, FAQ, 2012, p. 2). As new population data is released (generally every two years by the United Nations Population Division), revisions may be made to existing data. This data is of immense importance to policy makers around the world and can assist policy makers in answering questions of financial capacity, equity in the provision of educational opportunities, and are used to analyze new, existing, and trade-off policy implementation that can arise from financial constraints, educational goals, and/or political change (p. 11). The UIS is the primary educational data provider for analysis and monitoring of the MDGs and EFA goals, as well as the primary source of educational data for the World Bank (World Development Report), of which are all explored in this research.

Measurement of Indicators

Countries. Countries were chosen based on available educational data housed within the UNESCO UIS database. Enrollment in tertiary education was a limiting indicator with the least amount of information supplied by each country. As previously noted, UNESCO gathers reports on tertiary education levels through surveys, censuses, and questionnaires distributed by individual governments or other non-governmental organizations. Due to a lack of information, out of 210 countries that report to UNESCO, only 86 were considered for this study. These 86 countries provided fully documented information on tertiary educational enrollments in 2000 and 2010, the two years necessary for compilation of the research and model. Several other aforementioned studies have considered more countries in their models, but utilized increasingly complex modeling to fill gaps in the data that go beyond the scope of this paper. The use of 86 countries gave the researchers adequate data points for comparison of the three particular countries of this study. All other indicators from the model were abundant for the 86 countries, including population and GDP per capita.

Real Growth Rate. Real growth rate was calculated using GDP per capita found on UNESCO's UIS database for years 2000 and 2010. Real growth rate was calculated applying the following equation: $[(\text{real GDP per capita}_t - \text{real GDP per capita}_{t-1})/ \text{real GDP per capita}_{t-1}] * 100$, where t is the current or latest year and t-1 is the year prior to t. In this study, t is 2010 and t-1 is 2000. Real growth rate was applied as the dependent variable in efforts to determine if the real growth rate was effected by increases or decreases in tertiary education levels in the studied countries.

Population Growth. Population growth was calculated similarly to real growth rate, by means of the same equation, but employing population in place of GDP per capita. Population was also obtained from UNESCO's database for the years 2000 and 2010. Population growth was an independent variable and was important to include to control for population growth when testing whether increased enrollments in tertiary education effected GDP per capita in terms of the real growth rate.

Education 2000 and 2010. Tertiary enrollment data was collected from UNESCO's database and was the limiting factor in the type of model and in the number of data points presented. Enrollment in tertiary education was presented for this study as total enrollment in tertiary education, full and part time, male and female, public and private. UNESCO breaks down tertiary education into many categories including by major study area, which may be a space for future research, as well as by male and female, which is another area that is beyond the scope of this research but is an area for future studies. Tertiary enrollment level controlling for population were calculated for the years 2000 and 2010 by taking tertiary education enrollment in 2000 divided by population in 2000 and the same for 2010.

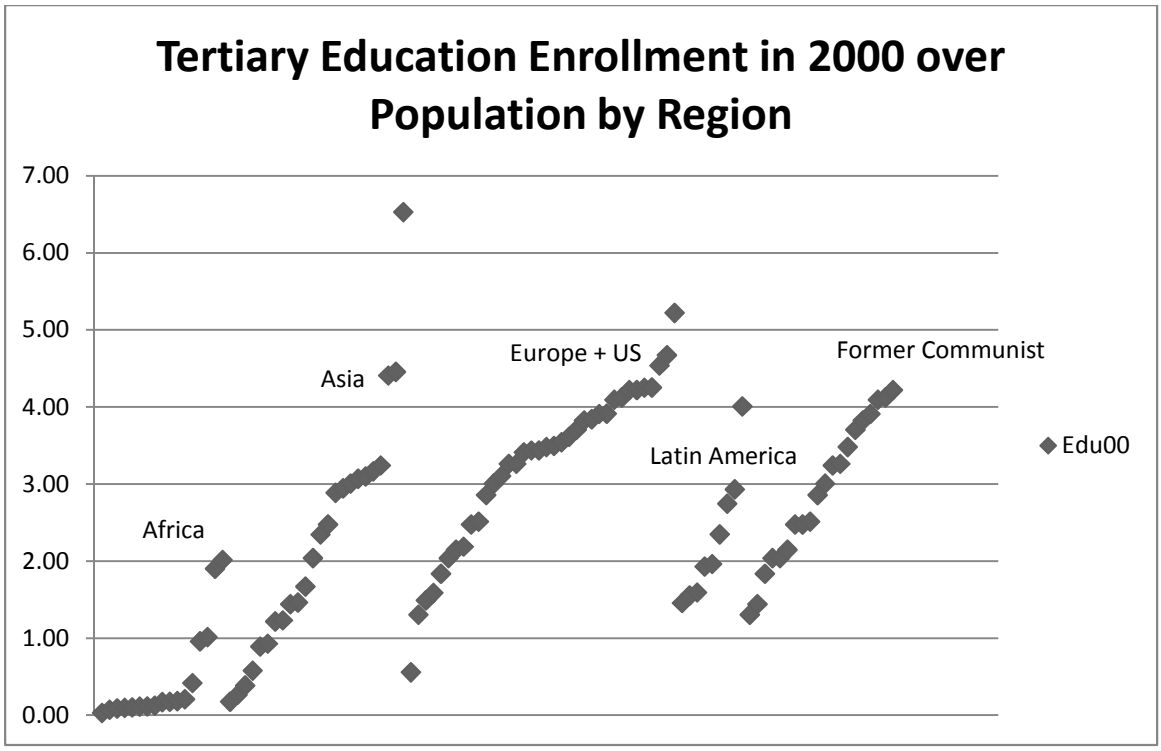

Figure 12. Tertiary Education Enrollment in 2000 over Population by Region.

Note: Data procured from UNESCO UIS (2013d), retrieved from http://www.uis.unesco.org/.

Change in tertiary education level was computed by subtracting these calculations from one another; this was referred to as delta education.

The years 2000-2010 were chosen based off available data, as well as the year 2000 serving as the first year for predictions on growth by 2010. Students enrolled in 2000 traditionally would have graduated somewhere in the years of 2000-04 and by 2010 each would have been a stable producer in the economy. As producers (or workers in the economy), particularly a few years out of tertiary education, models can begin to show how these students' have begun their contribution to the growth of society (seen here measured in the real growth rate). Several other abovementioned studies use this method, the lag method, or moving averages to predict future contributions by past or current enrollees (McClelland, 1965; Walters & Rubinson, 1983; Barro & Lee, 2010; Barro, 2013). In building an educational model, often economic fluctuations are thought to

influence economic outputs such as GDP, GNP, and GSP to varying degrees with instability in the markets. In order to alleviate impacts of those fluctuations, Baldwin, Borrelli, and New (2011) suggest calculating variables using four-year moving averages in order to reduce volatility. By using four-year moving averages, a look into a more comprehensive picture of the economy was observed. This comprehensive picture decreases variability of the timed indicators in the model and increases chances of generating significant results that are influenced by the particular variables at hand, rather than unintended outside sources. The same holds true for the model in this study, as gathering data over a ten-year span produced the most information about the students involved in tertiary education and their contributions to the economy.

GDP per Capita 2000 and 2010. GDP per capita data was assembled from UNESCO's database and was compared to The World Bank and the OECD's data on GDP per capita. Data were similar, if not exact, and was abundant in availability.

Interaction Variable. Education differed by income in each country, where countries with more income per capita tended to grow more slowly than countries with less income per capita. In efforts to determine the effect of education levels dependent upon country size, the researcher used an interaction variable to uncover this marginal effect. The interaction variable is tertiary education enrollment in 2000 times GDP per capita in 2000. This variable gave the marginal effect of one year of education on GDP growth, it is the marginal effect regardless of income in each country. If this term were negative, it would indicate that the effect of education on poorer countries is larger than in rich countries.

Dummy Variables. The researcher selected dummy variables constructed mostly by continent, with two exceptions. The dummy regions included Africa, Asia, Europe plus the United States, Latin America, and Former Communist states. The United States was the only country that was not associated with any other countries in its region and is considered a wealthy state, such like the European countries, so was grouped as such. Latin America includes all of Central America and South America that had data available for the 86 countries involved in the study. A dummy variable for the Former Communist states was selected as a region if efforts to observe the effects on education in those specific countries. Former Communist states have been observed to have large effects from increased efforts in tertiary enrollments and the researcher was interested in comprehending these effects in relation to the other regions listed.

After controlling for each country as a simple 0,1 dummy variable, the researcher also considered allowing each region to have an interactive educational effect in efforts to see the effect of education regionally, while still considering each region respectfully. For example, for the Asian educational dummy variable, Asian countries were given a value of each particular countries' tertiary education enrollment in 2000 and all other countries where denoted with a 0. This process was the same for each region listed. Some regions were accounted for twice if they were an Asian country, but also a Former Communist country, as well as a European country, but also a former Communist country. This gave the researcher an ability to compare this regional variable, and evaluate the model based on the listed regions. For a complete list of countries and their respective regions, refer to Appendix B.

Methodology

Gretl. Gretl (2013) was utilized for OLS regression modeling and is a free, downloadable source found online. Gretl is an open-source program which stands for GNU Regression, Econometrics and Time-series Library; Gretl is similar to SPSS or STATA, but is a free statistical package. Models were run checking for robust standard errors in order to control for problems with heteroskedasticity; the variant was HC1 (heteroskedasticity-consistent) (Gretl, 2013). Heteroskedasticity is the presence of non-constant variance, thus the bias of the standard error (Richards, 2009). Here, each of the different regions could have variable variances and the researcher tried to reduce the likelihood of heteroskedastic results with the use of robust standard errors. Heteroskedastic results bias standard errors, resulting in a biased relationship between exogenous and endogenous variables, therefore the model corrects for potential error with these results, utilizing the robust standard error.

Hypothesis.

H_1: There is a relationship between real growth rate from 2000-2010, population growth, and tertiary education enrollment, as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \varepsilon$

H_2: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, and GDP per capita in 2000 as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \varepsilon$

H_3: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, an interaction term, and regional dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \beta_{5\ \text{Interaction Term (Tert Edu Enrol 2000 * GDP per capita 2000)}} + \beta_6 D_{\text{Africa}} + \beta_7 D_{\text{Asia}} + \beta_8 D_{\text{Europe+US}} + \beta_9 D_{\text{Former Communist Countries}} + \varepsilon$

H_4: There is a relationship between real growth rate from 2000-2010, tertiary education enrollment, tertiary education enrollment squared, GDP per capita,

GDP per capita squared, regional dummy variables, and regional educational dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Tertiary Education Enrollment 2000}} + \beta_{2\text{Tertiary Education Enrollment 2000}^2} + \beta_{3\text{GDP per capita (PPP) 2000}} + \beta_{4\text{GDP per capita (PPP) 2000}^2} + \beta_5 D_{\text{Africa}} + \beta_6 D_{\text{Asia}} + \beta_7 D_{\text{Europe+US}} + \beta_8 D_{\text{Former Communist Countries}} + \beta_9 D_{\text{Africa Edu}} + \beta_{10} D_{\text{Asia Edu}} + \beta_{11} D_{\text{Europe+US Edu}} + \beta_{12} D_{\text{Former Communist Countries Edu}} + \varepsilon$

Models Tested. The researcher proposed the listed hypotheses to create a model that could be built upon to show tertiary educations' role in the real growth rate and to observe which variables could provide the best information for determining this relationship. The first model was designed simply with comparing the real growth rate to population growth and tertiary education enrollment in 2000, with subsequent models expanding upon this general concept. Overall, fifteen models were originally tested; the researcher chose these four to best show the changes of added quadratic indicators, GDP per capita indicators, and two types of dummy variables. Further explanation of choice of indicators and results from each model can be found in Chapter 4.

Methodological Assumptions and Limitations

Within the calculated data, many assumptions and limitations cause concerns of accuracy and reliability. That noted, the data available must be accepted as reliable and sufficient. There are numerous rationales for inaccuracies in the data and therefore the model and not every limitation can be accounted for in this study; as such, a few are listed here. Firstly, as noted by Barro and Lee (2010), OECD data and UNESCO data cannot be used concurrently as significant differences are found within the calculations of the datasets. OECD data is derived from labor force surveys at the individual level, where UNESCO data comes from census data (OECD, 2013a; UNECSO, About the UIS, 2012). Educational classifications systems are computed by distinct means that do not align. UNESCO data tends to be more complete as there are several more years of

census data available for computations as well as a more accurate set of data to construct backward-flow and forward-flow estimates as necessary (UNESCO, About the UIS, 2012; Barro & Lee, 2010).[4] Therefore, this study employs UNESCO data, as the researcher found it the most comprehensive, extensive, and reliable. As aforementioned, the quality of the data depends upon the statistical data collection method, as well as the organization that is collecting the data. Collection methods can be dissimilar and can lead to inconsistencies, particularly in poorer countries with inferior collection methods and data assemblage capabilities.

After these organizations collected the data, in many studies there are gaps in the figures available which causes necessity for complex calculations and in-depth statistical calculations that go beyond the scope of this research. Such calculations can be found in Becker (1993) or Krueger and Lindahl (2001). "Such data have serious intertemporal and inter-country comparability problems, and there are data gaps often filled with constructed data based on interpolatons and extrapolations" (Psacharopoulos & Patrinos, 2004). For the current data set, the researcher only utilized countries with a full data set available, hence the use of 86 countries out of 210 available through UNESCO. For these countries, tertiary education enrollment was the limiting factor and all other data were complete for the data set. The researcher also employed the use of a fixed effect, panel data set, if time-series or cross-sectional data is used, matters of heteroskedasticity can arise. "The availability of panel data provides the possibility of addressing a wider range of issues while still being sensitive to the threats of statistical analysis. . . . the U.S.

[4] See Barro and Lee's (2010) construction of backwards-flow and forward-flow estimates for a better understanding of complex use of equations to fill missing data points accurately.

has shown how panel data techniques can reduce analytical problems while opening up a much wider range of analysis" (Glewwe, Hanushek, Humpage, & Ravina, 2011, p. 44).

Often, complications of statistical bias create limitations within the data. Stevens and Weale (2003) suggested that previous authors might have been subject to elements of selection bias, creating some sort of bias, mathematical or otherwise, in previous publications (p. 20). Glewwe, et al. (2011) stated that "the most common generic concerns are omitted variable bias, sample selection, endogenous program placement, and measurement errors" (p. 11). Krueger and Lindahl (2000) explained that certain countries that may have underwent rapid GDP growth have increased interest from outside countries in outside investment, generating a potential scenario for simultaneity bias (p. 17). These biases arise from aforementioned issues in data collection and other statistical measurement errors that are perpetually observed in this type of modeling.

Other limitations of the data include questions of GDP and GDP per capita calculations and how this data are collected on a country-by-country basis. Poorer countries tend to have weaker forms of data collection and less totality of figures captured. Other issues arise within market verses non-market activities; "there are obvious questions over the GDP figures used, and particularly so for relatively poor countries where non-market activity is likely to be more important than in advanced countries" (Stevens & Weale, 2003, p. 19). These non-market activities skew GDP figures, but researchers must make the assumption that GDP data given is valid. When measuring GDP, questions of calculations arise, creating differing values from differing data sets. Blomström, Lipsey, and Zejan (1996) questioned whether physical capital should be encompassed in GDP because of impending endogeneity; countries that grow

quicker generally have more access to investment and capital as mentioned by Krueger and Lindahl. Other issues arise in capturing GDP data in relation to education,

> If a country has a low level of education for its measured GDP, it is likely that its true GDP is less than its measured GDP. If the error in GDP is transitory, then subsequent GDP growth will appear particularly strong for such a country because the negative error in the GDP is unlikely to repeat in the second period. (Krueger & Lindahl, 2000, p. 32)

Krueger and Lindahl (2000) pointed out that these types of inaccuracies can cause compounding errors not only with GDP, but also with educational data. This limitation, again, is an issue that every researcher must trust that the data is valid and continue to create models and calculations to close the gaps in the data.

When measuring education, limitations in calculations of marginal return to education arise.

> Given this assumption the [educational] figure measures the average return per year of education up to the point at which the marginal return to education just equals the marginal benefit identified by the individual. With reasonable assumption of declining marginal effects of education, it follows that this figure must be higher than the incremental benefit of an extra year's education. (Stevens & Weale, 2003, p. 6)

Issues with the data also include the fact that quality of education is difficult to encompass and cross-country models implicitly presuppose that all countries are housed within the same production frontier, which is an impossibility (Psacharopoulos & Patrinos, 2004, p. 14). Other differences lie in cultural aspects and measurement of

quality, as well as many other omitted variables that cause variation in outcome and true measurement of results.

In the model created by Stevens and Weale (2003), they noted "that growth in total factor productivity is exogenous" (p. 9) and that it is this variable, growth, that is in fact itself dependent on change in educational attainment and "then growth accounting will understate the true contribution of education to economic growth" (p. 9). As educational attainment increases, economic growth increases as a result of enlarged and improved producers in the economy. This creates a paradox of information that is recognized as a limitation. Limitations in educational data available is prominent, as well as its reliability. Stevens and Weale (2003) pointed out that there was often a large disparity in found measurements of years of education, produced from significant measurement errors, "thus the failure to find a link between expansion of education and economic growth may easily be attributed to measurement error" (p. 20). This creates a perpetual challenge for researchers and data collectors and causes continuous room for errors in educational models.

Conclusion

The researcher studied previous models and calculations in building the model for this study and found a historical review of major educational economist's research helpful. In testing tertiary enrollments effect on the real growth rate, four hypotheses were assessed from an original 15 models. The researcher used Gretl, an online statistical software, to run the models in an OLS regression with corrections for heteroskedasticity. Prior researchers have had access to much larger, more expensive databases and delved much further into constructing complex econometric equations that go beyond the scope

of this research. That said, the results from this research are significant and give insight into tertiary educations role in economic growth, particularly in Israel, Japan, and Norway, and the results shed light into the future of human capital development and how policy implementation can help optimize the balance between education and growth.

Chapter Four: Results

Gretl Output

As previously mentioned, the researcher confirmed four models were essential to understanding the relationship between tertiary education and the real growth rate, otherwise known as the relationship between human capital formation and economic growth. The indicators selected for the four models were real growth rate, population growth, tertiary education enrollment in 2000, tertiary education enrollment in 2000 squared, tertiary education enrollment in 2010, GDP per capita in 2000, GDP per capita in 2000 squared, GDP per capita in 2010, an interactive variable consisting of tertiary education enrollment in 2000 times GDP per capita in 2000, and several regional dummy variables. Regional dummy variables included Africa, Asia, Europe and the United States, Latin America, and Former Communist countries. The four models are as follows:

H_1: There is a relationship between real growth rate from 2000-2010, population growth, and tertiary education enrollment, as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \varepsilon$

H_2: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, and GDP per capita in 2000 as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \varepsilon$

H_3: There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, an interaction term, and regional dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \beta_{5\ \text{Interaction Term (Tert Edu Enrol 2000 * GDP per capita 2000)}} + \beta_6 D_{\text{Africa}} + \beta_7 D_{\text{Asia}} + \beta_8 D_{\text{Europe+US}} + \beta_9 D_{\text{Former Communist Countries}} + \varepsilon$

H_4: There is a relationship between real growth rate from 2000-2010, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, GDP per capita squared, regional dummy variables, and regional educational dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate}}$

$$\text{2000-2010} = \beta_0 + \beta_{1\text{Tertiary Education Enrollment 2000}} + \beta_{2\text{Tertiary Education Enrollment 2000}}^2 + \beta_{3\text{GDP per capita (PPP) 2000}} + \beta_{4\text{GDP per capita (PPP) 2000}}^2 + \beta_5 D_{\text{Africa}} + \beta_6 D_{\text{Asia}} + \beta_7 D_{\text{Europe+US}} + \beta_8 D_{\text{Former Communist Countries}} + \beta_9 D_{\text{Africa Edu}} + \beta_{10} D_{\text{Asia Edu}} + \beta_{11} D_{\text{Europe+US Edu}} + \beta_{12} D_{\text{Former Communist Countries Edu}} + \varepsilon$$

The following table displays the mean, maximum, and minimum for the listed indicators for the 86 countries, as well as results for Israel, Japan, and Norway.

Table 3.

Descriptive Statistics

	Real Growth Rate (%)	**Population Growth Rate (%)**	**Tertiary Education Enrollment 2000 (%)**	**Tertiary Education Enrollment 2010 (%)**	**Change in Tertiary Education 00-10 (%)**	**GDP per Capita 2000 (USD)**	**Interactive Variable**
Mean	76.4566	11.8858	2.3159	3.3556	1.0397	11,263.68	35.0926
Max	346.9365 (Azerbaijan)	43.2465 (Eritrea)	6.5311 (Republic of Korea)	6.7855 (Republic of Korea)	2.9761 (Armenia)	53648.17 (Luxembourg)	163.9605 (Spain)
Min	6.0876 (Eritrea)	-8.2920 (Georgia)	0.0319 (Malawi)	0.06909 (Malawi)	-0.4618 (Spain)	440.29 (Burundi)	0.0003 (Albania)
N	86	86	86	86	86	86	86
Israel	15.0022	23.3326	4.2542	4.8579	0.6036	23,519.70	94.3290
Japan	29.7839	0.6487	3.1674	3.0318	-0.1356	25,908.67	38.5052
Norway	57.6929	8.7345	4.2518	4.6017	0.3499	36,131.26	99.1398

Note: Calculations made from data available from UNESCO UIS (2013d). Retrieved from http://www.uis.unesco.org.

Israel, Japan, and Norway fell under the mean for real growth rate and Japan and Norway fell under the mean for population growth rate. All three countries were above the mean for tertiary education enrollment in 2000; Israel and Norway were above the mean in 2010. Japan had negative growth in tertiary education enrollment between 2000 and 2010. All three had higher GDP per capita in 2000 than the mean. The interactive variable is tertiary education enrollment in 2000 times GDP per capita in 2000; Israel and Norway had very high figures for this variable, where Japan came in around the mean. For full results and Gretl output, please refer to Appendix C.

In testing the hypotheses, the researcher observed the coefficient of determination (R^2), the F-test value (F), and the probability value (p-value). R^2 describes how much variation can be explained within the model and how much variation can be explained by the error term (ε) (Richards, 2009). The F test will test if the null hypothesis is true or false by analyzing explained and unexplained variances in the outcome; larger F values mean better results as the model shows more explained variance than unexplained variance (Richards, 2009). If the null hypothesis is false, it is rejected and the parameters did have some impact on the model. With a high F test, the model is statistically significant and the null hypothesis is rejected. The p-value tests individual parameters and gives statistical distributions. Using a 2-tail test and a 90% confidence level, critical values of t (absolute value) will be greater than 1.645 and p-values will be less than 0.10 for the parameter to be statistically significant.

Hypothesis 1

> There is a relationship between real growth rate from 2000-2010, population growth, and tertiary education enrollment, as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \varepsilon$

The first model tested the relationship between real growth rate, population growth, and tertiary education enrollment. This was a simple model to understand the effect of initial tertiary education enrollment on the real growth rate while controlling for population growth. This model states that a change in tertiary education enrollment in 2000 causes a percent change in GDP per capita real growth rate from 2000-2010. The predicted educational effect is that increased tertiary education enrollment would increase GDP per capita growth, but this was not the case in the first model. Results determine that there were negative returns to the real growth rate at the current level of tertiary

education enrollment; the tertiary education coefficient was -14.769. The results were significant at the 95% confidence level for population, p-value <0.0001, as well as education, p-value 0.00012; R^2 is 0.208993 and F is 14.59721. This model is very simple and does not give much insight into why there are negative returns to education, so additional indicators are included into the next model.

Hypothesis 2

> There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, and GDP per capita in 2000 as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \varepsilon$

In the second model, the researcher added a quadratic tertiary education term, as well as a variable for GDP per capita in 2000. These additional terms explain further how education impacts growth and gives supplementary information through the use of a non-linear term. Education was still negative, although less negative than previously (-9.50214), but no longer significant in this model. R^2 is 0.343699, meaning 34.37% of variation in the model was explained by the data and 65.63% of variation was unexplained by the model but explained by the error term. This model was necessary to understand if a quadratic term was valuable in further explaining effects on the real growth rate. In the next model, the researcher added dummy variables in order to further explain educations' role on a regional basis rather than inclusion of every country in the study.

Hypothesis 3

> There is a relationship between real growth rate from 2000-2010, population growth, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, an interaction term, and regional dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} +$

$\beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \beta_{5\ \text{Interaction Term (Tert Edu Enrol 2000 * GDP per capita 2000)}} + \beta_6 D_{\text{Africa}} + \beta_7 D_{\text{Asia}} + \beta_8 D_{\text{Europe+US}} + \beta_9 D_{\text{Former Communist Countries}} + \varepsilon$

The introduction of dummy variables in the third model helped the researcher to understand how tertiary education effected growth regionally, rather than globally. Each region gave insight into how education effects growth in the different areas, as some regions were held a positive effect and others, negative. The introduction of regional dummy variables into the model allows for differences in the relationship between tertiary education and growth between countries or groups of countries. The regional dummy variables account for the fact that difference in the average growth rates across world regions whereas the interaction terms allow for the possibility that there are regional differences in the effect of tertiary education on growth. This overcame the issue discussed by Hanushek and Woessmann in 2008, where the authors stated that utilizing enrollment data was insufficient if assuming the marginal returns to one year of schooling are the same from country to country, irrespective of the education system (p. 629).

This is an improvement over model 2, which assumes that the effect of tertiary education on growth is the same for all countries in the world. The interaction variable is introduced as well, tertiary education enrollment in 2000 times GDP per capita in 2000, in order to estimate the marginal effect of one year of education on growth, regardless of income. In model 3, the researcher found population growth, education, GDP per capita, the Asia dummy variable, and the Former Communist country variable significant at the 90% confidence level. R^2 was 0.515455 and F was 7.820382; the effects of education on growth were negative for Africa (-20.472) and Europe plus the United States (-0.91283) and were positive for Asia (34.8161) and the Former Communist countries (41.8994).

These results explain that Africa, Europe, and the United States may be spending too many resources on tertiary education when comparing with economic growth and Asia and the Former Communist countries are benefitting from their investments in tertiary education in relation to economic growth.

When conducting the Wald Test, the regression parameters were zero for education, education squared, and the interaction variable, leading to an F value of 2.042 and a p-value of 0.11507. This states the model was significant overall as it tested the value of the education parameters in relation with non-education parameters. The researcher used the Wald Test in order to test all coefficients simultaneously and because the education variable was seen in many places within the model. A final hypotheses was tested where educational dummy variables were included to create a better picture of regional data.

Hypothesis 4

> There is a relationship between real growth rate from 2000-2010, tertiary education enrollment, tertiary education enrollment squared, GDP per capita, GDP per capita squared, regional dummy variables, and regional educational dummy variables as represented by the equation: $\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Tertiary Education Enrollment 2000}} + \beta_{2\text{Tertiary Education Enrollment 2000}^2} + \beta_{3\text{GDP per capita (PPP) 2000}} + \beta_{4\text{GDP per capita (PPP) 2000}^2} + \beta_5 D_{\text{Africa}} + \beta_6 D_{\text{Asia}} + \beta_7 D_{\text{Europe+US}} + \beta_8 D_{\text{Former Communist Countries}} + \beta_9 D_{\text{Africa Edu}} + \beta_{10} D_{\text{Asia Edu}} + \beta_{11} D_{\text{Europe+US Edu}} + \beta_{12} D_{\text{Former Communist Countries Edu}} + \varepsilon$

The final model includes tertiary education, tertiary education squared, GDP per capita, GDP per capita squared, as well as regional dummy variables and educational regional dummy variables. The population growth rate was omitted, as it could be concluded that population growth is captured in enrollment and GDP per capita, creating issues with multicollinearity. Issues with multicollinearity arise when two or more variables are highly correlated (Richards, 2009), as presumably predicted here with

population growth and GDP per capita, as each tend to move in conjunction with each other.

Additional regional dummy variables were introduced to include educational values for each region, rather than relying on the assumption that all levels of education are the same worldwide. Each country held the value of its tertiary educational enrollment in 2000 as its value if it was classified in a particular region. This provided insight into the role of education in region and therefore allowed the researcher to test the three countries in this research against their particular region, rather than against educational enrollment globally.

In this model, GDP per capita in 2000, GDP per capita squared, the Asia dummy variable, and the Asia educational dummy variable were found to be significant at the 90% confidence level. R^2 was 0.580688 and F was 11.55522. The effects of education regionally on growth were negative in all regions, Africa (-2.916e-05), Asia (-28.7133), Europe and the US (-11.3552) and the Former Communist countries (-26.3591). Tertiary education enrollment was for the first time positive (9.75516), giving insight into why it is important to apply education regionally. These estimates provided evidence into to potential over enrollment into tertiary education in each region in relation to economic growth. The Wald Test again showed when testing the null hypothesis that the regression parameters were zero for the variables education, education squared, and all four regional education dummy variables. The test statistic produced a robust F of 7.0139 and a p-value of 6.44716e-006. This signifies that education is significant in the growth model as the R^2 value has changed significantly with the removal of all effects of education. The

model is significant and was used to develop point estimates for Israel, Japan, and Norway.

Point Estimates

In order to determine the marginal results of tertiary education, the researcher used model 4 to generate point estimates for Israel, Japan, and Norway. Derivatives of education were used to determine the sensitivity of educational change to change in the real growth rate. The researcher developed the following equations for use in determining point estimates for an individual country:

∂real growth rate/∂tertiary education enrollment = $\beta_0 + 2\beta_{1\text{Tertiary Education}} + \delta_{\text{Africa}}$

∂real growth rate/∂tertiary education enrollment = $\beta_0 + 2\beta_{1\text{Tertiary Education}} + \alpha_{\text{Asia}}$

∂real growth rate/∂tertiary education enrollment = $\beta_0 + 2\beta_{1\text{Tertiary Education}} + \theta_{\text{Europe + US}}$

∂real growth rate/∂tertiary education enrollment = $\beta_0 + 2\beta_{1\text{Tertiary Education}} + \upsilon_{\text{Latin America}}$

∂real growth rate/∂tertiary education enrollment = $\beta_0 + 2\beta_{1\text{Tertiary Education}} + \sigma_{\text{Former Communist}}$

∂ indicates the fractional derivative or half derivative. The result provides a positive or negative sign, which determines whether a particular country is over enrolling their population into tertiary education or under enrolling.

Israel

In the case of Israel, the following equation was developed:

∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education Israel$(4.254248) + \theta_{\text{Europe + US}}(-11.3552) = 15.8203$. The positive sign on the result gives insight into Israel's tertiary education system in that tertiary education enrollment is positively effecting the real growth rate. There was slight uncertainty in the

actual figure, 15.8203, as a true result for the effect because of the increasing standard error, but the positive sign is the important part of this equation.

Japan

The same equation was tested for Japan:

∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education Japan$(3.167403) + \alpha_{Asia}(-28.7133) = -5.9882$. Here, the negative sign signals that Japan was overenrolling its population in tertiary education from 2000 to 2010. In Asia, returns to education were found lower than average, with a -28.7133 coefficient. This coefficient is an average across all Asian counties and it is calculated that Japan's education system has a negative effect on economic growth.

Norway

Finally, the same equation was tested with Norway with the following results:

∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education Norway$(4.251815) + \theta_{Europe + US}(-11.3552) = 15.8104$. Returns to tertiary education were found positive in Norway, signaling tertiary education was responsible for some economic growth during the time period studied.

In order to find the optimization of tertiary education enrollment in each region, the researcher used the previous equation, but set each equal to zero. The following results were determined:

Africa: ∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education + $\delta_{Africa}(-2.91639e-05) = 0$; Tertiary education optimization in Africa* =

-2.3823

Asia: ∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education + α_{Asia} (-28.7133) = 0; Tertiary education optimization in Asia* = 4.6298

Europe and U.S.: ∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education + $\theta_{Europe + US}(-11.3552)$ = 0; Tertiary education optimization in Europe and the US* = 0.3907

Latin America: ∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education + $\upsilon_{Latin\ America}(0)$ = 0; Tertiary education optimization in Latin America* = 2.3823

Former Communist countries: ∂real growth rate/∂tertiary education enrollment = $\beta_0(9.75516) + 2\beta_1(2.04741)$*Tertiary Education + $\sigma_{Former\ Communist}(-26.3591)$ = 0; Tertiary education optimization in the Former Communist countries* = 4.0549

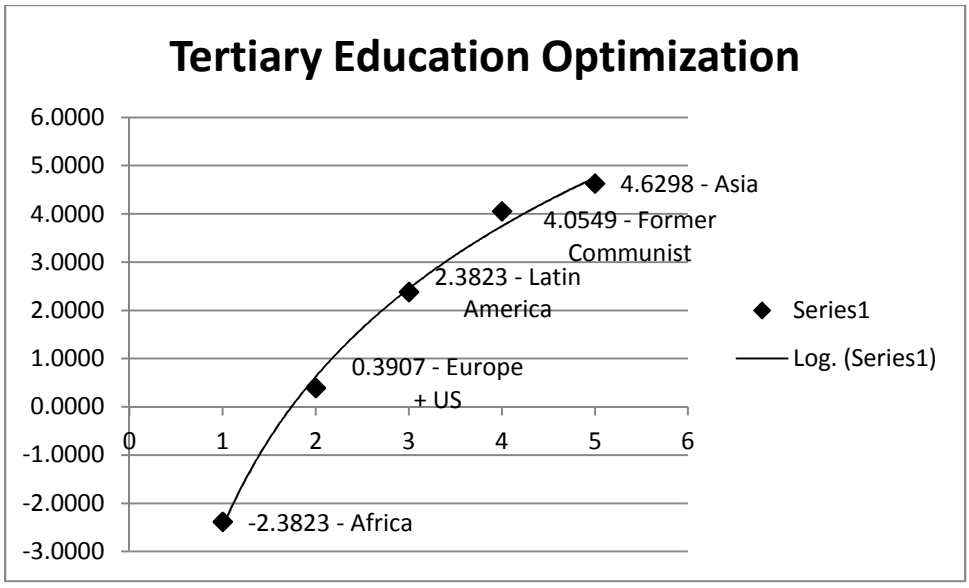

Figure 13. Tertiary Education Optimization.

Note: Calculated based on Gretl results.

These optimization estimates provide insight into the optimal level of tertiary education enrollment to maximize growth. Relative to each country, if the figure

determined for the country is less than the optimal figure, reducing education will raise growth, where if the figure determined for a particular country is greater than the optimal figure, increasing education enrollment will raise growth. In Israel and Norway, both countries should increase their tertiary education enrollments to increase real growth rate and Japan should decrease tertiary education enrollments to increase real growth rate.

Conclusion

In general, tertiary education enrollment moved from negative in the first three models to positive in the last. The last model was considered to hold the most information and the best evidence for determining tertiary education's role in economic growth as the educational dummy variables added information necessary to determine this relationship. By adding regional education dummy variables, the researcher could determine how education was effecting each region, rather than assuming education is the same for every region. Tertiary enrollment transitions into growth in certain regions, but does the opposite in other regions. Latin America was the closest to maximizing enrollments, and all other regions follow, beginning with Africa, Europe and the US, the Former Communist countries, and then Asia. There is much to determine from these results, as this will be discussed in Chapter 5.

Chapter Five: Discussion and Reflection

Methodology and Output

In determining how tertiary education and human capital formation influenced economic expansion in Israel, Japan, and Norway from 2000 to 2010, the researcher used an OLS regression to test four hypotheses and to calculate point estimates for the three particular countries in question. Each hypothesis was generated to build upon the previous hypothesis in efforts to ascertain significant indicators for tertiary education and economic development. Dummy variables proved to be critical in determining educational effects regionally; controlling for each region allowed for differences in average growth rates to be detected and the interaction term permitted for regional differences in the effect of tertiary education on growth.

R^2 increased with each hypothesis, meaning added exogenous variables helped explain more of the model with additional data with less explained by the error term. The Wald Test was utilized in the final two hypotheses to determine their significance as the parameter estimates for education in each model were zero proving the null hypothesis to be false and the models to be statistically significant. The researcher was interested in whether or not educational coefficients were positive or negative in order to determine their relationship with economic expansion. The first model, which was very simple, determined that there were negative returns to the real growth rate at current levels of tertiary enrollments, but this was assuming the marginal effect of one year of education was the same across all countries. This is not a very realistic situation and these results do not necessarily give much insight into tertiary educations role in economic growth. Although, this model does show that worldwide from 2000 to 2010, when controlling for

population, tertiary education enrollments were too high for the optimization of the real growth rate. The second model provided comprehension of a quadratic term in order to determine if the relationship was curvilinear. The relationship is in fact curvilinear where the function of the squared term was to allow for a curve in the regression line, in the quadratic models, education holds an asymptotic effect as it increases at a decreasing rate. This was valuable evidence in determining the best model to estimate tertiary education's relationship with the growth rate.

Models 3 and 4 proved to be more indicative of reality once the dummy variables were introduced. The marginal effect of a year of education was controlled by region in each of the last two models, and the dummy variables provided calculation of point estimates for Israel, Japan, and Norway, and, ultimately, could determine point estimates for any of the 86 countries in the model. In the third model, the Former communist countries and Asia had positive coefficients, where Europe and the US and Africa had negative coefficients, and Latin America was considered to be held at zero. This information explains that, for this particular model, tertiary education enrollment should be decreased in Europe and the US and in Africa for optimization of growth where enrollment should be increased in the Former Communist countries and Asia. Tertiary education overall is negative, implying that overall tertiary enrollment was too high for economic growth optimization. The Wald Test again provided that the regression parameters for education were zero, therefore the model was significant overall in relation with non-education parameters. In the fourth model, regional, educational dummy variables provided a very different picture than the other three models. The regional education dummy variable was negative for each region, again, meaning that

optimization is not being reached. This information is only used when testing the real growth rate; optimization of the real growth rate is the goal of these particular models, but may not necessarily be the goal of a country or region. This model was used to develop point estimates for Israel, Japan, and Norway, and allowed for greater insight into how education was effecting the model. R^2 was 58.07%, a relatively sound model for the amount of data available. The Wald Test again found this model significant and the Asia dummy variable and Asia educational dummy variable proved to have the strongest results. This model is reporting that there was an abundance of tertiary enrollments, or human capital development, during the years of 2000 to 2010 for all regions tested and for optimization of the real growth rate, ceteris parabis, enrollment overall should be decreased.

Interpretation of Results

As previously mentioned, Krueger and Lindahl (2000) predicted that countries with higher amounts of income largely have more educated populations, have greater access to capital, and have the capability of creating a more expansive, educated workforce. This would hold true for the three countries in this study, but may also explain the negative returns to education found in the fourth model. Countries with greater income levels are commonly predicted to realize a higher GDP growth rate than poorer countries, which could shed new light into the model. This research may have produced differing results if it had followed the models of Psacharopoulos and Patrinos (2004), as they measured low income, middle income, and high-income countries and their private and social returns to education. Granted, the researcher found similar results to Psacharopoulos and Patrinos (2004), in that Latin America held the highest returns to

education in each model, and overall, an increase in educational supply has led to a decrease in return. These are similar results to model 4 in this study and may add some legitimacy to these results.

Schofer and Meyer (2005) found that post 1960 tertiary education expanded with greater enrollments during periods where democracy was more prevalent and more quickly in nations that previously were deficient in tertiary education systems. This may explain some differences in this study, as the number of years considered were fewer and much more recent. From 1960 to 2000 forms of governments from different countries changed much more than from the period of 2000 to 2010. Schofer and Meyer (2005) found that there was positive growth associated with tertiary education, but because of the time period and various alternative indicators, this study finds otherwise. That said, it is interesting to note that this study was similar to Schofer and Meyer's (2005) explanation of "ethno-linguistic fractionalization" where in more homogenous societies tertiary enrollments grow faster than in more diverse societies (p. 40). This aids in revealing that because of the highly homogenous societies of Japan and Norway, this may have contributed to such high tertiary enrollments and enrollment growth. From 2000 to 2010, Japan had realized a declining population rate, but still had an increasing tertiary enrollment rate and Norway had a steady population rate with an increasing tertiary education enrollment rate (as can be seen in Figures 7 and 9). Each country has a highly homogenized population, as this may account for a component of their enhanced academic achievements.

In the fourth model, the researcher found negative growth returns to educational enrollment in each of the regions studied, aside from Latin America. These results are

similar to McMahon's (2004) results where he analyzed the returns to education including externalities respective of capital spending, and found his results as inefficient where the optimum level of economic progress was not realized (p. 211). McMahon (2004) stated the importance of choosing cross-country data, as this study has done, to permit a wider outcome variation and more sound statistical estimates when dealing with issues of multicollinearity, non-linearity, and unstable explanatory powers. Barro (2013) also devoted some thought to data that is highly homogenous, but explained with the use of regional data, this issue is potentially resolved. Both of these studies are in coherence with the current study and add to its validity. After creating regional educational variables, determining point estimates for Israel, Japan, and Norway was critical in determining the marginal effect of tertiary education in these countries.

Interpretation of Point Estimates

Computing point estimates for each country allowed the researcher to more fully understand how tertiary education enrollments were affecting the real growth rate in each of the respective countries and provided a summary of suggestions for each country and consideration for policy response. In Israel, the point estimate result offered insight into how enrollments were accountable for some positive economic growth. After reviewing previous literature on the subject of Israel's education system and the overall economic state, the religious struggle and immigration influx as well as overall conflict in the region has not seemed to cause overbearing problems with economic growth. Israel held relatively strong through the financial crisis of 2007 and 2008, and its strong commitment to industry and technology have proved to keep GDP high and funding flowing for education. Because of such high and consistent GDP, Israel is able to continue its high

public funding rates of tertiary education at 70% (Israel Ministry of Foreign Affairs, 2010). Because of this high public funding where students are charged a uniform rate, universities are encouraged to push students into the sciences and engineering in efforts to keep GDP high as Israel continues to capitalize on its strengths. This policy goes both ways, governmentally and institutionally, in efforts to continue strong real GDP growth. That said, the CHE has begun to institute policies aimed at declining the number of undergraduates, increasing the number of graduates, and increasing enrollments at private institutions, alleviating some financial strain off the government. Israel has seen an influx in immigrants into the country, but now needs to diversify its institutions, without leading towards cultural clashes and increased social tension. In order to optimize economic growth in relation to tertiary education enrollments and to stay in line with current set public policy, Israel should host more students, and particularly more international students. In 2010, as aforementioned, a new six year budget was approved to increasing diversification of minorities in order to expand culturally and actual number of students. As Israel continues to grow its tertiary population, Davidovitch (2011) concurs with this study in that there needs to be clear and uniform policy set in order to efficiently increase enrollments, decrease financial burdens of tertiary education, and to minimize social tensions. The CHE continues to work with the lack of government infrastructure to build the relationship between the government and institutions as movement continues towards privatization, capitalism, and internationalism.

Point estimates for Japan created a much different picture than for Israel. While the Asia educational dummy variable concluded that the Asia region was the least efficient in using tertiary education as a means to create an increased real growth rate,

Japan also produced a negative result in determining tertiary enrollments effect on the real growth rate, proving that it was not optimizing its enrollments in terms of GDP growth. The populations of Japan's zeal for tertiary education may be actually contributing to lower economic growth, ceteris paribus, in this study. Japan's drivers of GDP growth are manufacturing and innovation and has generally had a very high GDP per capita (see Figure 8). In the past twenty years, Japan's financial and economic stability has been oscillating with the financial crisis of 2007-2008, earthquake, and tsunami disasters. Although GDP per capita continues to grow, population growth is declining and may have some relationship with the calculated negative returns to education. Nearly 70% of 18 year-olds were involved in higher education in 2011 and with a fervently competitive educational structure, enrollments do not seem to be declining any time soon. Eighty percent of these students are enrolled in private universities, which are still under state control and subsidized partially by the government, and partly by private incomes and outside private institutions. Japan has one of the lowest tertiary educational expenditures per capita, but even so, cannot financially continue on its current path. Japan's GDP is declining at a fairly significant rate, from $509,860,000,000,000 in 2000 to $482,384,400,000,000 in 2010 (and again to $475,528,900,000,000 in 2012), and coupled with a negative population growth rate, expansion of public spending, and an aging population, Japan cannot continue down its current course without a change in fiscal policy. Japan's education system will most likely struggle through the continued expansion of students and contraction of funding and the MEXT must work the with government to alleviate upcoming complications. Culturally speaking, it is very important to high school aged students to enter into

university, either an elite public institution or a large private institution. The MEXT continues to promote programs such as “Global 30” and reaching 300,000 international students by 2020, but this may not lead to an optimization of economic growth, as calculated in model 4. Tertiary education is very important to the populace of Japan, as well as the ministry is dedicated to building one of the best education systems in the world, but set policies should be reconsidered to optimize the financial supply of the country as well as its optimal economic growth rate.

Norway’s point estimate results were similar to that of Israel in that tertiary enrollment was found responsible for some economic growth from 2000 to 2010. Norway holds a considerable stash of funds available from efficient use of an abundance of natural resources. Because of this abundance of funds, the government is able to provide free primary, secondary, and tertiary education, including graduate and PhD programs. Ninety percent of students take advantage of the free public higher education. As previously mentioned, Norway’s population is very homogenous, again, commonly leading to increased academic achievement and increased tertiary enrollment growth (Schofer & Meyer, 2005). The Bologna Declaration in 1999 aimed to reduce barriers in tertiary education across European Nations and to bolster international competitiveness. NOKUT was formed to help bridge this gap between the new policies from the Declaration, the government, and institutions, as all of this has led to increased tertiary enrollments. As natural resources may be waning, Norway should continue to focus on increased enrollments, particularly through the improved mobilization process that comes through the Bologna Process developments. Through NOKUT, students are advocated to study the sciences, math, and agriculture to stay in alignment with Norway’s natural

resources and its future labor structure. Much of Norway's GDP growth has been realized from increasing oil prices and may have some implications on how tertiary education effected the real growth rate. With high GDP growth, public expenditures per student on tertiary education were very high from 2000 to 2010 (see Figure 11). The government has the ability to support this type of financial structure currently, but only the future will tell if this current path can be sustained. As the labor structure continues to change, NOKUT and the government should reinforce tertiary education enrollment, particularly as point estimates point that Norway could continue towards optimization of tertiary education through increased enrollments. With relatively strong economic conditions and a flexible education structure, Norway has the ability to increase its enrollment over population ratio and maximize its economic growth.

Recommendations and Future Implications

These hypotheses give some insight into the efficiencies of tertiary education or human capital development in different regions and the point estimates for Israel, Japan, and Norway create some awareness of how to optimize enrollments for maximizing real growth. Each model built upon the prior model, and each model provided increased information about global and regional educational growth. These results can only be as accurate as the model, as there may be many other factors that are influencing the real growth rate, but this study was interested in educational enrollment, so the focus was on the marginal effects of education. This study produced similar results as certain studies, such as Schofer and Meyer (2005) and McMahon (2004), but found dissimilar results to other previous works, such as Hanushek and Woessmann (2008) and Barro and Lee (2010). However, each of these studies had various indicators and differing access to

data, therefore delivering contrasting hypotheses and outcomes. This study had some limitations in sources of potential bias and lack of available data.

Assuming the researcher could have had full access to all data, this study could have been improved by using a wider date range accompanied by the use of lags to better determine how and when enrollments were directly effecting economic growth. Human capital can be quantified by many other measures beyond enrollment and if the data was available, the research potentially could have produced stronger results. As with most economic evaluations, the researcher must contend with the ceteris paribus clause, in that these models were performed in efforts to determine the theoretical relationship between human capital in the form of tertiary education and economic growth. This allowed for the study to focus on a single indicator and its distinctive effects in this particular composite causal framework.

This study was developed so that any of the 86 countries involved could have point estimates calculated and case studies could be supported by the data. Regional studies could be produced by this data and these models as well as individual country analysis or multiple country comparison. In this particular study, the researcher was interested in high tertiary enrollment countries with high GDP per capita's, but many other combinations of country characteristics could be analyzed to produce supporting or alternate outcomes. Human capital development takes into account many different features, tertiary education enrollment just being one measure; new research could include additional measures, such as other prior research has done in order to determine more specific outcomes or policy recommendations for particular countries or regions. If available, this study might have produced stronger results if better data on financial

expenditures was available and if more countries could have been included. The regional results were only as good as the data behind the calculations and more countries per region might have provided a clearer picture of the educational situation for optimization. The researcher was surprised at the regional negative returns to education observed in model 4, particularly as overall returns to education were positive. Subsequent research could further explore this relationship and could consider different indicators in calculating optimizations.

Overall, this research was constrained by data availability and the inability to cross-contaminate data. There was much data available from UNESCO as well as from The World Bank, but it was recommended by most prior research to not use both data sets for the same calculations, as the data may or may not be reliable and valid if multiple data sets are used. As stated on UNESCO's website, data are becoming more obtainable and reliable each year as better methods for collection and storage are becoming available. As more and better data becomes available, new research will be more detailed and more precise to offer recommendations to government entities, NGO's, and educational institutions.

Conclusion

As governments and educational ministries continue to put forth efforts to continue forming a knowledgeable society through human capital development, exertions are placed in the tertiary education system and its ability to create substantial change in a society. Economic growth has consistently been a driver of policy implementation and only with analyzed and well-designed models can proper decisions be drawn upon from the data. Education plays a core role in government policy as well as societal

transformation and research such as this study can benefit in making decisions that will create optimal scenarios for different environments. Human capital calculations will continue to provide vision for the future and through continual research, societies will be able to flourish and capitalize on their populations flourishing knowledge society.

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Appendix A

Educational Attainment of 25-64 year-olds (2011)

Country	Educational Attainment of 25-64 year-olds (%)	OECD Rank
Canada	52.3294	1
Japan	47.4000	2
Israel	46.3969	3
United States	42.4484	4
Korea	41.4085	5
New Zealand	40.3327	6
United Kingdom	39.4124	7
Finland	39.3182	8
Australia	38.3421	9
Norway	38.0535	10
Ireland	37.7215	11
Luxembourg	37.0348	12
Estonia	36.3181	13
Switzerland	35.2043	14
Sweden	35.1744	15
Belgium	34.6130	16
Iceland	33.8693	17
Denmark	33.7020	18
Spain	31.5711	19
Netherlands	31.5470	20
France	29.7629	21
Chile	28.7000	22
Germany	27.5623	23
Poland	25.7255	24
Greece	25.6152	25
Slovenia	25.0906	26
Hungary	21.1240	27
Austria	20.3460	28
Czeck Republic	20.2432	29
Slovak Republic	18.3776	30
Mexico	18.3227	31
Portugal	18.2570	32
Turkey	16.0341	33
Italy	14.2423	34

(OECD, 2013b)

Appendix B

Countries with available tertiary data (countries used in regression analysis):

Albania
Armenia
Australia
Austria
Azerbaijan
Belarus
Belgium
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Cape Verde
Central African Republic
Chad
Chile
China
Colombia
Comoros
Croatia
Cyprus
Czech Republic
Denmark
El Salvador
Eritrea
Estonia
Ethiopia
Finland
France
Georgia
Greece
Honduras
Hungary
Iceland
India
Indonesia
Ireland
Israel
Italy
Japan
Jordan
Kazakhstan
Kyrgyzstan
Lao People's Democratic Republic
Latvia
Lebanon
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Mali
Malta
Mauritius
Mexico
Mongolia
Morocco
Nepal
New Zealand
Norway
Panama
Paraguay
Poland
Portugal
Republic of Korea
Republic of Moldova
Romania
Rwanda
Saudi Arabia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Tajikistan
Thailand
The former Yugoslav Republic of Macedonia
Tunisia
Ukraine
UK of Great Britain and Northern Ireland
United States of America
Uruguay
Uzbekistan
Viet Nam

Dummy Variable Denotations

Country	Region
Albania	Europe + US/ Former Communist
Armenia	Asia/ Former Communist
Australia	Asia
Austria	Europe + US
Azerbaijan	Asia/ Former Communist
Belarus	Europe + US/ Former Communist
Belgium	Europe + US
Brazil	Latin America
Brunei Darussalam	Asia
Bulgaria	Europe + US/ Former Communist
Burkina Faso	Africa
Burundi	Africa
Cambodia	Asia
Cameroon	Africa
Cape Verde	Africa
Central African Republic	Africa
Chad	Africa
Chile	Latin America
China	Asia
Colombia	Latin America
Comoros	Africa
Croatia	Europe + US/ Former Communist
Cyprus	Europe + US
Czech Republic	Europe + US/ Former Communist
Denmark	Europe + US
El Salvador	Latin America
Eritrea	Africa
Estonia	Europe + US/ Former Communist
Ethiopia	Africa
Finland	Europe + US
France	Europe + US
Georgia	Asia
Greece	Europe + US
Honduras	Latin America
Hungary	Europe + US/ Former Communist
Iceland	Europe + US
India	Asia
Indonesia	Asia
Ireland	Europe + US
Israel	Europe + US
Italy	Europe + US
Japan	Asia
Jordan	Asia

Kazakhstan	Asia/ Former Communist
Kyrgyzstan	Asia/ Former Communist
Lao People's Democratic Republic	Asia
Latvia	Europe + US/ Former Communist
Lebanon	Asia
Lithuania	Europe + US/ Former Communist
Luxembourg	Europe + US
Madagascar	Africa
Malawi	Africa
Malaysia	Asia
Mali	Africa
Malta	Europe + US
Mauritius	Africa
Mexico	Latin America
Mongolia	Asia
Morocco	Africa
Nepal	Asia
New Zealand	Asia
Norway	Europe + US
Panama	Latin America
Paraguay	Latin America
Poland	Europe + US/ Former Communist
Portugal	Europe + US
Republic of Korea	Asia
Republic of Moldova	Europe + US/ Former Communist
Romania	Europe + US/ Former Communist
Rwanda	Africa
Saudi Arabia	Africa
Slovakia	Europe + US/ Former Communist
Slovenia	Europe + US/ Former Communist
Spain	Europe + US
Sweden	Europe + US
Switzerland	Europe + US
Tajikistan	Asia
Thailand	Asia
The former Yugoslav Republic of Macedonia	Europe + US/ Former Communist
Tunisia	Africa
Ukraine	Europe + US/ Former Communist
United Kingdom of Great Britain and Northern Ireland	Europe + US
United States of America	Europe + US
Uruguay	Latin America
Uzbekistan	Asia
Viet Nam	Asia

Appendix C

Gretl Results

Hypothesis 1:

$$\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \varepsilon$$

Model 1: OLS, using observations 1-86
Dependent variable: RealGrowthRate
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	138.108	15.3992	8.9685	<0.00001	***
PopGrowthRate	-2.30927	0.432633	-5.3377	<0.00001	***
Edu00	-14.769	3.65142	-4.0447	0.00012	***

Mean dependent var	76.45663	S.D. dependent var	50.99077
Sum squared resid	174816.5	S.E. of regression	45.89360
R-squared	0.208993	Adjusted R-squared	0.189932
F(2, 83)	14.59721	P-value(F)	3.70e-06
Log-likelihood	-449.5659	Akaike criterion	905.1319
Schwarz criterion	912.4949	Hannan-Quinn	908.0952

Hypothesis 2:

$$\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \varepsilon$$

Model 2: OLS, using observations 1-86
Dependent variable: RealGrowthRate
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	139.352	17.8368	7.8126	<0.00001	***
PopGrowthRate	-2.09456	0.442194	-4.7367	<0.00001	***
Edu00	-9.50214	9.8383	-0.9658	0.33700	
Edu00_2	0.618234	1.41367	0.4373	0.66304	
GDPperCap00	-0.00183913	0.000439637	-4.1833	0.00007	***

Mean dependent var	76.45663	S.D. dependent var	50.99077
Sum squared resid	145045.9	S.E. of regression	42.31654
R-squared	0.343699	Adjusted R-squared	0.311289
F(4, 81)	13.88068	P-value(F)	1.15e-08
Log-likelihood	-441.5384	Akaike criterion	893.0768
Schwarz criterion	905.3486	Hannan-Quinn	898.0156

Hypothesis 3:

$$\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Population Growth (00-10)}} + \beta_{2\text{Tertiary Education Enrollment 2000}} + \beta_{3\text{Tertiary Education Enrollment 2000}^2} + \beta_{4\text{GDP per capita (PPP) 2000}} + \beta_5 \text{Interaction Term (Tert Edu Enrol 2000 * GDP per capita 2000)} + \beta_6 D_{\text{Africa}} + \beta_7 D_{\text{Asia}} + \beta_8 D_{\text{Europe+US}} + \beta_9 D_{\text{Former Communist Countries}} + \varepsilon$$

Model 3: OLS, using observations 1-86
Dependent variable: RealGrowthRate
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	117.599	20.7203	5.6755	<0.00001	***
PopGrowthRate	-1.04929	0.604254	-1.7365	0.08653	*
Edu00	-20.5169	10.3047	-1.9910	0.05007	*
Edu00_2	1.9559	1.32933	1.4713	0.14533	
GDPperCap00	-0.00113863	0.000606712	-1.8767	0.06440	*
inter	0.048456	0.137145	0.3533	0.72483	
former_comm	41.8994	24.8451	1.6864	0.09582	*
Euro+us	-0.91283	16.8801	-0.0541	0.95702	
Africa	-20.472	15.4976	-1.3210	0.19047	
Asia	34.8161	11.6478	2.9891	0.00377	***

Mean dependent var	76.45663	S.D. dependent var	50.99077
Sum squared resid	107086.9	S.E. of regression	37.53715
R-squared	0.515455	Adjusted R-squared	0.458075
F(9, 76)	7.820382	P-value(F)	4.60e-08
Log-likelihood	-428.4918	Akaike criterion	876.9836
Schwarz criterion	901.5271	Hannan-Quinn	886.8612

Wald Test: Test on Model 3:
Null hypothesis: the regression parameters are zero for the variables
Edu00, Edu00_2, inter
Test statistic: Robust F(3, 76) = 2.042, p-value 0.11507

Hypothesis 4:

$$\gamma_{\text{GDP per capita (PPP USD) real growth rate 2000-2010}} = \beta_0 + \beta_{1\text{Tertiary Education Enrollment 2000}} + \beta_{2\text{Tertiary Education Enrollment 2000}^2} + \beta_{3\text{GDP per capita (PPP) 2000}} + \beta_{4\text{GDP per capita (PPP) 2000}^2} + \beta_5 D_{\text{Africa}} + \beta_6 D_{\text{Asia}} + \beta_7 D_{\text{Europe+US}} + \beta_8 D_{\text{Former Communist Countries}} + \beta_9 D_{\text{Africa Edu}} + \beta_{10} D_{\text{Asia Edu}} + \beta_{11} D_{\text{Europe+US Edu}} + \beta_{12} D_{\text{Former Communist Countries Edu}} + \varepsilon$$

Model 4: OLS, using observations 1-86
Dependent variable: RealGrowthRate
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	51.815	15.6317	3.3147	0.00143	***
Edu00	9.75516	10.9277	0.8927	0.37495	
Edu00_2	2.04741	1.84927	1.1071	0.27187	
GDPperCap00	-0.0042249	0.00126281	-3.3456	0.00130	***
GDPperCap_2	6.4559e-08	2.53064e-08	2.5511	0.01283	**
former_comm	121.562	75.8113	1.6035	0.11315	
Euro+us	27.979	42.5548	0.6575	0.51294	
Africa	8.47877	20.0378	0.4231	0.67344	
Asia	94.7404	21.8808	4.3298	0.00005	***
former_comm1	-26.3591	20.5548	-1.2824	0.20377	
Euro+us1	-11.3552	9.62158	-1.1802	0.24176	
Africa1	-2.91639e-05	11.5176	-0.0000	1.00000	
Asia1	-28.7133	7.18389	-3.9969	0.00015	***

Mean dependent var	76.45663	S.D. dependent var	50.99077
Sum squared resid	92669.94	S.E. of regression	35.62936
R-squared	0.580688	Adjusted R-squared	0.511760
F(12, 73)	11.55522	P-value(F)	1.38e-12
Log-likelihood	-422.2742	Akaike criterion	870.5483
Schwarz criterion	902.4548	Hannan-Quinn	883.3892

Wald Test: Test on Model 4:
Null hypothesis: the regression parameters are zero for the variables
Edu00, Edu00_2, commies1, euros1, Africa1, Asia1
Test statistic: Robust F(6, 73) = 7.01349, p-value 6.44716e-006

Vitae

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United high-level leaders and decision-makers in international government associations, NGO's, global foundations, and academics at international Forums and Congresses to discuss problems facing developing nations, particularly to focus on providing food, fuel, fiber, and water to the world's growing population, and identify agricultural solutions enabling a sustainable agri-system capable of contributing to global economic development; organized and executed the 2010 World Conference, Brasilia, Brazil – "The Role of Latin America in Feeding the World in 2050"; conducted research, complied detailed data analysis, and created various econometric models on current and future agricultural and sustainability issues that surrounded certain regions world-wide; implemented and organized Forums in Ningbo, China, and Kampala, Uganda discussing resource deficiencies with leaders from each respective region

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Developed market research and financial plans for Arizona Department of Agriculture and local farmers at the Downtown Phoenix Farmers Market on projects in sustainability, co-operatives, and marketing locally grown products to develop the 'Arizona Grown' label; provided a series of seminars to a group of refugee farmers on basic accounting, business and marketing skills

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Introduction to Finance (FIN 300), Financial Investments (FIN 410), Intermediate Agribusiness Financial Management (FIN 431); Grader and Student Advisor

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Financial Analyst
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The Huntington Learning Center Williamsburg, VA 2007-2008
Mathematics Tutor Chandler, AZ 2008-2009
Algebra, Geometry, Calculus, and SAT Math tutoring; Teaching 5th Grade to High School seniors how to excel further with innovative teaching techniques; Preparing High School students for the math sections of the SAT using step-by-step techniques to focus on each individuals needs to thrive

Stoney Park Water Ski School Port Macquarie, Australia 2007-2008
Water Ski Instructor
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Treasurer - Missouri Water Ski Federation (2009 – Present)
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National Women's Overall and Jump Champion – US 2012 Goode National Water Ski Championships
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Research Papers

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A Global Exploration of Existing Structures for the Education of Adults

United States Adult Learning and Policy

International Adult and Higher Education

Arizona State University

Renewable Energy Resources (A Regression Analysis)

Molybdenum and the Climax Mine: Real Options, @Risk, Sensitivity, and Scenario Analysis

Chiquita Banana Financial, Ratio, and Risk Analysis

Agriculture and American-Mexican Immigration Laws

Ethanol: A Commodities Exchange Analysis

Ecuador and its International Economic Policies

U.S. Banana Imports from Ecuador: Prices and Elasticities

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International Financial Management: Caterpillar Case Study

Risk and Return: Astra Zeneca

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