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Old Dominion University

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Two-Year and Four-Year Tertiary Education: Measuring Human Capital Effects on Economic Growth in Developing and Developed Countries with the Uzawa-Lucas Model

by

Darryl M. Tyndorf Jr.
B.A. December 2003, North Central College
M.A. September 2008, Roosevelt University

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Approved by:

Dr. Christopher Glass (Director)

Dr. Shana Pribesh (Member)

Dr. Dennis Gregory (Member)

ABSTRACT

Two-Year and Four-Year Tertiary Education: Measuring Human Capital Effect on Economic Growth in Developed and Developing Countries with the Uzawa-Lucas Model

Darryl M. Tyndorf Jr.
Old Dominion University, 2015
Director: Dr. Christopher Glass

Tertiary education is believed to be a driver of economic development through the relationship between human capital development and economic output. Global massification efforts of tertiary education have led to increased global demand. Countries with limited tertiary education systems, like developing countries, have employed policies to increase domestic tertiary education opportunities instead of sending students abroad. Many tertiary education policies have focused on importing tertiary education from countries with established tertiary education systems. Import efforts first emphasized university models, but limited success prompted the import of more flexible short-cycle education modeled after the United States' community college system. Limited empirical research has studied the relationship between tertiary education and economic growth. Currently, there has been no research on the effect of importing U.S. four-year and two-year tertiary education models in other countries and the effect on economic growth. The purpose of this study was to examine differences between two- and four-year U.S. university models implemented in developing countries by examining changes in economic growth. Utilizing country level economic and tertiary education data spanning 1970 to 2013 from The World Bank and the United National Education, Scientific, and Cultural Organization Institute for Statistics in the Uzawa-Lucas model with a General Method of Moments (GMM) estimation of an autoregressive distribution

lag model to take into account the lagged effect of tertiary education on economic indicators.

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CHAPTER 1 INTRODUCTION

Introduction

Economists, non-governmental organizations, and governments emphasize the link between tertiary education investment and economic growth (Cutright, 2014; Ganegodage & Rambaldi, 2011; Hanushek, 2013; Holmes, 2013; Jensen, 2010; Mellow & Katopes, 2009) and expansion in the global economy (Tiliak, 2011). Tertiary education improves *human capital*, the economic value of "people's innate abilities and talents plus their knowledge, skills, and experience that make them economically productive" (The World Bank, 2004, para. 44), leading to economic growth as measured by Gross Domestic Product (GDP) (Browne Review, 2010; Naidoo, 2009). Policymakers emphasize the role of tertiary education in improving human capital by promoting *massification* and *diversification* agendas of tertiary education (Mohamedbhai, 2008). Massification, policymaker efforts to increase tertiary education enrollments, is believed to increase economic growth (Holmes, 2013); diversification, various levels and types of tertiary education, is believed to offer greater tertiary opportunities to a wider array of students (Kintzer & Bryant, 1998; Levin, 2001; UNESCO, 2003; Wang & Seggie, 2013). Policymakers pursue such agendas with little empirical guidance as to the effect of massification and diversification of tertiary education (e.g., certificate, associates, and bachelor's degree granting institutions) on the country's long-term economic growth (Altabch & Knight, 2007; Bashir, 2007; Guri-Rosenblit, Sebkova, & Teichler, 2007; Lien, 2008; Mohamedbhai, 2008). Such empirical guidance is especially consequential for policymakers in developing countries who must make decisions about the allocation of limited resources to meet excess demand for tertiary education (Mohamedbhai, 2008).

Therefore, the purpose of this study was to examine the effect of country-level massification and diversification agendas through an analysis of a longitudinal dataset over 19-years in 176 developed and developing countries.

Background to the Study

Economists measure economic growth by the production of goods and services within a country, i.e., GDP. Economic growth is increased through economic activity, the effort directed towards increasing the yield of a given effort or resource, or towards reducing the cost of a given yield (Lewis, 1955). Moreover, economists emphasize economic growth as a measurement believed to increase the quality of life of citizens by bettering the poor and reducing the proportion of people who are poor (Easterly, 2002), which leads to improve productivity, innovation, and technology.

Human effort promotes economic activity, thus spurring economic growth (Lewis, 1955). Human effort in enrolling in tertiary education shapes sustainable economic growth and social mobility, as well as produces individual and societal benefits contributing to national prosperity (Browne Review, 2010; Naidoo, 2009). Thus, human effort improves human capital leading to economic growth. Human capital has been researched thoroughly through microeconomic models showing demonstrable effect on a private individual's earning potential over a lifetime (Arnold et al., 2011; Card, 1999; Harmon, Oosterbeek & Walker, 2003; Krüeger & Lindahl, 2001; Pasacharopoulos & Patrinos, 2004; Stevens & Weale, 2004). However, the effect of investment in human capital is inconclusive within macroeconomic models that measure the effects of human capital investment on GDP (Deutsch, Dumas, & Silber, 2013; Ganegodage & Rabldi, 2011; Hanushek, 2013; Holmes, 2013; Jensen, 2010). Thus, empirical evidence is

inconclusive on the assumed positive link between tertiary education investment and economic growth with the various outcomes of the macroeconomic models.

Kaldor (1966) believed persistent growth of income per capita is one of the goals of advanced countries (Greiner, Semmler, & Gong, 2005). Understanding the determinants affecting economic growth through increasing returns generated endogenously, (Barro & Sala-i-Martin, 2004; Cortright, 2001; McCallum, 1996; Romer, 1994) resulted in the expansion of macroeconomic growth theory to a new growth theory by Romer (1986) – *endogenous growth models*. Endogenous growth models emphasize internal factors, such as tertiary education policies, as influential factors of economic growth (Pascharpopoulos & Patrinos, 2004) because they lead to spillover effects (Barro & Sala-i-Martin, 2004; Cortright, 2001; Greiner et al., 2005; McCallum, 1996; Pascharpopoulos & Patrinos, 2004; Romer, 1986) increasing economic growth.

Endogenous growth models provide empirical methods to understand the implications of policy decisions with knowledge as the driver of economic growth (Chen & Kee, 2005; Cortright, 2001). Studies by Adawo (2011), Gemmell (1996), Greiner, Semmler, and Gong (2005), and Hanushek and Woessman (2010) have found significantly positive effects on primary education investment on economic growth, especially for *developing countries*. Developing countries, categorized by The World Bank with low-middle or low gross national income (GNI) per capita, have emphasized such findings as the basis for massification of primary education. Consequently, primary education attainment has led to greater number of students prepared for tertiary education (Kapur & Crowley, 2008). To this point, few empirical studies have analyzed the role of tertiary education on economic growth (Holland, Liadze, Rienzo, & Wilkinson, 2013),

particularly in developing countries, and their results have been inconclusive. Therefore, there is limited empirical knowledge on the effect of massification and diversification agendas of tertiary education in developed and developing countries.

Economists, non-governmental organizations, and governments utilize the significant findings to emphasize the positive link between economic growth and tertiary education investment (Cutright, 2014; Ganegodage & Rambaldi, 2011; Hanushek, 2013; Holmes, 2013; Jensen, 2010; Mellow & Katopes, 2009). Tertiary education positions countries for sustainable economic growth and social mobility, as well as produces individual and societal benefits contributing to national prosperity (Browne Review, 2010; Naidoo, 2009). Tertiary education improves human capital, which is a key component to improving economic growth as measured by GDP (Deutsch, Dumas, & Silber, 2013; Ganegodage & Rabldi, 2011; Hanushek, 2013; Holmes, 2013; Jensen, 2010). This assumed link has increased demand for tertiary education worldwide.

Demand for Tertiary Education

Emphasis on the role of human capital in economic growth has prompted international organizations and governments to promote tertiary education initiatives (Holmes, 2013). For example, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) initiative focuses on global tertiary education attainment, especially in developing countries (UNESCO, 2010, 2014). The Browne Report in the United Kingdom (UK) emphasizes domestic tertiary education attainment as a means to promote economic growth (Browne Review, 2010). President Barack Obama's stated goal to increase tertiary education graduation rates has focused on policy proposals designed to increase community college attainment rates (The White House, n.d.). Such

policies have generated unprecedented global demand for tertiary education, especially in developing countries (Hanushek, 2013).

Trade of Tertiary Education

Liberalized trade of tertiary education provided massification opportunities to developing countries through importing tertiary education through franchising programs, twinning degrees, program articulation agreements, validation programs, distance programs, or branch campuses (Bashir, 2007). Excess tertiary education demand in developing countries has shifted international trade of tertiary education due to public sector's limited resources to meet national demand (Varoglu, 2002). Trade of tertiary education previously involved elite or financially capable students migrating to another country (Altbach, 2013; Altbach & Knight, 2007; Bashir, 2007; Mello & Katopes, 2010; Naidoo, 2009). National massification efforts designed to prepare a skilled and competent workforce to compete in a global economy yielded the need to import tertiary education, migrating institutions into developing countries (Wang & Seggie, 2013). Efforts to liberalize trade of tertiary education have taken place within the international framework of The General Agreement on Trade in Services (GATS) (Lester, 2013; Varoglu, 2002).

Tertiary education trade efforts initially focused on university tertiary models (Hewitt & Lee, 2006; Wang & Seggie, 2013; Woods, 2013) due to lack of prestige associated with technical or community college tertiary models (Castro, Bernasconi, & Verdisco, 2001; Roggow, 2014; Wang & Seggie, 2013; Zhang & Hagedorn, 2014). Focusing solely on university education has limited growth possibilities through the challenges of improving human capital, especially in developing countries (Wang & Seggie, 2013). University structures lack the ability to provide faster entry into the labor

force or massification of foundations for education in professions and technical fields or improved adaptability to changes in the economy (Roggow, 2014). Developing countries realized the need to engage tertiary education policy focusing on massification and diversification to meet national demand.

Developing country diversification agendas engaged the mission of implementing a more flexible short-cycle institution based on the U.S. community college model (Kintzer & Bryant, 1998; Levin, 2001; UNESCO, 2003; Wang & Seggie, 2013). U.S. community college education imports are "established by a myriad of stakeholders, including government-funded agencies and foundations, non-profit organizations, private sector entities, institutions and universities" (Tubbeh & Williams, 2010, p. 8). The U.S. community college model is viewed as an adaptive and responsive agent to the economic market providing an intermediate step between high school and tertiary education (Cohen & Brawer, 2003). The model increases accessibility to postsecondary education, and it addresses particular human capital needs of the labor market (Cohen & Brawer, 2003; Hewitt & Lee, 2006; Wang & Seggie, 2013). Developing and developed countries are customizing U.S. community college model initiatives to provide flexible short-cycle, job skill oriented education (Kotamraju, 2014; Raby, 2012; Roggow, 2014). Each partnership is unique to the respective country and designed to align with the economic, political, and educational goals needed to improve economic development within the developing country.

The push for importing of U.S. community college model has led to the Community College for International Development, Inc. (CCID) attaining increased interest from other countries to establish or restructure their tertiary education system in

order to meet demand (Violino, 2011). Ghana, Dominican Republic, Bahamas, Barbados, Qatar, Vietnam, Kuwait, Saudi Arabia, India, and Thailand have sought the expertise of U.S. community colleges to bridge educational gaps by providing education that is affordable, accessible, and adaptable (Cutright, 2014; Hartenstine, 2013b; Hewitt & Lee, 2006; Mellow & Katopes, 2010; Schroeder & Hatton, 2006; Spangler & Tyler, 2011; Wang & Seggie, 2012; Woods, 2013; Violino, 2011). Such importing strategies suggest there may be economic growth benefits associated with the trade of U.S. community college model (Hartenstine, 2013). However, no empirical research demonstrates the effects of importing U.S. community college model on economic growth in developing countries.

Microeconomic analysis has demonstrated significantly positive private effects of tertiary education on individual lifetime earnings. Individual effects have prompted national and international agendas to implement massification and diversification agendas of tertiary education to spur economic growth, especially in developing countries. However, there is anecdotal evidence on the effect of diversifying tertiary education with the U.S. community college system. Further, current macroeconomic analysis has been inconclusive on the effect of tertiary education on economic growth.

Purpose Statement

Economists are inconclusive on the effect between economic growth and improving human capital through tertiary education (Bils & Klenow, 2003; Cohen and Soto, 2007; Hartwig, 2014; Holmes, 2013; Krüeger & Lindahl, 2001; Lucas, 1988; Romer, 1990). Research has focused on the university model of tertiary education as a driver of human capital gains. There is little empirical work studying the two-year tertiary

education model, the U.S. community college system, as a driver of human capital development and ensuing economic growth. Therefore, the purpose of this study was to examine the effect of country-level massification and diversification agendas through an analysis of a longitudinal dataset over 19-years in 176 developed and developing countries.

Research Questions and Hypotheses

For this empirical study, I analyzed data on a comprehensive list of all countries from The World Bank's World Development Indicators dataset along with The World Bank (EdStats) and UNESCO Institute for Statistics (UIS) education statistics databases, utilizing the Uzawa-Lucas endogenous growth model. I examined the following questions:

1. To what extent do country-level tertiary education enrollments exert a significant positive effect on GDP over a 19-year period?
2. To what extent do relative enrollments in two-year tertiary education and university tertiary education exert a significant positive effect on GDP over a 19-year period?
3. To what extent do country-level tertiary education enrollments exert a significantly positive effect on GDP over a 19-year period in developed and developing countries, respectively?
4. To what extent does GDP growths differ between developing countries that have imported the U.S. community college model promote greater economic growth compared with those that have not?

The study estimated four hypotheses:

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP).

H_2: University tertiary education enrollments will have a significant effect on economic growth (GDP) than two-year tertiary education.

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

Methodology

Economists believe endogenous economic growth models provide insight into the factors affecting economic growth (Barro & Sala-i-Martin, 2004; Cortright, 2001; McCallum, 1996; Romer, 1994). The Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) endogenous growth model resembles the neo-classical economic growth model. However, the model consists of two-sectors: (a) produces the physical good from labor, physical capital, and human capital inputs that can be consumed or invested in the creation of physical capital good, and (b) produces human capital from an input factor of only human capital (Greiner, et al., 2005). Romer (1994) finds the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model "as powerful a piece of evidence as all the cross-country growth regressions combined" (p. 19).

To analyze the effect between tertiary education and economic growth, an augmented Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model utilizing a modified

Granger-causality test influenced by Hartwig (2014) and Jones (1995) was established. Augmentation of the model provided a human capital measure to account for tertiary enrollments in university education and two-year education. Further, the addition of a dummy variable accounted for countries importing U.S. community college model based on literature, information from the Community College for International Development (CCID), and the American Association of Community College (AACC). The augmented Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model expanded upon the Solow growth model as "the growth rate of human capital acquires the role that technical progress plays in the Solow model" (Hartwig, 2014, p. 144). Human capital accumulation can be explained in the model compared to technical progress in the Solow model (Hartwig, 2014), making it the ideal method to understand the effect between tertiary education and economic growth.

Definition of Terms

U.S. community colleges are institutions that provide two-year associate degrees and vocational-technical certificate/degrees while also including developmental education, adult basic education, education and training for citizens facing barriers to employment, customizing training for specific companies, preparing of students per industry certification exams, and noncredit instruction (Bailey & Morest, 2003).

Developed countries refer to countries categorized by The World Bank with middle or high gross national income (GNI) per capita.

Developing countries refer to countries categorized by The World Bank with low-middle or low gross national income (GNI) per capita.

Economic development refers to qualitative change and restructuring in a country's economy connected with technological and social progresses indicated by increasing GDP per capita, and closely linked with economic growth (The World Bank, 2004).

Economic growth refers to extensive quantitative change or expansion of a country's economy through the utilization of more resources, e.g., human capital, and measured as the percentage increase in GDP (The World Bank, 2004).

Endogenous growth refers to internal factors that influence economic growth, not external outside the economy (Pascharpopoulos & Patrinos, 2004).

Gross domestic product (GDP) per capita (current $US) refers to 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 divided by midyear population (The World Bank, n.d.a, para. 1).

Gross fixed capital formation (current $US) refers to the sum of physical investments including: land improvements (fences, ditches, drains); plants, machinery, equipment purchases; construction of roads, railways, schools offices, buildings; and any other acquisitions of valuables (The World Bank, n.d.c, para. 1).

Human capital refers to the economic value of "people's innate abilities and talents plus their knowledge, skills, and experience that make them economically productive. Human capital can be increased by investing in health care, education, and job training" (The World Bank, n.d.b, para. 44).

Massification refers to governmental agendas designed to increase national tertiary education enrollment (Mohamedbhai, 2008).

Tertiary education refers to all forms of postsecondary higher education including public and private institutions not limited to universities (The World Bank, 2004); includes universities and community college models.

Transnational education refers to tertiary education programs, courses of study, or education services (including those of distance education) where students are located in a country different from the one where the awarding institution is based and exported by a tertiary education system located internationally or independent of any national education system (UNESCO-Council of Europe, 2001).

University degrees refer to national degree and qualification structure generally associated with four-year institutions, and includes Bologna recognized three-year degrees and qualifications.

Delimitations

There are three main endogenous growth models: Romer (1986); Uzawa (1965) and Lucas (1988); and Romer (1990) and Aghion and Howitt (1992). Uzawa and Lucas (Lucas, 1988; Uzawa, 1965) engaged the role of human capital focusing on education. Since massification and diversification of tertiary education is emphasized as a means for increased economic growth, the Uzawa-Lucas model will be the priori model for the analysis.

Improved tertiary education data collection, especially in developing countries, has enhanced research capabilities. The population of 228 developed and developing country is longitudinal from EdStats and UIS spanning from 1995-2014. The sample during this time-period is 176 developed and developing countries providing rolling 5-year averages of the data.

The human capital variable was tertiary education enrollments by country. EdStats and UIS provide various tertiary statistics, e.g. tertiary graduation and average years of schooling. Average years of schooling does not differentiate between the various levels of education and it does not distinguish the effect of tertiary education on economic growth. Moreover, it does not provide a means to compare university tertiary education and U.S. community college two-year tertiary education. Tertiary education enrollments and number of tertiary graduates allows for analysis of tertiary education and diversification within tertiary education. Policymakers promote massification agendas for increased tertiary education; therefore, the human capital variable determined to best fit the research was tertiary education enrollments.

Significance of the Study

Tertiary education has become an essential component of economic development and essential for developing countries to prosper in a global economy (Shrivastava & Shrivastava, 2014). Research has utilized endogenous economic growth theories to understand the effect of tertiary education on economic growth (Arnold, Bassanini, & Scarpetta, 2011; Hartwig, 2014; Holmes, 2013; Krüeger & Lindahl, 2001; Lucas, 1988; Romer, 1990). Even though there is still little empirical consensus on the effect of tertiary education on economic growth, policies for tertiary massification and diversification have proliferated (Holmes, 2013). The effect of education on human capital is the reason endogenous growth models (e.g. Lucas, 1988; Romer, 1990) have been used extensively to study the linkages between investments in human capital and economic growth (Abdessalem, 2011).

This dissertation study provides further empirical research on the effect of tertiary education on economic growth by understanding massification and diversification agendas on tertiary education, particularly in developing countries. Policymakers utilize the empirical findings of this dissertation to determine if massification of tertiary education is bridging the global economic gap by improving economic growth through increased human capital. The findings provide developing countries with a greater understanding whether diversification promotes economic growth, and whether importing the U.S. community college model should be emphasized within tertiary education massification and diversification policies.

Summary

Tertiary education is believed to improve economic growth. Promotion of tertiary education has led to increased global demand, creating a redistribution and increase of trade in tertiary education. Such factors have prompted massification and diversification agendas on tertiary education, especially within developing countries, with a focus on importing the U.S. community college model. Economists engage economic models to understand the factors effecting economic growth in order to inform policies. However, there is little empirical evidence demonstrating the agendas promote economic growth. This study addresses gaps in the literature by engaging the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) economic growth model analyzing the effects of massificaiton and diversification tertiary education agendas.

CHAPTER 2 INTERNATIONAL TRADE OF TERTIARY EDUCATION, ECONOMIC GROWTH MODELS, AND TERTIARY EDUCATION EFFECT

Introduction

Little is known about the effect of tertiary education on economic growth. However, there is increase demand for tertiary education as policymakers view it to be a means to economic growth. The inconclusive empirical evidence on massification and diversification of tertiary education necessitates economic analysis on such agendas. Economists have studied economic growth since the initial works of Smith (1776). However, only recently have they sought to understand the impact of human capital (Holland, Liadze, Rienzo, & Wilkinson, 2013). This literature review provides insight into the redistribution of international trade of tertiary education, economic growth models, and the current research on tertiary education and economic growth.

International Trade of Tertiary Education

Policymakers' emphasis on tertiary education to improve human capital for economic growth has increased global demand for tertiary education (Altbach & Knight, 2007; Bashir, 2007; Lien, 2008; Mohamedbhai, 2008) resulting in pressures on governments and institutions to provide quality and relevant education within countries (Mohamedbhai, 2008). Massification and diversification policies on tertiary education are high on the agendas within many countries, especially in developing countries (Guri-Rosenblit, Sebkova, & Teichler, 2007), in order to meet excess demand. Developing country policies take into account the scarce resources and lack of capacity to internally develop tertiary education institutions to meet excess demand (Altbach & Knight, 2007; Mohamebdbhai, 2008; Tiliak, 2011) and local population views that domestic tertiary

education is an inferior good compared to international tertiary education (Bashir, 2007; Lane & Kinser, 2011). Thus, governments have established market-friendly reforms to import tertiary education (Tiliak, 2011), e.g., India establishing the U.S. community college model to meet tertiary education demands. Liberalization of trade of tertiary education expanded the competitive boundaries of tertiary education. Tertiary education used to be bound by national, geographic boundaries with an emphasis on affluent student migration from developing to developed countries (Altbach, 2013; Marginson & Rhoades, 2002). However, massification and diversification agendas increased demand for tertiary education among all socio-economic levels of society which migration initiatives could not sustain (Altbach, 2013; Bashir, 2007). Therefore, the limitations on student migration to meet excess demand resulted in the redistribution of tertiary education trade to focus on tertiary education from developed countries migrating to developing countries (Bashir, 2007; Lien, 2008; Lane & Kinser, 2011; Tilak, 2011).

Importing Tertiary Education

Unprecedented demand for tertiary education to improve economic growth emphasized the limited resources of developing countries to improve their tertiary education systems (Lien, 2008; Altbach, 2013), especially with massification and diversification policies as key national agendas. Developing countries need tertiary education to provide relevant academic programs and pedagogical practices (Lane, 2010; Lane & Kinser, 2011; McBurnie and Ziguras, 2007; Wildavsky, 2010) that promote economic development by improving human capital. Therefore, developing countries have pushed for importing tertiary education.

Importing tertiary education forced developed country tertiary education

institutions to focus on developing country's *comparative advantage* of labor. A country's comparative advantage of labor is believed to be an area that a country can efficiently produce a commodity (World Trade Organization, n.d.). Such focus entails a highly-qualified, university-designed curricula and quality measures while simultaneously supporting domestic lower-skilled level instructors (Bashir, 2007). Thus, *transnational education* was designed as the best mechanism to fulfill tertiary education demand for countries with limited domestic options (Lien, 2008). Transnational education, according to a joint UNESCO and Council of Europe (2001) effort refers to:

> All types of higher education study programs or set of courses of study, or education services (including those of distance education) which the learners are located in a country different from the one where the awarding institution is based. Such programmes may belong to the education system of a State different from the State in which it operates, or may operate independently of any national education system (para. 25).

Four modes of transnational education have been identified: cross-border supply, consumption abroad, commercial presence, and presence of natural persons (Altbach & Knight, 2007; Naidoo, 2009). *Cross-border supply* is the common flow of goods and services where only the service crosses into importing countries. *Consumption abroad* is associated with the migration of students to attain tertiary education outside their domestic country. *The commercial presence* of tertiary education is the establishment of a branch campus in another country or the partnerships with an entity within another country to develop a partnership to provide tertiary education services. Lastly, the *presence of natural persons* is the temporary migration of tertiary education staff to another country to provide tertiary education services.

Consumption abroad was the preferred trade in tertiary education that focused on activities such as study abroad, sister colleges/cities, student exchange, faculty and

student exchange, and dual credit (Knight, 2006; Tiliak, 2011) having students migrate from their home country. Cross-border supply, commercial presence, and presence of natural persons utilize franchising, twinning degrees, double/joint degrees, program articulations, validation programs, branch campuses, virtual/distance learning, consultation services as tertiary institution opportunities within developing countries (Altbach & Knight, 2007; Bashir, 2007; Lien, 2008; Naidoo, 2009). Franchising programs utilize the educational expertise of the tertiary education from the developed country to design a developing country's respective curriculum. A domestic provider of the designed curriculum delivers the curriculum while students receive the award from the international tertiary institution. Twinning degrees have students attain part of their education from a domestic institution and the remainder from the international tertiary institution. Students attain the degree from the international tertiary institution. Double/joint degrees provide developing country students a joint degree or two separate degrees from a domestic and international tertiary institution. Program articulations allow students in a developing country to attain transfer credit from a domestic institution that a developed country institution accepts towards a foreign degree. Validation programs collaborate with an equivalent domestic tertiary education institution that demonstrates similar academic integrity as the developed country tertiary institution leading to a degree from the later institution. Developed countries may establish their own subsidiary branch campus within the developed country providing the credits or degree from the developed country tertiary institution. Virtual/distance learning through various methods (e.g., post, internet) provides self-directed learning and may or may not engage a local partner (Bashir, 2007). Lastly, developing countries may engage developed country tertiary

institutions to consult on how to build their own tertiary education institution or system.

Transnational education terms are not universally articulated and are utilized inconsistently (Naidoo, 2009). Definition continuity discrepancies are brought upon by the limited data collection initiatives on transnational education. Developed country tertiary education data focuses on domestic tertiary education programs (Naidoo, 2009). Therefore, limited information is provided on the delivery methods developed countries are engaging in to provide tertiary education to developing countries. The goal of this research is not to understand the influence of respective transnational education efforts, but to analyze transnational efforts as an aggregate.

Developing country tertiary education trade agendas initially focused on engagement of four-year tertiary education (Bashir, 2007; Woods, 2013) because of prestige associated with university level degrees (Castro, Bernasconi, & Verdisco, 2001; Roggow, 2014; Wang & Seggie, 2013; Zhang & Hageddorn, 2014). Massification of four-year tertiary education is believed to provide greater returns on investment than specialized or vocational subjects (Psacharopoulos, 1985) by providing theoretical framework and generating knowledge (Schroeder & Hatton, 2006). Further, four-year tertiary education provides active research agendas on issues relevant to the respective country. However, a narrow focus on tertiary education trade limits the propensity for economic growth, especially in developing countries (Wang & Seggie, 2013). A tertiary education market over saturated by four-year education provides education accessible only to upper socio-economic citizens or citizens having passed entrance exams and admission criteria given scholarships (Altbach, 2013; Altbach & Knight, 2007; Bashir, 2007; Mello & Katopes, 2010; Naidoo, 2009).

Furthermore, four-year tertiary curricula are not designed to help recover from economic collapse or social dislocation (Schroeder & Hatton, 2006). Four-year tertiary education does not provide training for quick recovery of livelihoods and local economies or focus on immediate workforce training needs demanded by the labor market and community (Schroeder & Hatton, 2006). In addition, four-year institutions do not provide life-long learning to students not looking to attain a degree or developmental education to students not prepared for the rigors of college-level course work. Importing solely four-year baccalaureate institutions does not provide the flexible short-cycle, accessible, and affordable education system needed to promote core transformations increasing human capital to improve economic growth (Mellow & Katopes, 2010). Overcrowding tertiary education with four-year education fails:

> to address human capital needs of the productive sector, thereby constraining economic growth, productivity, and innovation. Existing employment opportunities go unmet; additional employment opportunities are not created; vast numbers of people in rapidly growing population end up unemployed and disillusioned. There is a desperate need for education approaches that integrate the institutions of education and the institutions of economic growth that link education programs to the needs of the market and the community in a manner that enriches both (Hewitt & Lee, 2006, p. 46).

This is particularly problematic for developing countries who have greater social disparity and limited infrastructure.

Limitations of developing country massification agendas focusing solely on importing four-year tertiary education led to diversification agendas to engage new and flexible short-cycle tertiary education models (Kintzer & Bryant, 1998; Levin, 2001; Wang & Seggie, 2012). Diversification agendas complemented massification agendas by expanding importation of tertiary education with tertiary education experienced in designing fast response programs that meet economic and social needs in order to build a

competent labor force. Countries with limited tertiary education opportunities, especially developing countries, need to diversify their tertiary education options (Hewitt & Lee, 2006; Schroeder & Hatton, 2006). Therefore, a push for importing of U.S. community college model to complement the university efforts has been encouraged (Cutright, 2014; Hartenstine, 2013b; Hewitt & Lee, 2006; Mellow & Katopes, 2010; Schroeder & Hatton, 2006; Spangler & Tyler, 2011; Violino, 2011; Wang & Seggie, 2012; Woods, 2013).

The U.S. community college model can increase the most valuable resource of emerging and developing nations, human capital, leading to increased national prosperity and international recognition (Spangler & Tyler, 2011). The experience of U.S. community colleges to provide tertiary education that helps students transition between high school and continuing to a university or directly to skilled employment complements developing country massification efforts (Spangler & Tyler, 2011). U.S. community colleges provide tertiary education institutions embedded in the local community, responsive to community needs, and cater to lower profile stakeholders and students (Cohen & Brawer, 2003; Schroeder & Hatton, 2006). The U.S. community college model provides a well-rounded educational system that promotes greater economic growth (Cohen & Brawer, 2003; Schroeder & Hatton, 2006; Spangler & Tyler, 2011; Woods, 2013). Such experiences of U.S. community colleges led to developing countries diversification agendas to import the U.S. community colleges to help massification agendas to improve human capital yielding economic growth.

Economic Growth Models

Economists continually search for the determinants of *economic growth*, the increase in output of goods and services an economy produces over a period measured by

GDP. Initial economics emphasized the role of capital and labor in economic growth that bounded economic growth due to limited resources (Cortright, 2001; Smith, 1991). Economists shifted economic thought to knowledge as the main contributor to improving boundless economic growth (Cortright, 2001). Knowledge is non-rival and partly excludable compared to other economic goods, which makes investments in knowledge creation an important input for sustained growth (Cortright, 2001). Further, investment in knowledge comes in different forms, e.g., research and development (R&D), education, entrepreneurship and tolerance for diversity, openness to trade (Cortright, 2001), but education is a significant policy agenda in all countries (Mohamedbhai, 2008). Such policies resulted in microeconomic and macroeconomic analysis of education.

Microeconomic Analysis

Both microeconomics and macroeconomics provide different analyses of education (Table 1). Microeconomic analysis provides analysis on private or narrow social returns on human capital (Psacharopoulos & Patrinos, 2004). The literature is replete with research suggesting an average private rate of return to a year of schooling is between 5% and 15% in wage increase, with greater return for disadvantaged families (Arnold et al., 2011; Card, 1999; Harmon, et al., 2003; Krüeger & Lindahl, 2001; Pasacharopoulos & Patrinos, 2004; Stevens & Weale, 2004). The evidence in the estimates demonstrates an unambiguously positive effect on individual earnings from investing in education (Harmon, et al., 2003), and helps explain human behavior for seeking different levels and types of education (Pascharopoulos & Patrinos, 2004). Microeconomic analysis provides market benefits, but does not provide insight into the effects of human capital on GDP. Consequently, the purpose of this study is to better

understand the effect of tertiary education massification and diversification agendas on economic growth, especially in developing countries

Table 1

Pathways to Measuring the Returns to Education

Nature of benefits	Data base	Empirical results	Methodology/approach
Market monetary	Micro data	Private Returns	Full discounting
			Mincerian earnings function
		Narrow social returns	Full costing
National accounts monetary	Macro data	Contribution to growth	Within-country growth accounting
			Cross-country panel regression
Wide social	Micro/macro combination	Non-market benefits	Contingent valuation
		Externalities	New growth theory

Note. Adapted from *Human Capital and Rates of Return,* p. 2, by G. Psacharopoulos, & H.A. Patrinos, 2004, UK: Edward Elgar Publishing Limited

Macroeconomic Analysis

Macroeconomic analysis researches the proximate causes and mechanics of economic growth with the aggregate production function based on the initial works of

Solow (1956) (Barro & Sala-i-Martin, 2004; Cortright, 2001; Greiner, et al., 2005; Hartwig, 2014; McCallum, 1996; Romer, 1994). Initial macroeconomic models emphasized continuously expanding technology over time, diminishing returns to capital and labor, and conditional convergence while maintaining the belief that economic growth is due to influences outside of the economy, external factors (Barro & Sala-i-Martin, 2004; Cortright, 2001; Greiner et al., 2005). Solow (1956) designed an economic growth model based on the Cobb-Douglass production function (Greiner, et al. 2005) that suggests economic growth comes from capital, labor, or new technology. The model seeks to understand how much economic growth came from each respective input. Solow's model assumes diminishing returns to capital investment, meaning with each capital investment the return is less than subsequent capital investments. Lastly, the model assumes there is convergence of economic growth around the world. The model is exogenous, or autonomous, that change happens outside of the model. Solow's model does not explain the factors influencing economic growth (Cortright, 2001; McCallum, 1996).

Background of macroeconomic models. Understanding the factors influencing economic growth started with the writings of Smith (1776) emphasizing the relationship between capital and labor in production of goods and services. His initial works influenced further literature by Ricardo (1817), Mill (1909), and Schumpeter (1934) who also wrote about capital and labor. However, an aggregate analysis of economic growth was not a formalized theory until macroeconomics emerged as a response to Keynes's (1936) short-run theory (Snowdon & Vane, 2005). The emergence of macroeconomic theories advanced to investigate long-run theories through the works of Harrod (1939,

1948) and Domar (1946, 1947) with their classical growth model, Solow (1956) with the neo-classical growth model, and with Romer (1986) and Lucas (1987) with endogenous growth models (Snowdon & Vane, 2005; McCallum, 1996; Greiner et al., 2005). The work of Romer (1986) and Lucas (1987) influenced interest in long-run economic growth generating advancements to endogenous growth models (Snowdon & Vane, 2005).

Economic growth is measured by the starting level of per capita GDP relative to the steady-state position of economic growth per capita, which drives from the assumption of diminishing returns to capital. *Diminishing returns* is where more capital or labor is added to production with fixed resources and the additions to output will diminish (Barro & Sala-i-Martin, 2004). Diminishing returns emphasizes that economies have less capital per worker tend to have higher rates of return and higher growth rates created the empirical hypothesis of *absolute* and *conditional convergence* (Barro & Sala-i-Martin, 2004). Absolute convergence states that poor countries have faster GDP growth without conditioning any other characteristics within the economy and that, in the long-run, GDP per capita converges to the same steady state growth path for all countries (Barro & Sala-i-Martin, 2004; Timakova, 2011). Conditional convergence states GDP per capita converges to a country specific steady-state long-run growth path where the individual country steady-state levels of capital and output per worker are dependent on the savings rates, growth rate of population, and the position of the production function within each respective country (Barro & Sala-i-Martin, 2004; Cortright, 2001; McCallum, 1996; Timakova, 2001). The speed of convergence provides insight into how close economies are to the steady-state level, and current research demonstrates developing countries are several generations away (Barro & Sala-i-Martin, 2004).

Further, diminishing returns increase marginal costs, critical to meet steady state levels, resulting in economic growth halting over a period of time (Cortright, 2001).

Neo-classical growth model. Solow (1956) challenged stalled and halted economic growth with a belief that technological advancements within and economy improves economic growth. He maintained there are diminishing returns to capital and labor, but that technology adaption is another important force. Technical knowledge and adaptation moderate the effect of diminishing returns by creating a polarizing neoclassical growth model (McCallum, 1996; Cortright, 2001; Barro & Sala-i-Martin, 2004). The model maintained the concept of diminishing returns to capital and labor, but allocated a technology variable maintaining continuous expansion over time, and not necessarily by economic forces (Cortright, 2001). The neo-classical model promoted the concept of conditional convergence, which has been the explanatory power of economic growth (Barro & Sala-i-Martin, 2004). The introduction of this new variable created an exogenous growth model that became one of the most important contributions to world economic development modeling (Barro & Sala-i-Martin, 2004; Cortright, 2001; McCallum, 1996; Romer, 1994). Solow's (1956) neoclassical model made significant contributions to the research on economic growth, but it did not explain the factors influencing economic growth (McCallum, 1996; Cortright, 2001). The model did not try to explain the causes of technology improvements over time, but held the assumption that technological advances happened resulting in accumulation of capital and improvements in labor to improve economic growth and maintained diminishing returns (Cortright, 2001; Greiner et al., 2005).

Endogenous growth model. Romer (1986) researched the determinants affecting

economic growth through increasing returns resulting in the start of new growth theory (Barro & Sala-i-Martin, 2004; Cortright, 200; McCallum, 1996; Romer, 1994). Romer (1986), Lucas (1988), and Rebelo (1991) adapted the works of Arrow (1962), Uzawa (1965), and Sheshinski (1967a, 1967b) leading to a new growth theory focusing on knowledge spillover as the central focus to economic growth (Barro & Sala-i-Martin, 2004; Cortright, 2001; Greiner et al., 2005; McCallum, 1996; Romer, 1986). The research provided empirical methods to understand the effect policy decisions have on economic growth, but the models are not a one-size-fits-all for every economy (Greiner, et al., 2005).

Countries are not at the same economic growth state, so utilizing a single growth model may not determine policy effects on economic development, thus endogenous growth models may measure various stages of economic growth (Greiner, et al, 2005). An early stage of economic growth may measure spillover effect from learning by doing (Romer, 1986). The next stage of economic growth may be focused on the spillover effect of human capital, based on education (Lucas, 1988; Uzawa, 1965) followed by research and design (R&D) expenditures (Aghion & Howitt, 1992; Romer, 1990). A later stage may be spillover from public infrastructure (Greiner et al., 2005; Klenow & Rodríguez-Clare, 1997; McCallum, 1996). As developed and developing countries push for tertiary education massification and diversity agendas, the Uzawa-Lucas model demonstrates the most beneficial model to understand the effect of human capital spillover, in the form of tertiary education policy, on economic growth.

Uzawa-Lucas model. The Uzawa-Lucas (Lucas, 1988; Uzawa, 1956) model is the most ideal endogenous growth model to examine the effect of tertiary education on

economic growth compared to the neo-classical Solow growth model. The neo-classical Solow growth model was the greatest contribution to economic growth analysis, but is an exogenous model and does not provide insight into the factors affecting economic growth (Cortright, 2001; Greiner, et al., 2005). McCallum (1996) and Arnold et al. (2011) analyzed the neo-classical model by including a human capital input and comparing convergence against new growth models, particularly the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model. Lucas (1988) and Uzawa (1965), within their respective models, demonstrated the temporary effect of the human capital enhancing policies within the neo-classical model was not as robust as the more persistent human capital policy effects (Arnold et al., 2011; McCallum, 1996). Further, Arnold et al (2011) and Hartwig (2014) demonstrated the significant difference in the neo-classical Solow model compared to the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model with the latter a more robust model for analyzing the effect of tertiary education on economic growth. Lucas (1988) and Uzawa (1965) provide an endogenous growth model ideal for understanding the effect of tertiary education on economic growth.

Tertiary Education Effect

Research measuring the effects of human capital spillover, massification of tertiary education, on economic growth is inconclusive, as few studies have analyzed the effects of tertiary education investments on economic growth (Holland et al., 2013). Cohen and Soto (2007), Hartwig (2014), Lucas (1988), and Romer (1990) demonstrate positive effects of investment in education on economic growth, but Benhabib and Spiegel (1994), Bils and Klenow (2000), Holmes (2013), and Pritchett (2001) non-significant effects. Similarly, studies from Barro & Lee (2010), Holmes (2013), Keller

(2006), Krüeger & Lindahl (2001), Loening (2005), and Pegkas (2014) find greater significance with secondary and tertiary education investment. Thus, while tertiary education is believed to meet excess demand, supply skilled workers, promote innovation, and increase individual quality of life bringing about social and economic benefits (McNeil & Silim, 2012), it may provide significant effects in developing countries compared to developed countries (Greiner et al., 2005; Krüeger & Lindahl, 2001).

Policymakers have expanded tertiary education agendas to include diversification agendas to complement massification agendas. Diversification of tertiary education agendas expanded tertiary education trade by engaging the U.S. community college model to improve human capital leading towards greater economic development. Research has strictly focused on the aggregate of tertiary education on economic growth (Arnold et al., 2011; Barro, 2013; Bils & Klenow, 2000; Ganegodage & Rambaldi, 2011; Hanushek & Woessmann, 2011; Hartwig, 2014; Krüeger & Lindahl, 2001). However, research has not differentiated between four-year and two-year education, the effects on developed and developing countries, or the redistribution of international trade of tertiary education by the importing of U.S. community college model. The Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model, modified to account for four-year and two-year education complemented by differentiating between developing countries, provides an ideal model to measure tertiary education policy effects on economic development and will bridge the gap in the literature.

Summary

Massification and diversification tertiary education agendas are engaged to meet

excess demand, provide relevant education to all levels of society, and increase economic growth. Such agendas have shifted international trade of tertiary education to focus on developing countries importing tertiary education through transnational education, with a recent emphasis on the U.S. community college system. While economists engage economic models to understand the effect of education on economic growth, there is limited empirical evidence on the effect of tertiary education massification and diversification on economic growth. This chapter provided an in-depth review of the international trade market, economic analysis, and current literature on tertiary education on economic growth. The literature demonstrated the need for further empirical research on the effects of tertiary education massification, especially in developing countries. Further, it demonstrated the need for empirical research on tertiary education diversification agendas, specifically the promotion of two-year education and importing of the U.S. community college model.

CHAPTER 3 METHODOLOGY

Introduction

The purpose of this study was to examine the effect of country-level massification and diversification agendas through an analysis of a longitudinal dataset over 19-years in 176 developed and developing countries. I examined the following research questions:

1. To what extent do country-level tertiary education enrollments exert a significant effect on GDP over a 19-year period?

This question was answered through the following alternative hypothesis:

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP).

2. To what extent do relative enrollments in two-year tertiary education and university tertiary education exert a significant positive effect on GDP over a 19-year period?

This question was answered by the following alternative hypothesis:

H_2: University tertiary education enrollments will a significant effect on economic growth (GDP) than two-year tertiary education.

3. To what extent do country-level tertiary education enrollments exert an effect on GDP over a 19-year period in developed and developing countries respectively?

This question was answered by the following alternative hypothesis:

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

4. To what extent does GDP growth differ between developing countries that have imported the U.S. community college model to promote greater economic growth compared with those that have not?

This question was answered by the following alternative hypothesis:

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

This chapter includes the following sections: (a) research design, (b) sample, (c) data collection and procedures, (d) statistical analysis procedures, and (e) limitations

Research Design

Longitudinal research was ideal for understanding economic growth over a 19-year period because it measures variability over time rather than one point in time (Ployhart & Vandenberg, 2010). Theories seek to describe how "parts of the theory work together in order for us to better understand why we could expect certain outcomes given certain inputs" (Ployhart & Vandenberg, 2010, p. 96). Most theory testing utilizes cross-sectional research putting a theory's variables in static terms because variables and their association are represented at one point in time, which does not represent change over time (Ployhart & Vandenberg, 2010). Variable association at a single point in time may lead to inaccurate conclusions (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010) because cross-sectional studies do not take into account the time elements and the ability to make precise inferences about the time involved in variable relationships (Mitchell & James, 2001).

Longitudinal research properly examines the dynamic nature of variables and their interrelationships by collecting the same units of data that link over time (Chan, 1998; Ployhart & Vandenberg, 2010). Longitudinal research emphasizes change, and it must capture within-unit change across time or growth trajectories (Bollen & Curran, 2009; Singer & Willett, 2003). It must capture interunit differences in change that can be either predicted or used for prediction (Bollen & Curran, 2009; Singer & Willett, 2003) and contain at minimum three repeated observations on at least one of the variables of interest (Ployhart & Vandenberg, 2010). Time represents a change process (Bollen & Curran, 2009; Singer & Willett, 2003). Thus, as this research sought to collect repeated observations over a 19-year timespan of GDP, human capital (tertiary enrollments), and physical capital, the appropriate research design is longitudinal.

The longitudinal design of this study examined economic growth. Economists use economic theory as a quantifiable tool to develop models that explain consistent recurring relationships to inform policymaking (Ouliaris, 2012). The magnitude of association of economic theory is extremely relevant and most often used by policymakers.

Econometric models blend economic theory, mathematics, and statistical inference providing policymakers the magnitude associated with economic theory. Economists engage econometric models to provide policymakers with an understanding of the likely effect of policies by:

> …convert[ing] qualitative statements (such as "the relationship between two or more variables is positive") into quantitative statements (such as "consumption expenditure increases by 95 cents for every one dollar increase in disposable income"). Econometricians – practitioners of econometrics – transform models developed by economic theorists into versions that can be estimated (Ouliaris, 2012, para. 3).

Economic theory often has competing models capable of explaining the same recurring relationships (Ouliaris, 2012). However, for this study endogenous growth theory was demonstrated to be significantly more robust than neo-classical growth theory (Arnold, et al., 2011; Hartwig, 2013).

Further, this study engaged endogenous growth theory based on Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) human capital growth theory. Competing endogenous growth theories of education by learning (Romer, 1986) and R&D (Aghion &Howitt, 1992; Romer, 1990) do not focus on the effect of education on economic growth. Romer (1994) argues the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model is the strongest of all the endogenous growth theories. Therefore, the endogenous growth theory engaged for understanding the effect of massification and diversification of tertiary education on economic growth is the Uzawa-Lucas model (Lucas, 1988; Uzawa, 1965). It is important to note, that even with advanced statistical methods, correlation studies cannot conclusively demonstrate cause-and-effect relationships (Leedy & Ormrod, 2013).

Population and Sample

The population for this study consisted of 228 developed and developing countries as defined by the World Bank country classification system based on GNI. Sample for the study came from utilizing readily available data for GDP, Gross Fixed Capital Formation, and Total Tertiary Education, but countries are not obligated to provide data to the World Bank or UNESCO. Countries without GDP or Gross Fixed Capital Formation were removed from the population, and countries with less than 6 years of total tertiary education within the five-year averages were removed from the population. Country removals yielded a sample of 176 developed and developing

countries (Appendix 1).

Rationale for Selection of Sample

The rationale for the selection criteria was the time-period when developed and developing countries provided education data to EdStat or UIS. Data collection of tertiary education has been limited, but improved methods of collecting data have increased the extent of education data collected, especially for developing countries.

Data Collection

Data Sources

The World Bank provides economic and education data pertinent to the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) endogenous growth model. Collection of the dependent variable, GDP, and the dependent variable, physical capital (real per-capita fixed capital formation), was from The World Bank's economic database. Attainment of the human capital variable (tertiary education) was from EdStats or UIS. EdStats and UIS share data and collection methods, so blending information does not pose a problem to reliability or validity. Data on countries importing the U.S. community college model was from research literature, the Community College for International Development (CCID), and the American Association of Community Colleges (AACC).

Dependent variable. The dependent variable for all four research questions was the measurement of economic growth, GDP per capita, in The World Bank economic database. GDP is the most widely used economic growth indicator providing insight into whether an economy is expanding or contracting. GDP provides the sum of gross value added by all resident producers in the economy plus product taxes and minus taxes, all divided by the midyear population (The World Bank, n.d.a). The dependent variable was

the change in GDP per capita.

Independent variables. The Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model utilizes two independent variables human capital and physical capital. The creation of two dummy variables adapted the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model to answer the research questions.

Country Classification (Dummy Variable) – Country classification labeled a country as developed or developing. The status was derived from the World Bank calculation based on Gross National Income (GNI). Middle or high GNI is associated with developed countries, while middle-low and low GNI are developing countries. However, in order to attain a five-year average, country classification was coded and then averaged (Table 2). The initial five-year average starting in 1995 represents the country classification for analysis. The variable equates to 0 for developed country and 1 for developing country.

Table 2

Classification Coding

Classification	Code	Developing Country
Low income	1	1
Low middle income	2	1
Upper middle income	3	0
High income	4	0

Importing U.S. community college model (Dummy Variable) – Countries stated in literature, CCID website, and AACC International Programs and Services that engage

any of the transnational education initiatives to provide the U.S. community college model within their borders. A coded variable of 0 was a non-importing developing country and 1 was an importing developing country. The list of countries importing U.S. community college models were validated by the CCID through email and phone conversation (Appendix 2).

The next independent variables placed into the model are:

Total Tertiary Education Enrollment – Sum of enrollments in respective country definitions based on mapping, but can include ISCED levels of upper secondary education, post-secondary non-tertiary education, and tertiary education ISCED 6 and 7. Each year was calculated for the change in total tertiary education enrollment.

University Tertiary Enrollments – Enrollment numbers in variable ISCED tertiary education, ISCED 6 and 7 programs. Each year was calculated for the change in total university tertiary education enrollment.

Community college tertiary education enrollments – Enrollment numbers in variable ISCED upper secondary education and/or post-secondary non-tertiary education depends on each respective country's ISCED data map. Each year was calculated for the change in community college enrollment.

*Gross Fixed Capital Formation in current US$* **–** The World Bank Variable for Gross fixed capital formation in current US$. Each year was calculated for the change in gross fixed capital formation.

Statistical Analysis Procedures

Utilizing an a priori model, the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model is a two-sector endogenous growth model resembling the neo-classical model designed

by Solow (1956) and the initial endogenous growth models, or “AK” style growth models (Greiner et al., 2005; Jones, 1995; Lucas, 1988). Lucas (1988) adapted the Solow (1956) model with Uzawa’s (1965) human capital component to account for the spillovers of human capital accumulation where educated workers advance economic growth by passing on knowledge and productive capabilities to other workers (Lucas, 1988; Holmes, 2013). Therefore, an increase in the investment of physical or human capital raises the steady state GDP growth rate (Hartwig, 2014).

Analysis of the longitudinal rolling five-year average data engaged the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model with a Generalized Method of Moments (GMM) estimation of an autoregressive distribution lag (ARDL). The GMM regression corrects endogeneity bias and allows to determine causality between massification and diversification efforts of tertiary education and economic growth (Roodman, 2008). The model examined the following hypotheses:

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP).

H_2: University tertiary education enrollments will have a significant effect on economic growth (GDP) compared than two-year tertiary education.

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

The Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model:

$$Y = F(K, N^e)h^a \quad (1)$$

is based on a production function where K is total capital, N^e is effective labor, and h^a is human capital or the skill level of a worker (Lucas, 1988). The model is based on a reduced-form production technology production function of:

$$y(t) = \bar{A}k_t, \bar{A} = A\psi^{1-\alpha} \quad (2)$$

where y(t) is growth, A is technology, ψ is the ratio of h/k (which is constant and equal to $1 - \alpha/\alpha$), and k_t is capital and labor input (Jones, 1995). A dynamic relationship of Equation 2 augments to:

$$g_t = A(L)g_{t-1} + B(L)i_t + \epsilon_t \quad (3)$$

where A(L) and B(L) are two lag polynomials with roots outside the unit circle, g_t represents GDP growth in period t, i_t is the rate of investment in period t, and ε_t is a stochastic shock (Jones, 1995). Equation 3 includes contemporaneous values of the capital formation variables and thus should engage a modified Granger test (Hartwig, 2014). The modified Granger-test equation yields:

$$X_{it} = \mu_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it} \quad (4)$$

where the growth rates of real GDP per-capita for real physical investment per-capita and human capital investment per-capita are X_{it}, Y_{it}, and Z_{it} respectively. N countries (i) are observed over T periods (t) and Hartwig (2014) allows for country specific effects with u_i and the disturbances u_{it} assumed to be independently distributed across countries with a zero mean. I augmented Equation 3 and Equation 4 to test the four hypothesis of this longitudinal research.

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP).

Augmenting Equation 3 for human capital with $C(L)h_t$ provided the following equations to test H_1.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t \quad (5)$$

$$X_{it} = \mu_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it} \quad (6)$$

H_2: University tertiary education enrollments will a significant effect on economic growth (GDP) than two-year tertiary education.

Augmenting Equation 3 and Equation 4 with a human capital variable to account for university and two-year tertiary education enrollments where $C(L)u_t$ and $\sum_{l=0}^{m} \psi Z_{it-l}$ accounted for university tertiary education enrollments and $D(L)j_t$ and $\sum_{l=0}^{m} \psi J_{it-l}$ accounted for two-year tertiary education enrollments to test H_2.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)u_t + D(L)j_t + \epsilon_t \quad (7)$$

$$X_{it} = \mu_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + \sum_{l=0}^{m} \psi J_{it-l} + u_{it} \quad (8)$$

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

Utilizing Equation 5 for total tertiary education enrollments as the form of human capital and augmenting Equation 4 with a country classification dummy variable of $\beta_i t_i$ tested H_3.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t \quad (9)$$

$$X_{it} = \mu_i + \beta_i t_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it} \quad (10)$$

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

Utilizing Equation 5 with total tertiary education, since importing U.S. community college tertiary education complements university tertiary education, and augmenting Equation 4 with the dummy variable of developing countries importing U.S. community college tertiary education models, $\beta_i t_i$, tested H_4.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t \quad (11)$$

$$X_{it} = \mu_i + \beta_i t_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it} \quad (12)$$

CHAPTER 4 FINDINGS

Introduction

Countries have increased the promotion of massification and diversification of tertiary education, especially in developing countries, (Guri-Rosenblit, Sebkova, & Teichler, 2007) with diversification efforts seeking engagement of the U.S. community college model (Cutright, 2014; Hartenstine, 2013b; Hewitt & Lee, 2006; Mellow & Katopes, 2010; Schroeder & Hatton, 2006; Spangler & Tyler, 2011; Violino, 2011; Wang & Seggie, 2012; Woods, 2013). It is believed tertiary education massification and diversification efforts will promote economic growth. However, there is little empirical evidence demonstrating the economic benefits of massification and diversification of tertiary education. The purpose of this study was to examine the effect of country-level massification and diversification agendas through an analysis of a longitudinal dataset over 19-years in 176 developed and developing countries utilizing an augmented Uzawa-Lucas (Lucas, 1988; Uzawa, 1965). The augmented model analyzed with the statistical frame work of a Generalized Method of Moments (GMM) estimation of an autoregressive distribution lag (ARDL) modified Granger-causality tested the following four research questions:

1. To what extent do country-level tertiary education enrollments exert a significant positive effect on GDP over a 19-year period?
2. To what extent do relative enrollments in two-year tertiary education and university tertiary education exert a significant positive effect on GDP over a 19-year period?

3. To what extent do country-level tertiary education enrollments exert a significantly positive effect on GDP over a 19-year period in developed and developing countries respectively?

4. To what extent does GDP growth differs between developing countries that have imported the U.S. community college model promote greater economic growth compared with those that have not?

The results of the study are presented in this chapter with the initial descriptive statistics and initial assumptions followed by the results of the models for each of the four research questions.

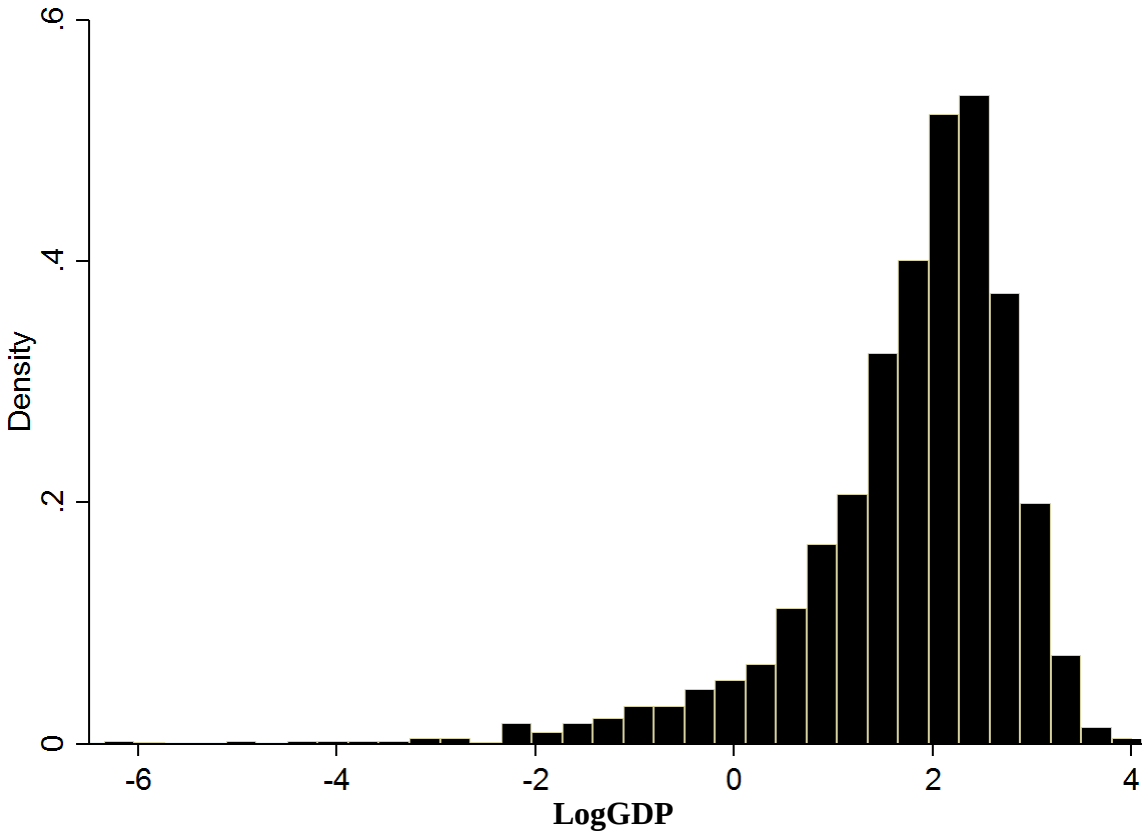
Descriptive Statistics and Initial Assumptions

Initial data analysis of the 176 developed and developing countries over the 19-year period demonstrated 101 developing counties and 75 developed countries with 25 countries importing community college education. Visual analysis of the data utilizing histograms of the five-year average growth rates of real GDP per-capita, gross fixed capital formation, and tertiary-level education demonstrated non-normal distributions, thus all variables were log-transformed to create an elastic relationship. The log transformation of the variables resulted in more normal distribution, however, the same variables still demonstrated outliers, Figures 1 - 5. Mozambique, Niger, and Seychelles were the outliers of real GDP per-capita growth. Finland and the United Kingdom were outliers in fixed capital formation growth. Norway and Tonga were the outliers of total tertiary education enrollment growth. Outliers were maintained in the data for analysis and the models re-estimated dropping each outlier to determine if the results are sensitive to exclusion of respective outliers. Log transformation of university tertiary education

enrollments and community college tertiary education enrollments did not demonstrate significant outliers. There were many countries with years of minimal total tertiary, university, or community college tertiary education enrollments, as demonstrated by the spike near zero of the distribution graphs.

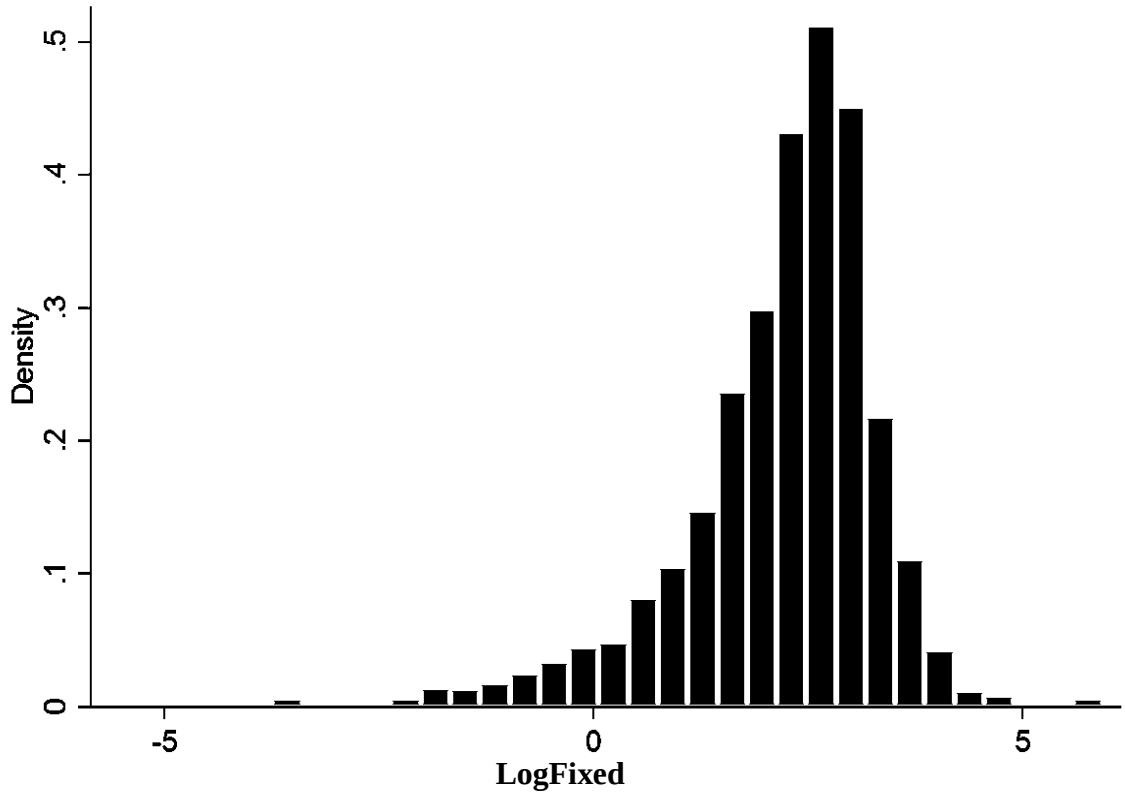
Histogram LogGDP 1995 – 2014

Figure 1



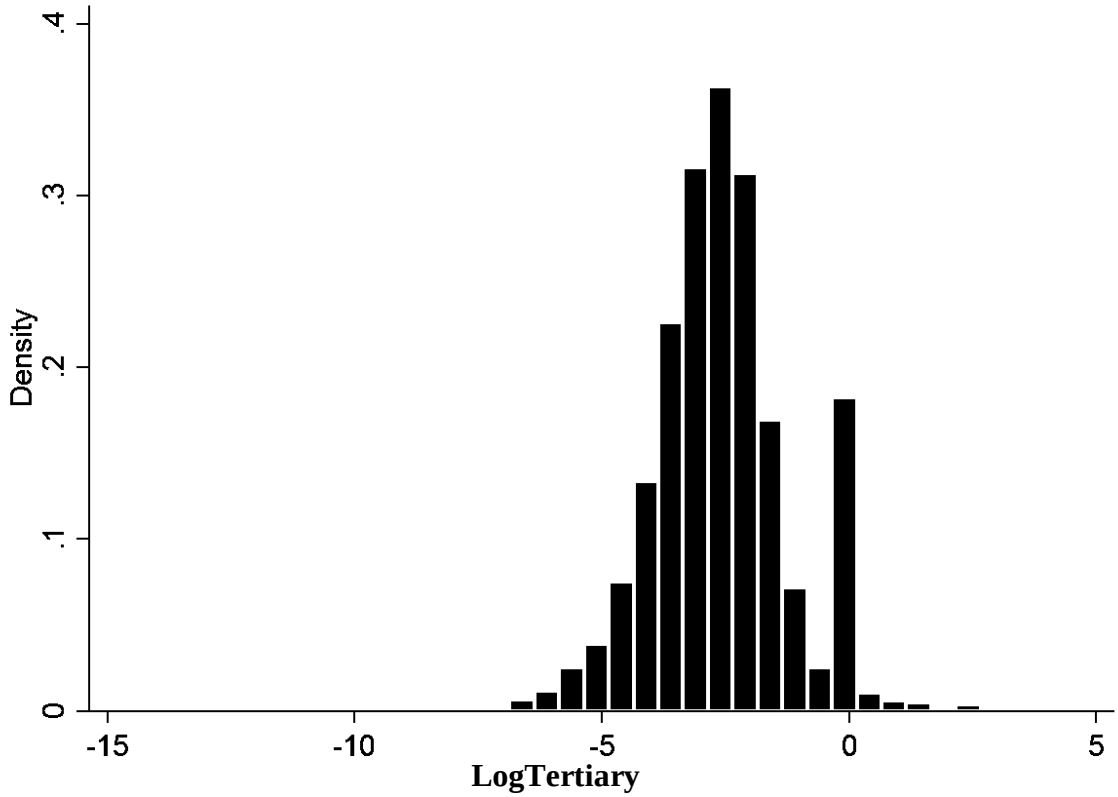
Histogram LogFixed 1995 – 2014

Figure 2



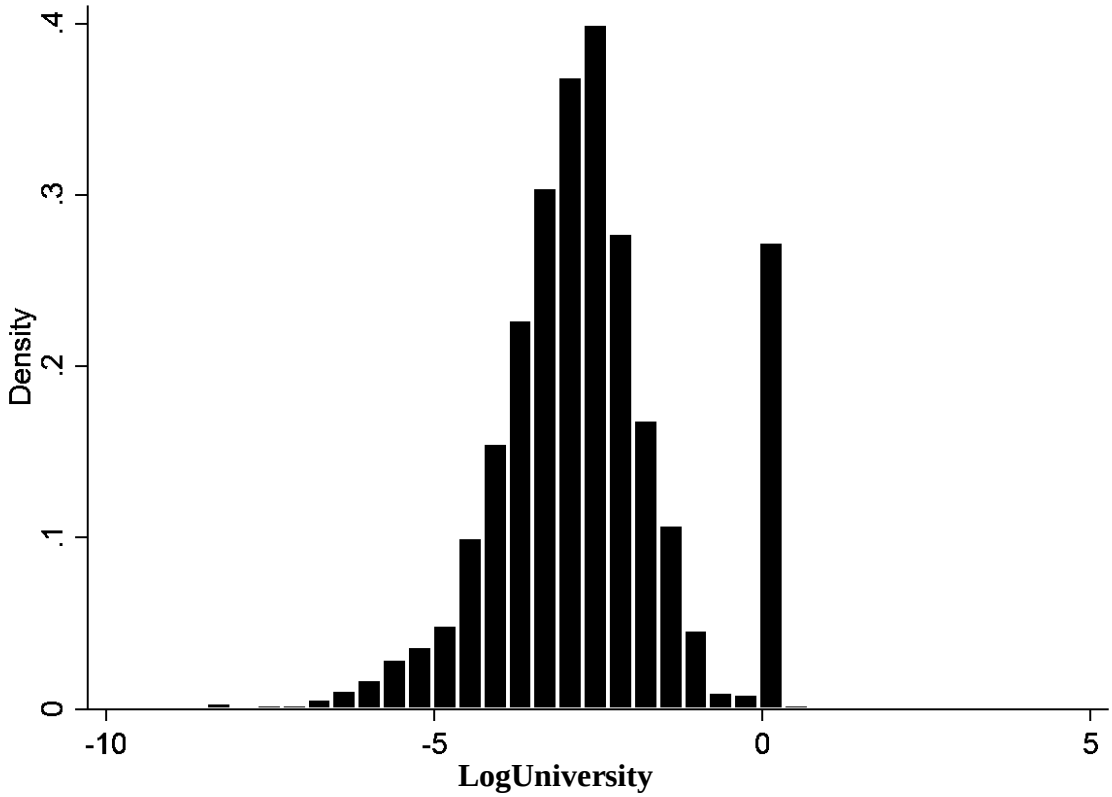
Histogram LogTertiary 1995 – 2014

Figure 3



Histogram LogUniversity 1995 – 2014

Figure 4



Histogram LogCC 1995 – 2014

Figure 5

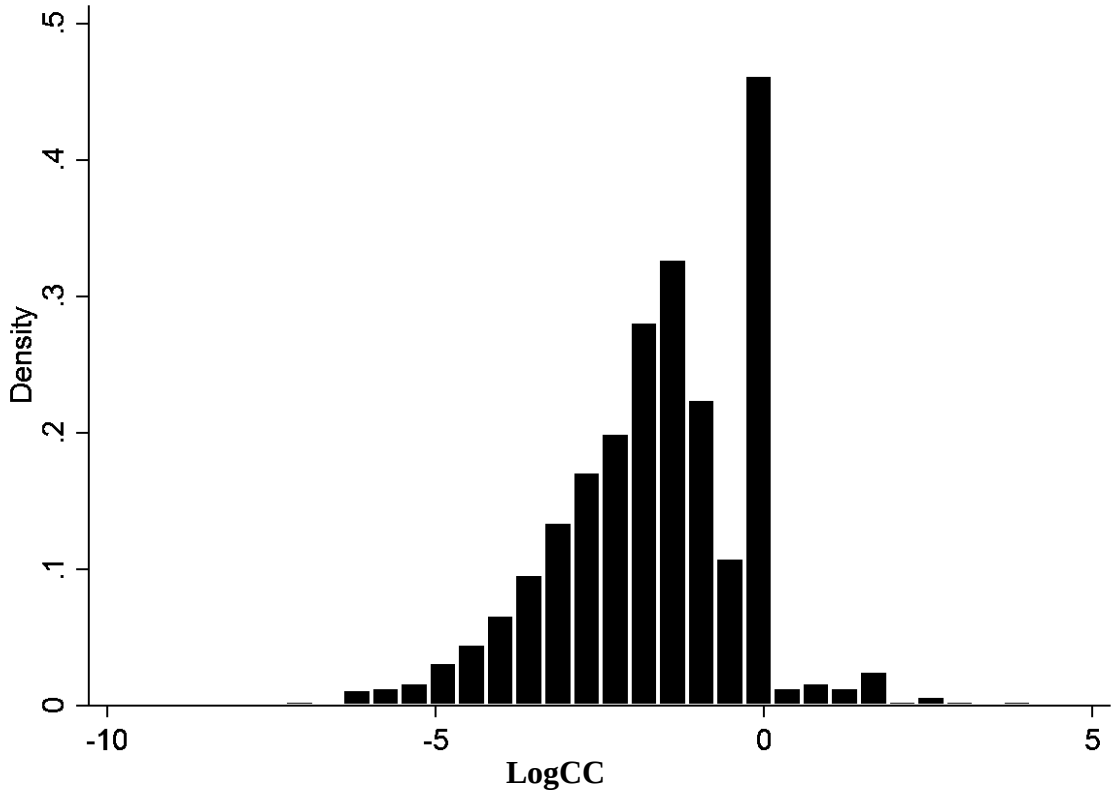


Table 3 displays the mean, standard deviation, maximum, and minimum for each variable for the 176 countries. In Table 4 the mean, standard deviation, minimum, and maximum segment by country classification - developing and developed countries. Developed countries demonstrated greater growth in GDP per capita and fixed capital formation compared to the total mean and developing counties. Developing countries yielded GDP and fixed capital growth below the aggregate mean. Mean growth in total tertiary education, community college, and university tertiary education enrollments demonstrated that decreases, but with developed countries demonstrating larger decreases compared to the Mean and developing countries demonstrating decreases below the

aggregate Mean.

Table 3

Descriptive statistics – all countries

Statistic	GDP	Fixed Capital	Tertiary Enrollment	Community College Enrollment	University Enrollment
N	2612	2388	2062	2138	1376
Mean	1.769	2.182	-2.586	-1.622	-2.689
SD	1.136	1.780	1.431	1.549	1.401
Min	-6.344	-5.473	-13.886	-8.501	-9.238
Max	4.115	5.938	2.666	4.945	3.386

Table 4

Descriptive statistics – by country classification

Statistic	Classification	GDP	Fixed Capital	Tertiary Enrollment	Community College Enrollment	University Enrollment
N	Developing	1529	1459	1266	821	1263
	Developed	1083	929	796	555	875
Mean	Developing	1.910	2.373	-2.360	-1.363	-2.403
	Developed	1.570	1.882	-2.946	-2.005	-3.102
SD	Developing	1.073	1.124	1.404	1.506	1.370
	Developed	1.193	1.196	1.400	1.534	1.343
Min	Developing	-6.344	-3.633	-10.282	-6.538	-8.762
	Developed	-5.755	-5.473	-13.886	-8.601	-9.238
Max	Developing	4.115	5.938	2.666	4.414	3.386
	Developed	3.574	4.139	2.304	4.945	0.260

Four hypotheses were tested to answer each of the respective research questions. In testing the hypotheses, the first step was to determine the appropriate lag length. Arellano and Bond (1991) suggest utilizing lags of two periods earlier of the dependent variable along with lags of independent variables. Engaging a pooled Ordinary Least Squares (OLS) estimator with cross-section fixed effects with the Akaike Information Criteria (AIC) for lag length determination demonstrated an optimal lag length of 1, *AIC* = 1.44 (Table 5). However, lag length of 2 was utilized per Roodman (2008) and Arellano and Bond (1991), especially since AIC for macroeconomic data does not

decline smoothing promoting a propensity to never find the global minimum (Webb, 1985). As a robustness check, estimations with one lag length were also conducted.

Table 5

Optimal lag length

Variable	Lag 0	Lag 1	Lag 2	Lag 3
AIC	2.60	1.44	1.72	1.87

Panel unit root tests determining stationary time series reject the null hypothesis for all variables ($p < .05$) demonstrating proceeding with the Granger-causality test (Table 6). Panel root tests are designed for longitudinal datasets with large time and cross section dimensions (Hartwig, 2009). The longitudinal dataset utilized has eleven time dimensions, thus may limit the effectiveness of the tests. However, the tests do not deter the utilization of the Granger-causality tests to answer the four hypotheses.

Table 6

Fisher-type Panel Unit Root Tests Results

Variable	Statistic	p-value	Obs.
logGDP	1805.02	0.00	173
LogFixed	1179.84	0.00	164
LogTertiary	1490.16	0.00	175
LogCC	1661.46	0.00	168
LogUniversity	1202.64	0.00	173

Each research questions was estimated with a one-step statistical diagnostics for model interpretation and instrument validation. One-step and two-step estimations are historically reported due to downward bias of standard errors in two-step estimation (Baltagi, 2008; Roodman, 2008) and over-rejection as *N* becomes smaller in one-step estimation (Soto, 2009). While the Windmeijer correction remedies the downward bias of the two-step estimation (Efendic, Pugh, & Adnett, 2011; Roodman, 2008), the one-step is the more reliable estimator (Soto, 2009) of the long-run effect of dynamic panels.

Research Questions

The augmented models analyzed with the statistical framework of a Generalized Method of Moments (GMM) estimation of an autoregressive distribution lag (ARDL) modified Granger-causality test includes lags of the both the dependent and independent variables to obtain long-run determinants. Utilization of GMM estimation corrects for endogeneity bias by removing fixed effects. The most common approach is to take the first difference of all variables to eliminate individual effects (Hartwig, 2009). However,

since there are gaps within the dynamic panel data, there was be missing transformed data. Therefore, the models engaged the forward orthogonal deviations transformation as proposed by Arellano & Bover (1995).

As demonstrated above, the lag length of 2 was utilized, which is in line with endogenous variables requiring lag lengths of 2 and up (Arellano & Bond, 1991; Roodman, 2008). Data were transformed into five-year rolling averages to account for the effects of shocks to investment on economic growth that disappear after six years and accounts for long-term lag (Jones, 1995; Hartwig, 2009). Further, the log function of all data transformed the panel into an elastic dataset. All models included period-specific effects and collapsed number of instruments as recommended in the literature (Roodman, 2008; Hartwig, 2009).

Each respective statistical equation was augmented to analyze each of the four hypotheses. Each hypothesis was estimated utilizing the methods above, and the augmented models utilizing endogenous growth should yield significantly positive impact of human capital, tertiary education, on long-term economic growth (second lag). The following sections describe the model validation and estimation findings.

Model Validations

The models utilized are valid instruments for testing the hypothesis. The bottom half of Table 7, Table 10, Table 13, and Table 15 demonstrate the assumptions met for model validation. The Arellano-Bond test, AR(1) and AR(2), tests for first-order and second-order serial correlation based upon the null hypothesis of no serial correlation (Arrelano & Bond, 1991). Validation of the instruments was confirmed by the rejection of the null hypothesis for AR(1) and failing to reject the null hypotheses for AR(2). Each

one-step mode rejected the null hypothesis for AR(1) and failed to reject the null hypothesis for AR(2). The Hansen J-test of overidentifying restrictions evaluates the model by testing the null hypothesis on the specifications and valid overidentifying restrictions of the model (Baum, 2006). Failing to reject the null hypothesis indicates the models are valid instrumentation (Efendic, et al., 2011). Further, the Hansen J-test should have a p-value below 1.00 and greater than .05 or 0.10 (Roodman, 2007). Both criteria were satisfied in each model. The Hansen J-tests estimates the validity of subsets of instruments utilizing difference-in tests, also known as the C-test (Baum, 2006; Roodman, 2008). The null hypothesis states that the specified variables are proper instruments within the models (Efendic, et al., 2011). The model cannot reject the null hypotheses of exogeneity of all the difference-in-Hansen tests of exogeneity for GMM and IV instruments. Lastly, the F-tests of joint significance reject the null hypothesis that independent variables are jointly equal to zero. Satisfaction of each respective test provided evidence on the validity of each model.

Research Question 1

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP):

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t$$

$$X_{it} = \mu_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it}$$

Findings.

Hypothesis one was supported with the one-step system GMM estimation of the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model by demonstrating a significant positive impact of the TertiaryEnrol (-2) on economic growth (Table 7). Elastic data

transformation demonstrated a one unit improvement of tertiary education enrollment, LogTertiary (-2), results in a .06 percent rise in GDP per capita. Hence, a ten percent improvement in tertiary education enrollment in the long-run will result in at .6 percent increase GDP per capita level. Total tertiary education has a positive impact on economic growth in the medium-run, LogTertiary (-1), but is non-significant.

Table 7 demonstrates the first lag level of GDP per capita, LogGDP (-1), has a positive and significant effect on the GDP per capita in the current period. LogGDP (-2) has a positive but non-significant effect on GDP per capita in the current term. Fixed capital formation (LogFixed) demonstrated a positive and significant effect on GDP per capita in the current term. The first lag of fixed capital formation, LogFixed (-1), is negative and significant, while in the second lag, LogFixed (-2), there is a positive and non-significant coefficient. The findings of fixed capital demonstrated the relationship predicted by exogenous growth theory. Therefore, long term economic growth is not driven by physical capital accumulation (Hartwig, 2009).

Table 7

One-Step System GMM for H_1

Variable	β	*t-value*	*p-value*
Constant	0.549	1.960	0.052
LogGDP (-1)	0.567	7.390	0.000
LogGDP (-2)	-0.049	-1.090	0.279
LogFixed	0.444	4.030	0.000
LogFixed (-1)	-0.228	-2.190	0.030
LogFixed (-2)	0.012	0.360	0.720
LogTertiary	-0.013	-0.280	0.777
LogTertiary (-1)	0.047	1.700	0.091
LogTertiary (-2)	0.062	2.700	0.008
Number of Observations	973		
Number of Groups	149		
Number of instruments	64		
F-test of joint significance	F(21, 148) = 71.89, p > F = 0.000		
Arellano-Bond test for AR(1)	z = -4.28, Pr > z = 0.000		
Arellano-Bond test for AR(2)	z = -0.80, Pr > z = 0.421		
Hansen J-test of overidentifying restrictions	chi2(42) = 47.28 Prob > chi2 = 0.266		
Difference-in-Hansen test of exogeneity of GMM-1	chi2(36) = 43.12, Prob > chi2 = 0.193		
Difference-in-Hansen test of exogeneity of GMM-2	chi2(6) = 4.16, Prob > chi2 = 0.655		
Difference-in-Hansen test of exogeneity of "IV"-1	chi2(29) = 32.22, Prob > chi2 = 0.269		
Difference-in-Hansen test of exogeneity of "IV"-2	chi2(13) = 14.06, Prob > chi2 = 0.369		

Outliers did not demonstrate a significant impact on the empirical model (Table 8). LogGDP (-1) remained positive and significant. LogGDP (-2) remained negative and non-significant. However, the coefficient decreased by almost half with the removal of Mozambique. LogFixed remained positive and significant while LogFixed (-1) maintained a negative coefficient and significance. The removal of Mozambique demonstrated a slight increase in the LogFixed (-1) compared to other removals.

LogFixed (-2) maintained similar coefficient direction and significance for all outlier removals, but the removal of Mozambique doubled the coefficient. LogTertiary demonstrated greater negative coefficients when Mozambique and Niger were removed. LogTertiary (-1) maintained similar findings to the aggregate model with the exception of removing Mozambique. The removal of Mozambique yielded a significantly positive impact of the first lag of tertiary education enrollment on GDP per capita. LogTertiary (-2) maintained consistency compared to the aggregate model. The exclusion of Mozambique does impact the model, however there is no impact on the long-run effect of tertiary education enrollment on economic growth. The exclusion demonstrates a significant impact on tertiary education in the medium-run.

Table 8

One-Step System GMM for $H_{1:}$ excluded countries

	Finland	Mozambique	Niger	Norway	Seychelles	Tonga	U.K
LogGDP (-1)	0.567** (0.077)	0.532** (0.084)	0.574** (0.076)	0.571** (0.078)	0.567** (0.077)	0.568** (0.077)	0.566** (0.077)
LogGDP (-2)	-0.049 (0.045)	-0.028 (0.058)	-0.050 (0.045)	-0.052 (0.045)	-0.049 (0.045)	-0.049 (0.045)	-0.049 (0.045)
LogFixed	0.444** (0.111)	0.565** (0.123)	0.443** (0.110)	0.422** (0.108)	0.444** (0.110)	0.443** (0.110)	0.443** (0.110)
LogFixed (-1)	-0.228** (0.105)	-0.347** (0.115)	-0.227** (0.105)	-0.216** (0.104)	-0.228** (0.104)	-0.227** (0.104)	-0.228** (0.104)
LogFixed (-2)	0.012 (0.034)	0.024 (0.039)	0.012 (0.034)	0.011 (0.033)	0.012 (0.034)	0.012 (0.034)	0.011 (0.034)
LogTertiary	-0.015 (0.047)	-0.036 (0.050)	-0.022 (0.048)	-0.004 (0.046)	-0.013 (0.047)	-0.014 (0.047)	-0.011 (0.047)
LogTertiary (-1)	0.048 (0.028)	0.054** (0.027)	0.050 (0.029)	0.048 (0.030)	0.047 (0.028)	0.047 (0.028	0.047 (0.028)
LogTertiary (-2)	0.063** (0.023)	0.064** (0.023)	0.064** (0.025)	0.067** (0.025)	0.062** (0.023)	0.062** (0.023)	0.062** (0.023)
Number of obs.	968	962	962	965	973	972	970
Number of instruments	64	64	64	64	64	64	64
F-test	71.860	67.90	71.27	69.59	71.89	71.90	72.25
F-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Mozambique and Niger did affect the empirical model, which could be caused by the inclusion of developing countries because of their positive growth trajectory compared to developed countries (Hartwig, 2014). The model was estimated removing both developing and developed countries, respectively, as demonstrated in Table 9. LogGDP (-1) remains positive and significant. The second lag of GDP per capita, LogGDP (-2), maintains a negative coefficient, but becomes significant for developed countries, meaning the long-run GDP per capita has a negative and significant effect on the GDP per capita in the current year for developed countries. Fixed capital formation,

LogFixed, remains positive and significant, but with greater impact in developed countries compared to developing countries. LogFixed (-1) maintained a negative coefficient compared to the aggregate, but is not significant for developing or developing countries. The second lag of fixed capital formation, LogFixed (-1), demonstrated a negative effect in developing countries and a positive effect in developed countries, but neither was significant. LogTertiary education demonstrated a positive effect and negative effect for developing and developed countries, respectively, without significance. The first lag of tertiary education enrollments, LogTertiary (-1), maintained a positive impact on GDP per capita. The long-run tertiary education enrollment, LogTertiary (-2), was not significant when removing developed or developing countries. There was a positive impact, but no significance.

Table 9

One-Step System GMM for $H_{1:}$ developed vs developing countries

	Aggregate	Developing	Developed
LogGDP (-1)	0.567**	0.551**	0.623**
	(0.077)	(0.121)	(0.105)
LogGDP (-2)	-0.049	-0.012	-0.190**
	(0.045)	(0.044)	(0.091)
LogFixed	0.444**	0.242**	0.556**
	(0.110)	(0.083)	(0.212)
LogFixed (-1)	-0.228**	-0.075	-0.309
	(0.104)	(0.080)	(0.215)
LogFixed (-2)	0.012	-0.011	0.168
	(0.034)	(0.032)	(0.089)
LogTertiary	-0.013	0.027	-0.138
	(0.047)	(0.040)	(0.082)
LogTertiary (-1)	0.047	0.043	0.028
	(0.028)	(0.030)	(0.050)
LogTertiary (-2)	0.062**	0.042	0.088
	(0.023)	(0.026)	(0.060)
Number of obs.	973	669	304
Number of instruments	64	64	64
F-test	71.89	54.55	91.16
F-value	0.000	0.000	0.000

Hypothesis one was supported on the effect of tertiary education on economic growth. Removals of outliers did affect the empirical model, but did not demonstrate a change on the effect of tertiary education enrollments on GDP per capita. Running the empirical model by country classification demonstrated that removal of a country classification impacts the results of the model and that tertiary education does not have a significant impact on economic growth. Tertiary education impacts GDP per capita regardless of country classification.

Research Question 2

H_2: University tertiary education enrollments will a significant effect on economic growth (GDP) compared to two-year tertiary education.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)u_t + D(L)j_t + \epsilon_t$$

$$X_{it} = \mu_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + \sum_{l=0}^{m} \psi J_{it-l} + u_{it}$$

Findings.

Hypothesis two was not supported. Augmentation of the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model expanded the human capital model to segment university and community college tertiary education enrollments. The one-step system GMM estimation for H_2 demonstrated that first lag of GDP per capita, LogGDP (-1), had positive and non-significant effects on current period GDP per capita while the second lag, LogGDP (-2), had negative and non-significant influence on GDP per capita. Fixed capital formation was positive and significant. The first lag of fixed capital formation, LogFixed (-1), was negative and non-significant while the second lag, LogFixed (-2), was positive and non-significant. The findings contradict the relationship prediction of exogenous growth theory with the negative and non-significant first lag of fixed capital formation. Thus, negating long-term economic growth is not driven by physical capital accumulation. However, the findings on fixed capital formation were in-line with the findings of Hartwig (2009) prior to each country exclusion from his estimated models. Removal of each country was not conducted for this study.

Segmenting tertiary education by university and community college tertiary education enrollments demonstrated a positive influence on GDP per capita, but non-significant. The results did not demonstrate a significant influence of a tertiary education

enrollment classification over another, meaning university tertiary education enrollments did not significantly impact GDP per capita compared to community college tertiary education enrollments or vice versa. Each respective enrollment classification had a positive non-significant effect, but when classification is not taken into consideration, there is a positive and significant effect on GDP per capita as demonstrated in hypothesis one.

Table 10

One-Step System GMM for H_2

Variable	β	*t-value*	*p-value*
Constant	0.997	2.630	0.010
LogGDP (-1)	0.245	1.590	0.115
LogGDP (-2)	-0.009	-0.090	0.930
LogFixed	0.326	2.970	0.004
LogFixed (-1)	-0.157	-1.160	0.250
LogFixed (-2)	0.094	1.440	0.154
LogUniversity	0.061	0.870	0.384
LogUniversity (-1)	0.012	0.240	0.813
LogUniversity (-2)	0.065	1.970	0.053
LogCC	0.028	0.660	0.512
LogCC (-1)	0.020	0.570	0.570
LogCC (-2)	0.031	1.160	0.249
Number of Observations	270		
Number of Groups	85		
Number of instruments	80		
F-test of joint significance	F(24, 84) = 15.73, p > F = 0.000		
Arellano-Bond test for AR(1)	z = -2.60, Pr > z = 0.009		
Arellano-Bond test for AR(2)	z = -1.26, Pr > z = 0.209		
Hansen J-test of overidentifying restrictions	chi2(55) = 52.52, Prob > chi2 = 0.570		
Difference-in-Hansen test of exogeneity of GMM-1	chi2(47) = 48.25, Prob > chi2 = 0.422		
Difference-in-Hansen test of exogeneity of GMM-2	chi2(8) = 4.28, Prob > chi2 = 0.831		
Difference-in-Hansen test of exogeneity of "IV"-1	chi2(42) = 40.33, Prob > chi2 = 0.545		
Difference-in-Hansen test of exogeneity of "IV"-2	chi2(13) = 12.20, Prob > chi2 = 0.512		

Removal of outliers demonstrated very little effect on the estimation of the empirical model (Table 14). The first lag of GDP per capita, LogGDP (-1), remained positive with each respective outlier removal, but was significant with the removal of Norway. All other variables were in line with the findings of the aggregate model

demonstrating that outliers did not bias the findings of tertiary education. The removal of Norway did demonstrate lower positive coefficients for LogUniversity (-1) and LogCC, but the impact and significance remained similar to the aggregate model.

Table 11

One-Step System GMM for $H_{2:}$ excluded countries

	Finland	Mozambique	Niger	Norway	Seychelles	Tonga	U.K
LogGDP (-1)	0.245	0.245	0.215	0.253*	0.245	0.246	0.245
	(0.154)	(0.154)	(0.146)	(0.146)	(0.154)	(0.154)	(0.154)
LogGDP (-2)	-0.009	-0.009	-0.004	-0.014	-0.009	-0.009	-0.009
	(0.101)	(0.101)	(0.102)	(0.101)	(0.101)	(0.101)	(0.101)
LogFixed	0.326**	0.326**	0.333**	0.323**	0.326**	0.325 **	0.326**
	(0.110)	(0.110)	(0.110)	(0.105)	(0.110)	(0.110)	(0.110)
LogFixed (-1)	-0.157	-0.157	-0.148	-0.150	-0.157	-0.157	-0.157
	(0.135)	(0.135)	(0.140)	(0.131)	(0.135)	(0.135)	(0.135)
LogFixed (-2)	0.094	0.094	0.093	0.091	0.094	0.095	0.094
	(0.065)	(0.065)	(0.067)	(0.064)	(0.065)	(0.066)	(0.065)
LogUniversity	0.061	0.061	0.073	0.059	0.061	0.060	0.061
	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
LogUniversity (-1)	0.012	0.012	0.016	0.005	0.012	0.011	0.012
	(0.049)	(0.049)	(0.051)	(0.047)	(0.049)	(0.049)	(0.049)
LogUniversity (-2)	0.065	0.065	0.070	0.058	0.065	0.065	0.065
	(0.033)	(0.033)	(0.035)	(0.032)	(0.033)	(0.034)	(0.033)
LogCC	0.028	0.028	0.019	0.016	0.028	0.027	0.028
	(0.042)	(0.042)	(0.042)	(0.040)	(0.042)	(0.042)	(0.042)
LogCC (-1)	0.020	0.020	0.021	0.026	0.020	0.021	0.020
	(0.036)	(0.036)	(0.037)	(0.037)	(0.036)	(0.036)	(0.036)
LogCC (-2)	0.031	0.031	0.029	0.037	0.031	0.031	0.031
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Number of obs.	270	270	265	265	270	269	270
Number of instruments	80	80	80	80	80	80	80
F-test	15.73	15.73	15.71	14.16	15.73	15.85	15.73
F-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Segmenting the estimation between developing and developing countries provided differences between the empirical models (Table 12). LogGDP (-1) and LogGDP (-2) yielded positive and negative significant effects on GDP per capita, respectively. LogFixed demonstrated a positive and non-significant effect for developing

countries compared to developed countries and the aggregate model. The first lag of fixed capital formation, LogFixed (-1), demonstrated positive and non-significant effect on GDP per capita for developing countries compared to positive and non-significant effect in the aggregate and developed country models. LogUniversity (-1) was negative and non-significant for both developing and developed countries, but was positive and non-significant in the aggregate model. The long term effect of community college enrollment, LogCC (-2), demonstrated a negative and non-significant effect for developed countries, but a positive and non-significant effect for developing countries.

Hypothesis two was not supported. University tertiary education enrollments do not have a significant impact on GDP per capita compared to community college tertiary education enrollments. Therefore, economic growth is not impacted by a respective tertiary education enrollment classification. There is greater effect on economic growth through diversification promoting both university and community college tertiary education enrollment.

Table 12

One-Step System GMM for $H_{2:}$ developed vs developing countries

	Aggregate	Developing	Developed
LogGDP (-1)	0.245 (0.154)	0.196 (0.134)	0.671** (0.153)
LogGDP (-2)	-0.009 (0.101)	0.003 (0.135)	-0.198** (0.090)
LogFixed	0.326** (0.110)	0.265 (0.157)	0.228** (0.122)
LogFixed (-1)	-0.157 (0.135)	0.005 (0.148)	-0.109 (0.132)
LogFixed (-2)	0.094 (0.065)	0.081 (0.090)	0.019 (0.114)
LogUniversity	0.061 (0.069)	0.055 (0.062)	0.086 (0.109)
LogUniversity (-1)	0.012 (0.049)	-0.006 (0.043)	-0.115 (0.143)
LogUniversity (-2)	0.065 (0.033)	0.035 (0.028)	0.217 (0.109)
LogCC	0.028 (0.042)	0.063 (0.052)	0.026 (0.051)
LogCC (-1)	0.020 (0.036)	0.000 (0.041)	0.015 (0.050)
LogCC (-2)	0.031 (0.027)	0.027 (0.027)	-0.011 (0.041)
Number of obs.	270	193	77
Number of instruments	80	80	73
F-test	15.73	7.79	124.99
F-value	0.000	0.000	0.000

Research Question 3

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t$$

$$X_{it} = \mu_i + \beta_i t_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it}$$

Findings.

Hypothesis three was not supported with the augmented GMM estimation model engaging an interactive dummy variable for country classification (Table 13). Developing_Classification demonstrated a non-significant interactive dummy variable with $p > .05$. The addition of the dummy variable demonstrated a negative and non-significant medium-run effect of fixed capital formation, LogFixed (-1), on GDP per capita. The negative non-significant first lag of fixed capital formation is not in-line with Hartwig's (2009) exogenous theory stated in hypothesis one - long-term economic growth is not driven by physical capital accumulation. However, as stated previously, the results for H_3 may be driven by the inclusion of certain countries as Hartwig (2009; 2014) removes each OECD country respectively. Country exclusion was not conducted for this study.

The addition of the dummy variable demonstrated a significantly positive LogTertiary (-1) which was not seen in the estimation of H_1. The second lag, LogTertiary (-2), is also positively significant exerting a substantial influence on economic growth. Therefore, a one unit improvement of the first lag results in a .04 percent rise in GDP per capita in the medium-run and a .05 percent rise in GDP per capita in the long-run.

Table 13

One-Step System GMM for H_3

Variable	B	*t-value*	*p-value*
Constant	0.552	1.980	0.049
LogGDP (-1)	0.620	8.190	0.000
LogGDP (-2)	-0.067	-1.550	0.124
LogFixed	0.308	2.880	0.005
LogFixed (-1)	-0.110	-1.220	0.225
LogFixed (-2)	0.004	0.120	0.907
LogTertiary	0.007	0.110	0.911
LogTertiary (-1)	0.037	2.150	0.033
LogTertiary (-2)	0.054	2.900	0.004
Developing_Classification	0.004	0.080	0.940
Number of Observations	973		
Number of Groups	149		
Number of instruments	80		
F-test of joint significance	F(22, 148) = 65.08, p > F = 0.000		
Arellano-Bond test for AR(1)	z = -3.91, Pr > z = 0.000		
Arellano-Bond test for AR(2)	z = -0.90, Pr > z = 0.366		
Hansen J-test of overidentifying restrictions	chi2(57) = 66.67, Prob > chi2 = 0.179		
Difference-in-Hansen test of exogeneity of GMM-1	chi2(50) = 61.09, Prob > chi2 = 0.135		
Difference-in-Hansen test of exogeneity of GMM-2	chi2(7) = 5.58, Prob > chi2 = 0.590		
Difference-in-Hansen test of exogeneity of "IV"-1	chi2(44) = 59.62, Prob > chi2 = 0.058		
Difference-in-Hansen test of exogeneity of "IV"-2	chi2(13) = 7.05, Prob > chi2 = 0.900		

Removal of outliers Finland, Mozambique, Niger, and Norway demonstrated differences in the model compared to the aggregate estimation (Table 14). Finland demonstrated a positive non-significant LogGDP (-1) compared to the positive significant effect demonstrated in the aggregate model and the other models estimations with the removal of each respective outlier. Mozambique and Niger yielded negatively non-significant LogTertiary compared to positive non-significant. Norway demonstrated a

positive non-significant LogTertiary (-1) instead of a positive significant LogTeritary (-1). Thus, the model demonstrated some sensitivity to outliers similar to the findings of Hartwig's (2009) removal of individual countries from the model.

Table 14

One-Step System GMM for H_3: excluded countries

	Finland	Mozambique	Niger	Norway	Seychelles	Tonga	U.K
LogGDP (-1)	0.619 (0.076)	0.600** (0.081)	0.625** (0.075)	0.628** (0.078)	0.620** (0.076)	0.621** (0.076)	0.619** (0.076)
LogGDP (-2)	-0.067 (0.043)	-0.059 (0.055)	-0.068 (0.043)	-0.072 (0.044)	-0.067 (0.043)	-0.067 (0.043)	-0.067 (0.043)
LogFixed	0.312** (0.109)	0.385** (0.122)	0.307** (0.105)	0.275** (0.106)	0.308** (0.107)	0.308** (0.107)	0.310** (0.107)
LogFixed (-1)	-0.112 (0.092)	-0.181 (0.104)	-0.108 (0.089)	-0.087 (0.091)	-0.110 (0.090)	-0.109 (0.090)	-0.113 (0.091)
LogFixed (-2)	0.004 (0.031)	0.011 (0.034)	0.003 (0.031)	0.004 (0.030)	0.004 (0.031)	0.003 (0.031)	0.003 (0.031)
LogTertiary	0.003 (0.068)	-0.019 (0.066)	-0.001 (0.066)	0.019 (0.070)	0.007 (0.066)	0.007 (0.066)	0.007 (0.067)
LogTertiary (-1)	0.037** (0.017)	0.039** (0.018)	0.038** (0.017)	0.040 (0.019)	0.037** (0.017)	0.037** (0.017)	0.037** (0.017)
LogTertiary (-2)	0.054** (0.019)	0.054** (0.019)	0.055** (0.019)	0.059** (0.021)	0.054** (0.019)	0.054** (0.019)	0.054** (0.019)
Classification	0.008 (0.056)	0.030 (0.056)	0.012 (0.055)	-0.003 (0.061)	0.004 (0.055)	0.004 (0.055)	0.005 (0.056)
Number of obs.	968	962	962	965	973	972	970
Number of instruments	80	80	80	80	80	80	80
F-test	65.62	68.35	64.10	60.91	65.08	65.13	65.37
F-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis three was not supported for a significant effect on economic growth (GDP) in developing countries compared to developed countries. Tertiary education provided a positive and significant effect in the medium- and long-run, but did not

demonstrate a differentiation between country classifications. The findings were also supported by the testing of H_1 by country classification.

Research Question 4

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

$$g_t = A(L)g_{t-1} + B(L)i_t + C(L)h_t + \epsilon_t$$

$$X_{it} = \mu_i + \beta_i t_i + \sum_{l=1}^{m} \beta_l X_{it-l} + \sum_{l=0}^{m} \delta Y_{it-l} + \sum_{l=0}^{m} \psi Z_{it-l} + u_{it}$$

Findings.

Hypothesis four was not supported. The augmented model included an interactive dummy variable for countries importing U.S. community college education which resulted in a negative and non-significant Importing_CC variable (Table 15). Thus, finding no difference in economic growth between countries importing and not importing community college education.

The model held the exogenous and endogenous principles stated by Hartwig (2009) (Table 17). Fixed capital formation in the medium-run, LogFixed (-1), was negatively significant and the long-run, LogFixed (-2), was positive and non-significant. Endogenously, long-run impact of tertiary education, LogTertiary (-2), demonstrated positive significance ($p < .05$). Thus, a one unit improvement of the second lag results in a .05 percent rise in GDP per capita.

Table 15

One-Step System GMM for H_4

Variable	B	*t-value*	*p-value*
Constant	0.556	2.150	0.033
LogGDP (-1)	0.579	7.530	0.000
LogGDP (-2)	-0.050	-1.150	0.253
LogFixed	0.418	3.980	0.000
LogFixed (-1)	-0.210	-2.070	0.040
LogFixed (-2)	0.006	0.180	0.861
LogTertiary	0.023	0.560	0.576
LogTertiary (-1)	0.027	1.190	0.235
LogTertiary (-2)	0.047	2.080	0.039
Importing_CC	-0.027	-0.710	0.481
Number of Observations	973		
Number of Groups	149		
Number of instruments	80		
F-test of joint significance	F(22, 148) = 73.24, p > F = 0.000		
Arellano-Bond test for AR(1)	z = -4.24, Pr > z = 0.000		
Arellano-Bond test for AR(2)	z = -0.97, Pr > z = 0.333		
Hansen J-test of overidentifying restrictions	chi2(57) = 65.25, Prob > chi2 = 0.212		
Difference-in-Hansen test of exogeneity of GMM-1	chi2(50) = 58.73, Prob > chi2 = 0.186		
Difference-in-Hansen test of exogeneity of GMM-2	chi2(7) = 6.52, Prob > chi2 = 0.481		
Difference-in-Hansen test of exogeneity of "IV"-1	chi2(44) = 58.48, Prob > chi2 = 0.071		
Difference-in-Hansen test of exogeneity of "IV"-2	chi2(13) = 6.77, Prob > chi2 = 0.914		

The removal of outliers demonstrated that the model estimation for H_4 was influenced by the inclusion of Norway and the UK (Table 16). Norway demonstrated a negative and non-significant logFixed (-1) whereas the aggregate model and removal of other outliers demonstrated a positive and significant logFixed (-1). Removing the UK from the model demonstrated a positive and non-significant effect of fixed capital formation, LogFixed, along with a positive and significant second lag of fixed capital

formation, LogFixed (-2). Yet, while the removal of certain countries seems to affect the exogenous function of the model, the long-run, second lag of tertiary education, LogTertiary (-2), remains significant and does not need to revise the conclusion drawn from the aggregate sample as demonstrated by Hartwig (2009).

Table 16

One-Step System GMM for H_4: excluded countries

	Finland	Mozambique	Niger	Norway	Seychelles	Tonga	U.K
LogGDP (-1)	0.579** (0.077)	0.553** (0.084)	0.586** (0.076)	0.584** (0.078)	0.579** (0.077)	0.580** (0.077)	0.578** (0.077)
LogGDP (-2)	-0.050 (0.044)	-0.033 (0.056)	-0.051 (0.044)	-0.055 (0.044)	-0.050 (0.044)	-0.051 (0.044)	-0.050 (0.044)
LogFixed	0.419** (0.106)	0.508** (0.119)	0.413** (0.104)	0.391** (0.103)	0.418** (0.105)	0.418** (0.105)	0.418 (0.105)
LogFixed (-1)	-0.210** (0.102)	-0.304** (0.113)	-0.205** (0.101)	-0.191 (0.102)	-0.210** (0.101)	-0.209** (0.101)	-0.210** (0.101)
LogFixed (-2)	0.006 (0.034)	0.014 (0.037)	0.006 (0.034)	0.006 (0.033)	0.006 (0.034)	0.006 (0.034)	0.005** (0.034)
LogTertiary	0.022 (0.042)	0.014 (0.043)	0.021 (0.042)	0.034 (0.044)	0.023 (0.042)	0.023 (0.042)	0.024 (0.042)
LogTertiary (-1)	0.027 (0.022)	0.028 (0.022)	0.027 (0.023)	0.026 (0.025)	0.027 (0.022)	0.027 (0.022)	0.027 (0.022)
LogTertiary (-2)	0.047** (0.023)	0.046** (0.023)	0.048** (0.024)	0.051** (0.026)	0.047** (0.023)	0.047** (0.023)	0.047** (0.023)
Importing	-0.026 (0.038)	-0.023 (0.036)	-0.027 (0.038)	-0.029 (0.040)	-0.027 (0.038)	-0.026 (0.038)	-0.026 (0.038)
Number of obs.	968	962	962	965	973	972	970
Number of instruments	80	80	80	80	80	80	80
F-test	73.32	72.31	72.60	70.11	73.24	73.30	73.59
F-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis four was not supported that importing U.S. community college education will exert a significant effect on economic growth (GDP) compared with

countries not importing U.S. community college education. Tertiary education provides a positive and significant effect in the long-run, but did not demonstrate a differentiation between countries importing U.S. community college education.

Summary

The Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model was augmented four ways to test four hypothesis to answer the respective research questions. Overall, long-run tertiary education demonstrated a positive and significant impact on GDP per capita. Attempting to determine the impact of university education enrollment compared to community college enrollment demonstrated positive non-significant results that yielded no difference. Including dummy variables to determine differences between developing and developed countries and importing and non-importing countries demonstrated no difference. Tertiary education demonstrates an overall significant impact on economic growth.

CHAPTER 5 CONCLUSION

Introduction

Tertiary education is promoted as a key driver in promoting economic growth which has led to worldwide investment in tertiary education resulting in increased demand (Altbach & Knight, 2007), even when this policy is supported with little empirical evidence. Global investment increased demand for tertiary education in developing countries resulting in the design of innovative methods to supply tertiary education from developed countries, known as transnational education (Altbach & Knight, 2007; Bashir, 2007; Lien, 2008; Lane & Kinser, 2011; Tilak, 2011). Initial focus of transnational education initiatives emphasized importing university education based on the belief a four-year university education provided greater returns on investment (Psacharopoulos, 1985). Focus on university education led to oversaturation of the market which limited economic growth by failing to meet country tertiary education demands (Altbach, 2013; Bashir, 2007; Mellow & Katopes, 2010; Naidoo, 2009; Schroeder & Hatton, 2006). Desire to meet education demand prompted tertiary education massification to be complemented with diversification policies, particularly policies emphasizing importing U.S. community college education. Massification and diversification tertiary education policies are being emphasized with little empirical evidence on their impact (Holland et al., 2013). Massification of tertiary education focused on university education (Bashir, 2007; Woods, 2013), however the research demonstrated that tertiary education massification initiatives focusing strictly on university education do not significantly impact economic growth. Massification complemented with diversification, with community college tertiary education, provides

a positive and significant impact on economic growth. Massification and diversification agendas of tertiary education are believed to provide a greater impact to developing countries compared to developed countries (Greiner et al., 2005; Krüeger & Lindahl, 2001). Yet, the research demonstrated no significant impact of massification and diversification agendas on economic growth in developing countries compared to developed countries. Lastly, massification and diversification efforts engaging transnational education that imports U.S. community college education demonstrated no significant impact on economic growth.

Purpose Statement and Research Questions

The purpose of this study was to examine the effect of country-level massification and diversification agendas through an analysis of a longitudinal dataset over 19-years in 176 developed and developing countries. The research questions used to guide the study were:

1. To what extent do country-level tertiary education enrollments exert a significant positive effect on GDP over a 19-year period?
2. To what extent do relative enrollments in two-year tertiary education and university tertiary education exert a significant positive effect on GDP over a 19-year period?
3. To what extent do country-level tertiary education enrollments exert a significantly positive effect on GDP over a 19-year period in developed and developing countries respectively?

4. To what extent does GDP growth differs between developing countries that have imported the U.S. community college model promote greater economic growth compared with those that have not?

In order to analyze the four research questions, the study estimated four hypotheses:

H_1: Total tertiary education enrollments will have a significant effect on overall economic growth (GDP).

H_2: University tertiary education enrollments will have a significant effect on economic growth (GDP) than two-year tertiary education.

H_3: Total tertiary education enrollments will exert a significant effect on economic growth (GDP) in developing countries compared to developed countries.

H_4: Importing U.S. community college tertiary education will exert a significant effect on economic growth (GDP) compared with countries not importing U.S. community college tertiary education.

Review of the Methodology

Too test the hypotheses and answer the research questions, a longitudinal research design engaging a dynamic panel of country level economic and education data of 176 countries over a 19-year period was utilized. Data obtained for the longitudinal research was the dependent variable, GDP per capita, the independent variables fixed capital formation, total tertiary education enrollments, university tertiary education enrollments, and community college tertiary education enrollments. Further, two interactive dummy variables were created, country classification, determining developing and developing

countries, and importing community college education for countries engaging U.S. community college education within their respective borders.

The longitudinal design engaged an econometric model that blends economic theory, mathematics, and statistical inference (Ouliaris, 2012) to analyze massification and diversification policy initiatives of tertiary education. Endogenous growth theory was the economic theory base for the research, specifically engaging the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model which measures the economic benefits of human capital on economic growth. Each hypothesis augmented the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) model to statistically test each respective hypothesis with a GMM estimation of an ARDL.

Results

Augmentation of the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) for each hypothesis was estimated through the GMM estimation of an ARDL. All models were valid instruments meeting all model assumptions. The models were validated by rejection of the null hypothesis, $p > .05$, for AR(1) and failing to reject the null hypotheses, $p < .05$, for AR(2). Rejection of the null hypothesis of the Hansen J-test of overidentifying restrictions, along with a p-value below 1.00 and greater than .05 or .10 further provided indication the models were valid instruments. All models failed to reject the null hypothesis of exogeneity of all difference-in Hansen tests of exogeneity for GMM and IV instruments and rejected the null hypothesis of the F-test demonstrating model validation. Therefore, all assumptions were met demonstrating model validation for all hypothesis.

Hypothesis one was supported. Total tertiary education enrollments had a positive and significant impact on economic growth with a .6 percent increase in GDP per capita

with a ten percent improvement in tertiary education enrollments. Outliers, specifically the developed countries Mozambique and Niger, demonstrated some influence on the model, which could demonstrate a bias in findings due to inclusion of developing countries. However, when estimating the models by country classification, neither classification influenced the model which demonstrated tertiary education enrollments do not significantly affect developing countries compared to developed countries as suggested in the literature (Hartwig, 2014).

Hypothesis two was not supported. University tertiary education enrollments did not demonstrate a significant effect on economic growth compared to community college education. University and community college education provided a positive influence on economic growth, but neither tertiary education segment demonstrated a significant effect on GDP per capita over the other. Outliers did not demonstrate an influence on the model. Yet, when segmenting by country classification, the long term effect of community college education demonstrated a negative influence on GDP per capita in developed countries.

Hypothesis three was not supported. Tertiary education enrollments did not exert a significant effect on economic growth in developing countries compared to developed countries. The interactive dummy variable was non-significant, $p > .05$. Tertiary education provided a significant and positive long-term effect on GDP per capita. Model estimation demonstrated sensitivity to outliers, but did not demonstrate a change to the long term effect of tertiary education enrollments on GDP per capita.

Hypothesis four was not supported. Countries that imported U.S. community college tertiary education did not demonstrate a significant effect on economic growth

compared to countries not importing U.S. community college education. The interactive variable was non-significant, $p > .05$. Tertiary education still demonstrated a positive and significant effect on GDP per capita. The model demonstrated some influence by outliers, impacting the fixed capital formation, but the long-term effect of tertiary education remained positive and significant.

Discussions of Findings

The spillover effect of human capital, based on education, on economic growth was measured by the Uzawa-Lucas (Lucas, 1988; Uzawa, 1956) model. The model was augmented to measure the impact of total tertiary education enrollments on GDP per capita, the impact of university and community college tertiary education enrollments, country classification, and countries importing U.S. community colleges in order to analyze massification and diversification policy initiatives. This research helps bridge the literature gap analyzing the effects of tertiary education investment on economic growth and provides more evidence for policymakers, tertiary education institutions, and tertiary education stakeholders.

Massification

This research supported the initial findings of Barro & Lee (2010), Holmes (2013), Keller (2006), Krüeger & Lindahl (2001), Loening (2005), and Pegkas (2014) that demonstrated positive effects of investment in tertiary education on economic growth. Aggregate tertiary education enrollments significantly impacted economic growth demonstrating a ten percent improvement in tertiary education enrollment resulting in a .6 percent increase in GDP per capita in the long-run. The findings on tertiary education enrollments are in line with Hartwig (2011) and Arnold et al. (2011).

Hartwig (2011) and Arnold et al. (2011) focused on OECD area countries and engage different proxies for human capital formation. Hartwig (2011) utilized public education expenditures while Arnold et al. (2011) researched average years of education. The models utilized for this research engaged the similar economic approach as Hartwig (2011), but a different approach than Arnold et al. (2011) (Pooled Mean Group). This researched engaged a rolling five-year average compared to the five-year averages implemented by Hartwig (2009, 2014). The model demonstrated further evidence of human capital formation, in this case tertiary education enrollment, as a driver for economic growth.

Model estimation did not demonstrate a statistically significant difference of tertiary education enrollments on economic growth between developing and developed countries. Estimation of the models with each respective country classification and with the utilization of a dynamic dummy variable, validated the country classification findings. The findings contradict the statements of Greiner et al., (2005), Krüeger & Lindahl (2001), and Wang & Seggie (2013) that tertiary education provides a significant effect on developing countries economic growth compared to developed countries. However, this could be due to developing countries involved in different states of economic growth. Greiner et al. (2005) stated that countries are not necessarily at the same economic growth state and utilization of a single endogenous growth model may not determine policy effects on economic growth. Some developing countries may be in an early growth stage which may require measuring the spillover effects of learning by doing, and some may be in a later economic growth stage of measuring spillover from public infrastructure (Greiner et al., 2005). While education provides an aggregate

significant effect on economic growth, it does not demonstrate a significant effect in developing countries over developed countries.

Country classification findings demonstrated that community college tertiary education enrollments had a long term negative non-significant effect in developed countries compared to developing countries. Developing countries may attain greater longer-run positive benefit from community college education. Community college education provides the flexible short-cycle education that meet economic and social needs of the labor force (Kintzer & Bryant, 1998; Kotamraju, 2014; Levin, 2001 Raby, 2012; Roggow, 2014; Wang & Seggie, 2013). Further, community college education provides transitionary education from high school and university education or skilled employment (Spangler & Tyler, 2011) and is ideal for transition economies, economies with greater social disparity, and economies fractured by disasters (Kintzer & Bryant, 1998; Levin, 2001; Schroeder & Hatton, 2006). Therefore, there is a greater longer term positive effect in developing countries engaging community college education and this research supports the statements of Hewitt & Lee (2006), Kintzer & Bryant (1998), Levin (2001), Schroeder & Hatton (2006), and Wang & Seggie (2012) on the promotion of diversification by promoting community college education.

Furthermore, the significant impact of tertiary education enrollment on economic growth results in microeconomic benefits. The ten percent increase in tertiary education enrollments also suggests that each student within the group should average a private rate of return between 5% and 15% in wages, with greater returns for disadvantaged families (Arnold et al., 2011; Card, 1999; Harmon, et al., 2003; Krüeger & Lindahl, 2001; Pasacharopoulos & Patrinos, 2004; Stevens & Weale, 2004). Tertiary education helps

redistribute wealth through the private rate of return in wages.

Alfred Marshall (1890) stated “any change in the distribution of wealth which gives more to the wage receivers and less to the capitalists is likely, other things being equal, to hasten the increase of material production” (p. 24). Redistribution of wealth through increased private rate of return in wages increases disposable income, purchasing power, and savings leading not only to increased individual quality of life, but to increased productivity. Increased education results in greater wages which motivates employees and attracts skilled labor force.

Diversification

Segmenting tertiary education between university and community college tertiary education enrollments demonstrated no statistically significant difference, thus neither provided a greater benefit on economic growth over the other. The results complemented the statements of Wang & Seggie (2013) that a narrow focus on a single segment of tertiary education limits economic growth. Diversification policies of tertiary education provide greater economic benefit compared to singular tertiary education initiatives. Further, this research expands upon the previous literature that focused on the aggregate of tertiary education on economic growth (Arnold et al., 2011; Barro, 2013; Bils & Klenow, 2000; Ganegodage & Rambaldi, 2011; Hanushek & Woessmann, 2011; Hartwig, 2014; Krüeger & Lindahl, 2001).

Diversification efforts utilizing transnational education to import U.S. community colleges did not demonstrate a significant effect on economic growth. This research supports the statements by Cutright (2014), Hartenstine (2013b), Hewitt & Lee (2006), Mellow & Katopes (2010), Schroeder & Hatton (2006), Spangler & Tyler (2011),

Violino (20100), Wang & Saggie (2012), and Woods (2013) to engage the U.S. community college model as a means to promote diversification, which in turn leads to positive and significant effect on economic growth, but the findings did not demonstrate diversification by importing U.S. community college education as a significant contributor to significantly impacting economic growth. The research demonstrated community college education and university education have a significant effect on economic growth, but there was no significant positive effect of importing U.S. community college education. However, importing U.S. community college education may provide greater impact on economic growth in developing countries which was not a measurement within this research.

Summary

This research design identified the impact of tertiary education massification and diversification initiatives on economic growth by examining the effect of total tertiary education enrollments, university and community college tertiary education enrollments on GDP per capita, respectively while also expanding the research to determine the effects of tertiary education by country classification and countries importing U.S. community colleges. This information is quintessential to the literature as it provides another level of analysis providing affirmation on the significant impact of overall tertiary education. Thus, demonstrating the impact of tertiary education massification efforts on economic growth. Further, this research is the first to segment tertiary education by university and community college tertiary education enrollments. The findings demonstrated that diversification over exclusive tertiary education promotes greater economic growth. The research also provided the start of empirically testing on

transnational education through the analysis of importation of U.S. community college education. This research not only furthers the literature on massification and diversification of tertiary education for governments, policymakers, tertiary education institutions, and students, but also provides rationale for the promotion of massification and diversification agendas of tertiary education.

Implications for Research

Demand for tertiary education created a redistribution of trade in the tertiary education market (Bashir, 2007; Lien, 2008; Lane & Kinser, 2011; Tilak, 2011) resulting in innovative distribution methods known as transnational education (Altbach & Knight, 2007; Lien, 2008; Naidoo, 2009). This research did not demonstrate a significant impact on economic growth between countries importing U.S. community college education and countries that are not. Utilizing similar research techniques to this study, the empirical model could be re-estimated utilizing developing countries to determine if there is a significant benefit to developing countries to engage in importing U.S. community college education. Further, previous research has not differentiated between transnational methods of cross-border supply, consumption abroad, commercial presence, and presence of natural persons. As more data becomes available it will become increasingly important to expand this research to understand the impact of each respective mode of transnational education on economic growth and importing countries.

Another research opportunity on massification and diversification initiatives is through the lens of tertiary education quality based on Martin Trow's (2007) Theory of Massification of Higher Education. The theory provides criterion for educational quality in tertiary education and the role of stakeholders in massification of tertiary education.

Trow's (2007) theory is applicable to developed countries, but could be analyzed from the developing country perspective (Misaro, Jonyo, & Kariuiki, 2013). Qualitative case study research analyzing tertiary education through the lens of developing countries and engaging Trow's (2007) Theory of Massification of Higher Education.

Other research opportunities exist with regards to the social impact of community college education. Case studies research could understand the individual and local impact of community college education. Utilization of a production function measuring economic growth provides a lack of measurement in social benefit in the aggregate production function (Voon, 2001). Thus, there is an underestimation of the social benefit of education on labor force quality (Voon, 2001). Qualitative research could be conducted on the social benefit of university and community college education on the local labor force to determine if it promotes more skilled and productive labor force.

Further, a research opportunity is present for estimating an educational production function for community college education in developing countries. The research would attempt to estimate efficiency in the production of community college education through the utilization of data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC), a survey skills such as literacy, numeracy, and problem solving. The research could expand upon the findings of Deutsch, Dumas, & Silber (2013) which utilized OECD's Programme for International Student Assessment (PISA), a surveys of skills and knowledge of 15-year-old students, to estimate an educational production function in Latin America.

Implications for Practice

Tertiary education is emphasized as an essential element for countries to thrive in a global economy, especially developing countries (Shrivastava & Shrivastava, 2014). Empirical consensus is limited on the effect of tertiary education on economic growth (Holland et al., 2013), but tertiary education massification and diversification policies have proliferated (Holmes, 2013). Utilizing an endogenous economic growth model that provides insight into the effect of tertiary education on economic growth (Abdessalem, 2011; Arnold, et al., 2011; Hartwig, 2014; Holmes, 2013; Krüeger & Lindahl, 2001; Lucas, 1988; Romer, 1990), this research provides empirical understanding on the impact of massification and diversification agendas of tertiary education, particularly in developing countries. The findings on the impact of tertiary education massification and diversification agendas on economic growth provide policymakers with the magnitude of association of economic theory. Countries, especially developing countries, attain empirical evidence on the impacts of massification, diversification, and importing U.S. community college education which can utilized in policy decisions.

The empirical findings of this research supports the promotion of massification and diversification efforts of tertiary education. Although, many countries have not planned appropriately to accommodate the mass demand in tertiary education (Mohamedbhai, 2008). Policymakers and tertiary education institutions need consider the effects of massification and diversification efforts to create appropriate policies and strategic plans to adapt to the changing tertiary education market.

Massification

The first primary policy implication of this research concerns Government's promotion of massification of tertiary education focusing on single tertiary education. Massification of single tertiary education does demonstrate a positive effect on economic, yet the results demonstrate greater economic growth potential with diversification efforts. Thus, engaging in single tertiary education massification policies highlights a gap in economic growth potential and points to a need to understand the implication of single tertiary education massification policies.

Fostering massification policies designed to provide accessibility to tertiary education for all populations and seeking target enrollments of ten percent of current tertiary education enrollment over ten years to attain .6 percent GDP increase will need to understand the shifts in student demographics and academic levels. Lifelong learning for students of all ages and all demographic backgrounds is the byproduct of massification (Mohamedbhai, 2008). Traditional age students, i.e., 18-24 years of age, financial capable students, and students with readily available accessibility to education will not be the only student demographic demanding tertiary education (Mohamedbhai, 2008). Massification results in the demand for tertiary education from all socio-economic and geographic locations. Further, massification increases the student population resulting in increased academic level diversity.

As demonstrated in Chapter 2, developing countries have scarce resources and desire to improve domestic tertiary education in order to help massification policies, yet in order to improve GDP per capita massification policies must focus on financial support initiatives. Governmental financial support through domestic investment or the coordination of outside financial investment will be imperative for developing countries

to attain the positive economic growth benefits of massification of tertiary education policies. Financing massification comes through governmental funding, parents, students, philanthropists, or businesses (Sanyal & Johnstone, 2011). Countries are pushing massification of tertiary education, but many, especially developing countries, are reluctant to provide financial support (Lien, 2008). As governmental resources continue to dwindle, tertiary education findings will become more adept and will distribute to latter four stakeholders stated above. Most parents and students in developing countries cannot afford tuition (Altbach, 2013; Altbach & Knight, 2007; Bashir, 2007; Mello & Katopes, 2010; Naidoo, 2009), leaving the financial burden to likely fall on philanthropists or businesses; in the transnational education market the financial burden may fall on the exporting institutions. Promoters of massification of tertiary education will need to develop strategies to appropriately finance the initiatives.

Another primary policy implication for this research is the demographic reach of massification efforts. As demonstrated in Chapter 2, tertiary education in developed countries was initially offered to elite or financially capable students, but has expanded to supply all students with access. Policymakers must invest in infrastructure in order to provide accessibility of tertiary education, domestic or transnational. Providing education to the masses means the ability to provide tertiary education to rural areas with limited infrastructure and lower socio-economic students that may not have the means to travel to specific locations offering the education opportunities. Thus, massification of tertiary education has led to the development of transnational education initiatives (Lien, 2008) in order to provide education to the masses. Yet, these tertiary education initiatives must

provide viable resources and infrastructure to meet the needs where access is limited, rural or hard to reach areas and lower socio-economic students.

Diversification

Another primary policy implication of this research is the promotion of diversification with massification policies of tertiary education. Policymakers must enhance the various tertiary education levels as a legitimate response to encourage economic growth. As demonstrated in Chapter 2, policies on transnational education to promote massification have generally emphasized university education with little success on economic growth. The findings of this research demonstrated diversification of tertiary education instead of single tertiary education focus provides a significant impact on economic growth. Therefore, providing university and community college tertiary education options provides the propensity to improve GDP per capita.

Further, there is a negative stigma associated with community college tertiary education (Castro, Bernasconi, & Verdisco, 2001; Roggow, 2014; Wang & Seggie, 2013; Zhang & Hagedorn, 2014), which has led to oversaturation of university tertiary education, especially in developing countries (Altbach, 2013; Bashir, 2007; Mellow & Katopes, 2010; Naidoo, 2009; Schroeder & Hatton, 2006). The negative connotation of community college education must be alleviated. Promoting the short-cycle education that provides quick turnaround into the labor market or an ideal low-cost transition to university education as a quality tertiary education that provides economic benefit must be appropriately marketed and branded within each respective country in order to embrace the significant economic benefit of tertiary education.

In order to maximize the effect of diversification efforts, government backing and incentives promoting attendance of community college education, employer hiring of community college graduates, and employer engagement of community college education as a professional development institution will help remove the negative stigma associated with community college education demonstrated in Chapter 2. The findings of this research demonstrated that human capital increased through a combination of university and community college education leads to greater economic growth. Diversification of tertiary education with community college education provides a technical and industry specific labor force that enters the labor market faster helping increase productivity and increasing economic growth (Roggow, 2014). Such labor specific education must be designed in cooperation with employers so that curriculum is appropriate, relevant, and adaptive. Initiatives for diversification of tertiary education must articulate relevant differences between university and community college education while also seeking methods of maintaining cooperative relationships between employers and tertiary education institutions, especially community college tertiary education institutions.

Massification and Diversification

Another policy implication of this research stems from the data collection and definition component of tertiary education. Increased massification and diversification tertiary education policies along with greater utilization of transnational education initiatives requires a greater focus on tertiary education data collection to promote economic research. To promote successful economic research demonstrating the impact of massification and tertiary education agendas and transnational education initiative impact on economic growth, governments should focus on the collection of tertiary

education data along with the design of automation to recode country specific data into OECD data definitions. Few studies have measured the impact of tertiary education on economic growth, none differentiates tertiary education segmented by community college and university tertiary education, and none seeks to understand the impact of importing community college tertiary education. Limitation of tertiary education research is the result of scarce tertiary education data collection. UNESCO attains tertiary education data from each respective country, with developing countries just recently regularly supplying data. The data sets also lack information on importing and exporting, especially by each transnational education initiative. Education classification is different within each country, especially when community college tertiary education is taken into consideration, and there limited information on transnational education and importing and exporting. Increased massification and diversification of tertiary education and transnational education initiatives requires standardized data and new data pieces to help better understand and analyze the education market.

A final policy initiative coming from massification and diversification initiatives is the need to mandate engaging community college education to provide developmental education. Increased tertiary education demand in developed countries led to the struggle of many students needing developmental education (Cohen et al., 2014). As demand increases in developing countries, developmental education should be in the scope of massification and diversification of tertiary education policy initiatives. Diversification practices, especially engaging U.S. community college education, can help bridge the educational gaps. The U.S. community college was designed to alleviate university institutions of developmental education (Cohen, Brawer, & Kisker, 2014). Massification

and diversification of tertiary education will need to take into account the varying degrees of academic levels and engage the U.S. community college model to help increase the number of students ready for the rigor of any tertiary education.

Relationship of Results to Theory

The findings of hypothesis one are in-line with the economic discussion favoring the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) endogenous growth theory based on human capital growth compared to exogenous growth models. The presence of a significantly positive correlation between lagged investment growth and real GDP per capita growth corroborates utilizing the Uzawa-Lucas (Lucas, 1988; Uzawa, 1965) endogenous growth model as the alternative would suggest a positive impact on real GDP per capita growth in the same period with a negative impact in the lag period due to convergence to the steady state of economic growth (Hartwig, 2009). Further, the findings demonstrate a significantly negative medium-term and an insignificant long-term coefficient for fixed investment growth demonstrating the relationship predicted by exogenous growth theory holds true and growth is not exogenous (Hartwig, 2009). Thus, the model complements the findings of Hartwig (2009, 2014) in favor of the Uzawa-Lucas model of endogenous growth theory in measuring the impact of human capital accumulation on long-term economic growth.

Concluding Remarks

Tertiary education has become a global commodity seeking to meet economic demand (Altbach, 2004; Sanyal & Johnstone, 2011). It is a microeconomic and macroeconomic entity believed to improve individual and economic growth (Arnold et al., 2011; Card, 1999; Harmon, et al., 2003; Krüeger & Lindahl, 2001; Lucas, 1987;

Pasacharopoulos & Patrinos, 2004; Romer, 1986), Stevens & Weale, 2004). Such beliefs have changed the trade of tertiary education (Bashir, 2007; Lien, 2008; Lane & Kinser, 2011; Tilak, 2011) with the component of transnational education to meet the tertiary education demands within developing countries (Altbach & Knight, 2007; Lien, 2008; Naidoo, 2009). Efforts to meet tertiary education demand resulted in massification and diversification efforts (Mohamedbhai, 2008). This research provided analysis of tertiary education massification and diversification efforts helping add to the literature and bridge the literary gaps.

This study is an addition to the literature demonstrating the positive effect tertiary education has on economic growth. Econometric models provide insight into recurring relationships helping inform policymaking (Ouliaris, 2012). The findings of this econometric model demonstrated that massification and diversification efforts significantly impact economic growth. Tertiary education impact does not significantly impact developing countries more than developed countries, but community college education may provide a greater benefit in developing countries than in developed countries given their economic growth status. Importing community college education did not demonstrate a significant effect on economic growth, but the data is limited on this information and should be analyzed as more understanding is attained into importing tertiary education. The findings are important because it complements other findings on the role of tertiary education on economic growth, and started the research on the impact of diversification of tertiary education and importing U.S. community college education on economic growth.

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APPENDIX A

Country Classification beginning of 5-Year Average Time-Period

Country Classification

Country	Classification
Afghanistan	Developing
Albania	Developing
Algeria	Developing
Andorra	Developed
Angola	Developing
Antigua and Barbuda	Developed
Argentina	Developed
Armenia	Developing
Aruba	Developed
Australia	Developed
Austria	Developed
Azerbaijan	Developing
Bahrain	Developed
Bangladesh	Developing
Barbados	Developed
Belarus	Developing
Belgium	Developed
Belize	Developing
Benin	Developing
Bermuda	Developed
Bhutan	Developing
Bolivia (Plurinational State of)	Developing
Bosnia and Herzegovina	Developing
Botswana	Developed
Brazil	Developed
Brunei Darussalam	Developed
Bulgaria	Developing
Burkina Faso	Developing
Burundi	Developing
Cambodia	Developing
Cameroon	Developing
Cabo Verde	Developing
Cayman Islands	Developed
Central African Republic	Developing
Chad	Developing
Chile	Developed
China	Developing
China, Hong Kong Special Administrative Region	Developed
China, Macao Special Administrative Region	Developed
Colombia	Developing

Comoros	Developing
Congo	Developing
Côte d'Ivoire	Developing
Croatia	Developed
Cuba	Developing
Cyprus	Developed
Czech Republic	Developed
Democratic Republic of the Congo	Developing
Denmark	Developed
Djibouti	Developing
Dominica	Developing
Egypt	Developing
El Salvador	Developing
Eritrea	Developing
Estonia	Developed
Ethiopia	Developing
Fiji	Developing
Finland	Developed
France	Developed
Gabon	Developed
Georgia	Developing
Germany	Developed
Ghana	Developing
Greece	Developed
Grenada	Developed
Guatemala	Developing
Guinea	Developing
Guyana	Developing
Honduras	Developing
Hungary	Developed
Iceland	Developed
India	Developing
Indonesia	Developing
Iran (Islamic Republic of)	Developing
Iraq	Developing
Ireland	Developed
Israel	Developed
Italy	Developed
Jamaica	Developing
Japan	Developed
Jordan	Developing
Kazakhstan	Developing
Kenya	Developing
Kuwait	Developed
Kyrgyzstan	Developing
Lao People's Democratic Republic	Developing
Latvia	Developing
Lebanon	Developed

Lesotho	Developing
Liberia	Developing
Libya	Developed
Liechtenstein	Developed
Lithuania	Developing
Luxembourg	Developed
Madagascar	Developing
Malawi	Developing
Malaysia	Developed
Maldives	Developing
Mali	Developing
Malta	Developed
Marshall Islands	Developing
Mauritania	Developing
Mauritius	Developed
Mexico	Developed
Monaco	Developed
Mongolia	Developing
Montenegro	Developed
Morocco	Developing
Mozambique	Developing
Myanmar	Developing
Namibia	Developing
Nepal	Developing
Netherlands	Developed
New Zealand	Developed
Nicaragua	Developing
Niger	Developing
Nigeria	Developing
Norway	Developed
Oman	Developed
Pakistan	Developing
Palau	Developed
Panama	Developing
Paraguay	Developing
Peru	Developing
Philippines	Developing
Poland	Developed
Portugal	Developed
Puerto Rico	Developed
Qatar	Developed
Republic of Korea	Developed
Republic of Moldova	Developing
Romania	Developing
Russian Federation	Developing
Rwanda	Developing
Saint Kitts and Nevis	Developed
Saint Lucia	Developed

Saint Vincent and the Grenadines	Developing
San Marino	Developed
Saudi Arabia	Developed
Senegal	Developing
Serbia	Developed
Seychelles	Developed
Singapore	Developed
Slovakia	Developed
Slovenia	Developed
South Africa	Developed
Spain	Developed
Sudan	Developing
Suriname	Developing
Swaziland	Developing
Sweden	Developed
Switzerland	Developed
Syrian Arab Republic	Developing
Tajikistan	Developing
Thailand	Developing
The former Yugoslav Republic of Macedonia	Developing
Timor-Leste	Developing
Togo	Developing
Tonga	Developing
Trinidad and Tobago	Developed
Tunisia	Developing
Turkey	Developing
Turks and Caicos Islands	Developed
Uganda	Developing
Ukraine	Developing
United Arab Emirates	Developed
United Kingdom of Great Britain and Northern Ireland	Developed
United Republic of Tanzania	Developing
United States of America	Developed
Uruguay	Developed
Uzbekistan	Developing
Vanuatu	Developing
Venezuela (Bolivarian Republic of)	Developed
Viet Nam	Developing
Yemen	Developing
Zimbabwe	Developing

APPENDIX B

Countries Importing Community College Education

Countries importing community college education

Country	Classification
Aruba	Developing
Brazil	Developing
Chile	Developing
China	Developed
China, Hong Kong Special Administrative Region	Developing
Egypt	Developed
Georgia	Developed
Ghana	Developing
India	Developed
Indonesia	Developed
Japan	Developed
Jordan	Developing
Kuwait	Developed
Malaysia	Developing
Mexico	Developed
Namibia	Developing
Nigeria	Developed
Qatar	Developing
Saudi Arabia	Developing
South Africa	Developed
Trinidad and Tobago	Developing
Tunisia	Developing
Turkey	Developing
Viet Nam	Developed
Yemen	Developed