

World Education Finance and Higher Education Access:
Econometric Analyses of International Indicators and the Implications for China

by

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DEDICATION

To my parents
Yanchuan Yang and Junying Li
For paving the way for my education leading to a career in higher education

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Abstract

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This dissertation, in the format of three interrelated manuscripts, uses panel data models to analyze the international indicators and examines the statistical relationship between education finance policies and higher education access among OECD nations (Chapter II) and among 98 countries (Chapter III) respectively. Then the dissertation uses the analytical framework and empirical findings from Chapters II and III to reframe the discourse of education finance policy and access for China's higher education (Chapter IV).

Chapter II concludes that scholarships/grants as a percentage of public tertiary expenditure and student loans as percentages of public tertiary expenditure do not exert statistically significant effect on college access among OECD nations. This chapter also finds that the growth of GDP per capita, and public spending on education as a percentage of GDP have a statistically significant, positive impact on college enrollment.

Chapter III concludes that public spending on education as a percentage of GDP, public expenditure per secondary student as a percentage of GDP per capita, and GDP per capita have no statistically significant main effects on tertiary enrollment ratios among the 98 nations. However, the study finds that the growth of GDP per capita and public spending on education as a percentage of GDP have a greater impact on access for developed countries than for less developed countries

Both Chapters II and III conclude that public expenditure per tertiary student as percentage of GDP per capita, an indicator examined in both chapters, bears a statistically significant but negative association with tertiary enrollment. This finding implies that for a fixed total budget on higher education and a rising total enrollment, various nations appear to have reduced spending on each student and drawn on more private resources to increase higher education access.

Chapter IV finds that, although China's dramatic economic growth has strongly driven higher education access, the increasing economic disparities have intensified unequal access between rural and urban students and between eastern and western regions. The role of education finance policies in promoting equal access to higher education is too limited to mitigate the negative influence of income disparities in China.

CHAPTER I

Introduction

Over the last twenty years, higher education systems have increased quite rapidly from serving the elite (under 15% of the college-age group participating in higher education) to serving to masses (20%-30%) in developed, developing and least developed nations. The social and economic context for this worldwide higher education expansion is global economic restructuring, in which nations grow human capital largely through higher education to boost technological advancement and enhance competitiveness in a global economy (Friedman, 2005; Johnstone, 2004; Premfors, 1984). This economic restructuring has also involved the shift of global manufacturing capacity from developed nations to developing countries, especially to those in Asia. As a consequence, China has undergone the most dramatic growth worldwide, not only in its national economy, but also in higher education.

High-income countries such as most of those in the OECD (Organization for Economic Cooperation and Development) established universal access (above 30% of the relevant age group participating in postsecondary education) to higher education a decade ago. In the face of growing individual demand but declining public subsidies over the

past two decades, OECD countries boosted higher education enrollment via increased privatization and cost-sharing strategies. A few countries (e.g., Germany, Luxembourg, and Greece) that retained free tuition and student grants in the 1990s transitioned to charging tuition and operating mixed systems of grants and loans in the 21st century (Eurydice, 1993; Psacharopoulos, 1992; Vossensteyn, 2004). Unconditional loans or means-tested loans are now common in many European countries (Vossensteyn, 2004). To counteract the negative effects of the increased financial burden on students, a few countries (e.g. Australia, the U.K., and the U.S.) have implemented income-contingent loans, which are considered a more effective way of equalizing opportunity for higher education (Lleras, 2004; Vossensteyn, 2004). Overall, while still depending heavily on public subsidization, the education finance policies of OECD countries exhibit a clear trend of replacing grants with loans (Yang, et al., 2007).

Similar developments in the higher education systems and changes in education finance have also been widely seen in less developed nations. To overcome public financial austerity, many developing and least developed countries in Asia, Latin America, and Africa tend to rely more on tuition fees and student loans as a means of financing higher education expansion. These nations introduce or increase tuition and fees in public institutions (e.g., Indonesia, Malaysia, Philippines, Thailand, and Vietnam) or rapidly establish more private institutions to absorb the excessive demand (e.g., Cambodia, Bangladesh, Colombia, and Brazil). Although implemented in many less developed countries (e.g., India), when compared to their developed counterparts, student loans were not as well implemented and evaluated due to the lack of a necessary economic infrastructure and the absence of carefully designed programs.

As a student who came from China, I am particularly interested in how these global patterns of economic development and educational reform can inform planning for higher education in China. China's participation in the global economy, along with its economic transition from a centralized, planned economy to a market economy, has resulted in the fastest economic growth in the world. China's economic growth has driven a rapid, large-scale higher education expansion, although its equal education opportunities have worsened (e.g., Lei & Chung, 2005; Rong & Chen, 2010). In recent decades, China has adopted marketization and cost-sharing strategies similar to those in other nations to expand higher education access.

In a context that one nation after another has adopted similar education finance strategies to expand higher education systems, it is reasonable to ask: How have the education finance factors influenced expansion of higher education access across nations? What are other factors that have affected access? Are there any differences in the way these factors have influenced access within high-income countries compared to developing nation states? How can national planners learn from global patterns? This dissertation aims to address these questions using three research papers: 1) a study of economic and social-demographic factors influencing enrollment rates in OCED nations; 2) a study of the economic and social-demographic factors influencing enrollment rates in both developed and less developed nations; and 3) an analysis of enrollment patterns in China, a country not included in either set of international indicators. I return to these questions in the conclusion.

Higher Education Access Defined by Existing Comparative Studies

Corresponding to the expansion of higher education worldwide, comparative studies on access to higher education have also taken on increased importance. *Access*, however, has not been clearly defined in existing studies. As Halsey (1993) cautioned, existing comparative studies have rested on multiple assumptions of what access means. A closer examination of the literature discerns the following three major clusters of literature, each cluster representing different underlying assumptions about access.

One group of studies viewed access from a socio-political perspective and explored the relationship between social inequality and access. Trow's (1973) influential writing about the stages of development of higher education systems stated that higher education systems in both Europe and the U.S. expanded from elite to mass and then to universal access (above 30% of the college age group participating in higher education). In each of the three stages, college access resembled the fundamental social structure of the country. In the elite and mass systems, those who gained access to higher education were mostly from the upper or middle class. It was only at the universal access stage that college entry selection would be removed and the composition of the college student body would represent the social composition of a nation's population. Thus, Trow proposed an equal representation of social groups in college access as the ultimate goal of access policy. He argued that the aim of universal access was toward the equality of social group achievement rather than the equality of individual opportunity as in the elite or mass systems. Trow's proposal has been extensively used in access research and has become a significant evaluative criterion of access in addition to the traditional evaluation of college enrollment numbers/ratios.

Consistent with Trow's socio-political view on access, Furth (1978) also expressed concerns that social stratification undermined the college dreams of students from the lower social class in mass higher education systems. In addition, a few studies in the early 1990s and before noted that the socialist/capitalist classification of regime types affected the students' social composition of a country (Brown, 1992; Halsey, 1993; Premfors, 1984). For example, a few socialist countries (e.g., Czechoslovakia, Hungary and Poland) have historically set preferential enrollment policies to enroll a higher proportion of working-class students than capitalist countries, whereas capitalist societies encourage more middle-class students (Brown, 1992; Halsey, 1993). Thus, a core assumption of their argument is that access is a socio-political ideal wherein individuals should have the opportunity for higher education regardless of their social or class origin.

Differing from the above socio-political perspective, another group of scholars adopted an education-system perspective on college access, focusing mainly on factors within national educational systems, such as stratification of higher education institutions, tracking systems in secondary schools, and rigid college entry selection. According to Clark (1978), Furth (1973) and Scott (1995), since stratified or tiered higher education institutions are characterized by differential quality of programs, size, and funding resources, students do not have equal opportunity to gain entry to the best higher education institutions with more funding resources. Unequal access within differentiated systems was particularly obvious when transferability from lower to higher tiers was restricted to only a small number of students. Jallade (1989) found that dividing secondary education into academic and vocational tracks limited college access, since students who graduated from vocational schools were often denied access to universities.

Young (1993) suggested that the lack of knowledge of the rules of the educational system made it more likely that first-generation students would be streamed into the non-academic track. Moreover, Young (1993) suggested that it was the divided higher education system of separate academic and vocational tracks that led to separate preparation and academic qualifications. In addition, Clark (1985) found that a rigid college selection process formed a legitimate barrier of access by forcing out a large number of students with lower academic preparation at the secondary school level. Due to a lack of family resources to support their college preparation, students from lower-income families were more likely to lose ground in the selection process. Thus, from an education-system perspective, access is regarded as the pathway from secondary schools to higher education institutions, and the influence of school/education-system factors, such as institutional stratification, secondary tracking systems, and rigid college entrance selection, should be examined.

Viewing access from an economic perspective has been prominent in the most recent comparative access research. Many studies focus on the role of education finance policies in meeting students' economic needs to finance their higher education access. (e.g., Baber & Lindsay, 2006; Blondal, Field & Giroard, 2002; Dolton, Greenaway & Vignoles, 1997; Johnstone, 2002; Kim & Lee, 2006; Palfreyman, 2004; Vossensteyn, 2004). These authors stress that tuition costs impede access, particularly for students from disadvantaged backgrounds, which may lead to inequity and social exclusion. Barr (1993) highlighted the detrimental effects of reduced grants on access of low-income students, the most financially needy. Regarding the role of student loans, Albrecht and Zideman (1993) in a World Bank study found that student loan programs in 21 countries

mostly “bestow large subsidies on the wealthier groups” (p. 86), resulting individuals in lower-income groups often lacking access to higher education, regardless of student loan programs. According to Shen and Ziderman (2009), the standards as to whether or not a loan program successfully promotes college access have not been clearly defined, and “the evidence did not indicate any high degree of success in increasing the university access of the poor” (p. 332). In addition, some scholars have explored the effect of net college cost (grants minus tuition) (e.g., Heller, 2006; Johnstone, 1986, 2003; Palfreyman, 2004). They find that as the costs of college are shifted from the government to the students, it is the lower income students who are most likely to be forced out of higher education, or at the very least forced to attend lower-cost or less-prestigious institutions. Therefore, from an economic perspective, they argue that access is an opportunity to pursue higher education that should not be constrained by family ability to pay, and the academically qualified students should be able to attend college regardless of their economic need.

Overall, the concept of access varies by countries’ socio-political structure, national educational systems, and economic growth. Each of the above three perspectives considers distinct factors that may form access barriers. It becomes more complicated when factors from different perspectives interact. For example, social stratification together with tuition policy may result in an underrepresentation of working class students in college.

Importance of Comparative Studies on Access

Although access is a concept with complex implications, comparative studies on access have made significant contributions to the field of higher education. First, they

have identified global trends in higher education and examined how various types of policies have affected access. Second, the comparisons have allowed countries to recognize strengths and weaknesses in their own educational systems and policies as well as to critically understand the wider world (CERI, 1998; Heyneman, 1998). Third, by revealing the existence of alternative solutions for similar problems in different countries, comparative higher education research has played an important role in encouraging countries to adopt different policies (e.g., income-contingent loans were initiated in Sweden and have been adopted by many other countries) in order to widen access (Clark, 1985, Jallade, 1989; Henry et al., 2001).

Problem Statement

Despite extensive research on access throughout the recent decades, much of the existing comparative literature is plagued with problems. Four major limitations are: a lack of generally accepted definition of access, measurement errors in data, an incomplete analytical framework, and methodological problems.

First, the term *access* has not been clearly defined in comparative higher education research. This has resulted in different methods of data collection and analysis and led to differing interpretations of results. Given the way access definitions shape crucial policy areas such as education finance (Ruppert, 1998), comparative studies based on a vaguely defined concept may fail to clearly inform policy-makers who seek to build on the experiences of other nations in developing appropriate programs to promote access. Thus, a clear working definition of access is necessary to provide common ground for the following chapters.

Second, while a set of cross-country time-series international indicators has been generated by some international agencies (e.g., UNESCO, OECD), problems with data and interpretation arise when these indicators are used in research. Limitations include, for example, the absence of some important measures, vaguely defined or classified variables, and missing data. For example, information about one of the most important indicators of higher education finance, tuition, has not been collected and reported across countries. In addition, need-based aid (grants) and merit-based aid (scholarships or loans) in OECD datasets are grouped together. Such classification is problematic as scholars find that grants exert a greater influence on student access than scholarships, especially for low-income students (e.g., Heller, 2001). The data problems may jeopardize the validity and quality of comparative research.

Third, although international data have been collected for analysis, previous research has not established a clear connection between economic factors and increased access. The problem is partially due to the methodological limitations of the existing studies. Most current comparative studies of the impact of financing policy on access are descriptive or theoretical in nature, and many adopt qualitative approaches such as interviews and grounded theory (e.g., Young, 2004). Although they have the advantages of analyzing trends and generating theories (Creswell, 1994), these analyses are mostly suggestive, rather than definitive, as to how these factors affect access. Among the very few comparative studies using quantitative methods, descriptive data analyses (e.g., Vossensteyn, 1999; Usher and Cervenán, 2005) are dominant, which neither allows researchers to simultaneously examine the effects of many factors, nor controls for time effects. Given these problems, it is not surprising that Callender (2006) regrets that the

real effect of loans on access in the U.K. will be uncertain until there is a robust, systematic analytical model for assessing the impact of changes in student funding.

Advanced analytical approaches, including statistical methods to evaluate the effects of college finance on access, have been best developed and widely used in the U.S. (Dresch, 1975; Daun-Barnett, 2008; St. John, 2003, 2006) since the 1973 report of the National Commission on the Financing of Postsecondary Education (NCFPE) and the subsequent staff reports. Some advanced statistical methods or econometric methods, such as fixed and random-effects models (Park, 2005), allow researchers to focus on the impact of one factor or a set of factors on access while simultaneously controlling for many other factors in the same model. For example, St. John (2006) adopts fixed-effects models to analyze state indicators and examine the relationship between the adoption of new education policies and related outcomes (e.g., college-going rates) across the 50 states in the U.S. If cross-sectional time-series data on the 50 states in the U.S. can be used to discern how state finance policies link to state enrollment rates, then these methods can be adapted to use international indicators to examine economic factors associated with enrollment rates across nations. The research efforts of American scholars can serve as valuable templates for cross-country comparisons.

Fourth, most comparative research to date concerning how changes in educational finance policies have influenced college access across countries focuses exclusively on the financial aid, chiefly education cost, grants/scholarships, and loans. In his research, James (2007) criticizes current comparative access research because it “narrowly equates socio-economic, educational disadvantage(s) with financial hardship” (p. 12). This “equation” reflects a lack of consideration of other elements because education finance is

only one inhibiting factor. Other access barriers, such as lower enrollment ratios in basic education, could also explain access problems, particularly for middle- and low- income countries with underdeveloped educational systems. Moreover, the financial aid factors in existing research and their theoretical foundations (e.g., human capital theory (Becker, 1964; Lleras, 2004), demand-supply theories (Clotfelter & Rothschild, 1993)) are primarily micro-economically oriented. They overlook or underestimate other economic factors at the macro level, such as public expenditure on education as a percentage of GDP, which may, themselves, influence access. Comparative research and policy-making must be framed around multi-causal understandings of varying factors and how they interact.

In addition to the above problems, the findings of quantitative cross-countries studies may seem readily generalizable to individual countries within a data set, but this may not be the case due, for example, to distinctive features of a nation's higher education system that are not taken into account in the macro analyses. Marginson and Rhoades (2002) note that globalization processes in higher education are under-studied and under-theorized. To enrich understanding, they build a "global-national-local" or "glonacal" agency heuristic, which features a dynamic mechanism across global, national and local dimensions: higher education across nations is being influenced and reshaped by global economic, cultural and educational forces, while simultaneously national higher education systems that express national cultures are being challenged by movements to preserve and promote local (e.g., a local government, or a particular higher education institution) cultural identity and independence. From this "glonacal" perspective, a comparative access study would result in an incomplete view of globalization of higher

education access if it does not consider differences among national systems. Thus, multi-dimensional glonacal studies that integrate a quantitative data analysis of global trends with country case studies, along with local or institutional reactions, are needed to enrich our understanding of higher education access around the world.

Purposes of this Research

In light of the limitations of previous comparative studies of access to higher education, this dissertation aims to further our understanding of access internationally and examine the role of education finance in promoting access. Specifically, this study will:

- 1) propose a clear working definition of access;
- 2) construct a comprehensive analytical framework that systematically accounts for the effects of public educational finance policies, national economic growth, elementary and secondary education, and population characteristics, on higher education access;
- 3) examine theories of education finance policies in relation to higher education access, such as Friedman's theory (2005), which reflects a balance between economic development and social equity, and the new growth theory (Romer, 1990, 1994), which deals more with economic growth issues;
- 4) use panel data models in data analyses of international indicators and examine the association between education finance and access among high-income OECD countries and among a wider country group, in both of which analyses similar indicators will be used; and
- 5) use the comprehensive analytical framework and the empirical findings from the above analyses to examine how global economic forces have influenced

the dynamic of education finance policies and higher education access in China.

A Working Definition of Higher Education Access

To avoid confusion and provide a common basis for pursuing the above goals, this study proposes a working definition of higher education access. That is, *access is an opportunity of and pathway to higher education that may be facilitated or impeded by students' sociodemographic characteristics and educational system factors such as, but not limited to, students' social/class origins, family income, ethnicity, gender, geographic location, and school factors.* This working definition is based largely on a synthesis of the implication of access in the aforementioned three strands of literature and then tailored to the purposes of data analysis and theoretical analysis in this dissertation. Thus, in this study, access reflects not only quantitative enrollment size for undergraduate students in both 4-year and 2-year higher education institutions, but also equality issues involved in higher education.

Significance of the Research

Both the quantitative analysis and the China case study will offer important contributions to comparative access research and educational finance policy practice. First, while focusing on education finance policies, both the data analyses and case study examine access from multiple perspectives, which include socio-economic development, educational system and population. Such a broad view of access can enhance the analytical rigor and conceptual richness of access research, whether quantitative or qualitative. Second, the quantitative studies adopt appropriate analytical approaches and

clarify a connection that has been vague in the previous literature: a connection between theory and evidence as to how education finance may promote access. Third, the case study of China addresses how the general conclusions from quantitative analyses of large groups can be applied to a unique country case, and can assist in understanding the issues surrounding Chinese higher education access in relation to the global picture.

The dissertation research is timely given that it offers critical insights into how to finance higher education access in most nations in light of the global economic crisis that arose in 2008. In general, an improved understanding of access could also better inform policy-makers in government agencies by ensuring that policy adoption, implementation, and evaluation are closely aligned with appropriate research efforts.

However, since international indicators have not been previously used to examine the impact of finances on college access, this dissertation breaks new ground but does not fully resolve issues relative to the measurement of student financial aid, especially in Chapter II that uses the OECD indicators. Therefore an additional purpose of this dissertation is to suggest strategies for improving international indicators to be used in comparative studies.

Outline of the Dissertation

The dissertation consists of three manuscripts (Chapters II-IV) with an introduction (Chapter I) and conclusion (Chapter V). The three middle chapters (II-IV) are three interrelated investigations, each with its own focus.

Chapter I provided background on the problems of existing research, defined the purposes of this new research, and illustrated the significance of the dissertation for

future research and policy practice. For the purpose of clarity and consistency, this chapter provided a working definition of access used in the following chapters.

Chapter II¹ uses econometric analyses to examine the link between student aid policies and college access in relation to the economic development among OECD countries. The study selects 27 out of the 33 OECD member countries (three countries were newly admitted to OECD as of September, 2010) that had sufficient data on the selected international indicators from 1998 to 2006 (three countries lacked sufficient data for inclusion in the study), and reviews the literature regarding the recent policy practices in these countries. This chapter then employs fixed and random-effects models to examine whether student aid policies (i.e., scholarship and grants, student loans, and public expenditure per tertiary student as a percentage of GDP per capita) promote access, after controlling for other types of education finance policies (i.e., public spending on tertiary institutions, public expenditure per secondary student, and public spending on education as percentage of GDP), national economy, population characteristics, and basic education. As an integral part of the models, the findings as to whether national economic development (reflected mainly by GDP per capita) drives college access provide important insight into changes in postsecondary enrollment rates among these high income countries, especially under the circumstances of a stagnant economy.

Using a similar analytical framework and methodology as in Chapter II, Chapter III² expands the scope of analysis to 98 developed, developing and least developed countries that have data available on the selected international indicators. The chapter

¹ An earlier version of the first manuscript (Chapter II) was published in the *University of Houston Institute for Higher Education Law and Governance (IHELG) Monograph Series*. This dissertation chapter updated the dataset, revised the methodology and analysis, and is now in preparation for journal submission.

²This manuscript is in preparation for journal submission.

first presents a theoretical literature review to analyze the rationales for government or public spending on higher education, and then summarizes the international trends and practices of education finance policies across countries. Drawing on data from the World Development Indicators (WDI) from 1998 to 2006, the study examines whether education finance policies—including public spending on education as a percentage of GDP, public expenditure per tertiary student as a percentage of GDP per capita, and public expenditure per secondary student as a percentage of GDP per capita—have promoted access, after taking into consideration the national economy, population characteristics, and basic education. In addition, distinct from the findings of Chapter II on high-income countries, this chapter also tests whether the influences of these education finance policies on access differ between the developed countries and less developed countries. Further examinations of basic education and population factors assist in constructing a more comprehensive understanding of the entire picture of access. The wider selection of countries enables this chapter to generalize its findings to a broader range of countries.

Chapter IV applies the general empirical findings of Chapters II and III to China and investigates its higher education finance and access over the past two decades. This study examines how the newly adopted marketization and cost-sharing strategies in education finance policies may interact with rapid economic growth and affect higher education access in China. All the education finance indicators that were examined in Chapter II and III, such as public spending on education, public expenditure on tertiary institutions, and student financial aid, are also examined in China in terms of their influence on access. In addition, other relevant policy factors, such as secondary school

tracking and secondary education expenditure, and demographic characteristics (e.g., population growth rates, rural population, and employment rates of youth population) are discussed.

Chapter V summarizes the findings from Chapters II, III and IV and illustrates how these studies may inform analytical frameworks, data collection, analytical approaches and policy-making in the future.

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CHAPTER II

Economic Development, Student Aid, and College Access: An Analysis of Demographic, Policy, and Financial Indicators for OECD Countries

Introduction

Expanding college access has become an important goal in developed and developing nations, particularly given the international competition in the globalization process (Friedman, 2005). Without appropriate financial support, it is unlikely that college-prepared students from low-income families will have access to college. Increasing inequality in income and educational opportunity has been evident in the United States for about three decades (Fogel, 2000; Friedman, 2005; St. John, 2006). During this period, the United States has dropped in international ranking in college enrollment rates. While there is extensive research on the effects of student aid in the U.S., the U.S. is not the most generous nation in support of college students (Johnstone, 2004). Despite the growing inequality in postsecondary opportunity in the U.S., state investment in need-based grant aid plays a substantial role in expanding college access for low-income, college-prepared students (Heller, 2004; St. John, 2003, 2006).

The World Bank and other international organizations have promoted the use of student loans coupled with tuition increases as a means of expanding college access, a

strategy characterized as the Washington Consensus (Stiglitz, 2002). It is appropriate to ask: Do developed nations have student aid policies—loans and/or grants—that promote college access, supplementing the role of economic development and income growth in fueling expansion in college access? To address this question, this chapter presents comparative analyses of international indicators for nations that consistently report education, public finance and demographic statistics to the Organization on Economic Cooperation and Development (OECD). First, as background, this article describes the framework guiding this inquiry, review prior research, and state the questions that guided the study. Research methods, findings, conclusion and discussion follow.

Theoretical Background and International Practices

Comparative research on college access in the last two decades is best understood within the context of globalization. Economists focus on the economic impact of the globalization of industry (Friedman, 2005; Stiglitz, 2002), while critics of globalization focus on social inequalities created by the emphasis on loans and accountability schemes in higher education (Henry et al., 2001; Rizvi, 2004, 2006). It is important to situate the comparative study of college access rates using a theoretical perspective that considers both viewpoints.

Rethinking College Access in Relation to Globalization and Social Justice

In *The Moral Consequences of Economic Growth*, Benjamin Friedman (2005) provides a perspective that accommodates both the rationale for privatization (i.e., the use of tuition and loans) as a means of financing expansion of access and the critiques that consider income and opportunity inequalities as possible outcomes. Friedman argues that in periods of economic growth, there is more likely to be greater opportunity and liberty,

while in periods of stagnation liberties are curtailed. To test this proposition, he analyzes the history of economic development and public policy initiatives in the U.S., France, Britain, and Germany and compares indicators of economic development and growth to international measures of human liberties using correlations. He finds a correlation between increased liberties and both wealth and economic growth rates, but he stops short of claiming causality, a caution that is appropriate given his historical and correlational analyses. Instead, he recognizes the potential role of government intervention during periods of stagnation, including Franklin Roosevelt's New Deal programs during America's great depression. He concludes that investment in education is one of the few means of overcoming inequality and decline in liberties during periods of economic stagnation. Regarding college access, Friedman argues:

Getting more young Americans to go to college—and among those who do, getting more to finish—presents a different set of issues [than improvement of secondary schools]. College is not free. High school students from middle-income families often find it a struggle to go to the best institutions willing to accept them. Students from lower-income background find it difficult to go to any college at all without a scholarship. (2005, p. 424)

Not only does expanding college access represent a strategy for generating productivity in developed democratic societies, but equal opportunity to attend college based on qualifications rather than on income could be considered a basic right (St. John, 2006). Noted philosopher Martha Nussbaum (1999, 2000, 2004) argues that education to a level necessary to support a family should be included among basic rights, particularly for women in developing countries. More recently, the Commission on the Skills of the American Workforce (2007) argued that collegiate education, possibly in the STEM fields (science, technology, engineering, and math) may become necessary for meaningful employment that allows individuals an income sufficient to support a family

and for the expansion of opportunity within the American economy. It may also be necessary in other developed countries that wish to remain competitive economically.

Unequal access to basic liberties such as education is a problem from a perspective that values justice and equity. In his theory of justice, John Rawls (1971, 1999, 2001) distinguishes the principle of equal access to basic liberties, such as advanced education, from the difference principle, which argues that the least advantaged should have the first opportunity. In the case of college access, students from low-income families are at an inherent disadvantage when paying for college. Consistent with Friedman's argument, a substantial body of research argues that low-income students are more responsive to student aid for college enrollment than middle-income and wealthy students (Dynarski, 2004; Heller, 1997; St. John, 2003). A recent study using time series data to compare U.S. states (St. John, 2006) finds that state funding for need-based grants had a more substantial effect on school continuation rates (i.e., the percentage of high school graduates enrolling in college) than did funding for merit grants, but both were positively associated with enrollment. Therefore, there is reason to test whether financial interventions have an influence on expanding college access, controlling for the role of economic development and family income.

Financial Aid Policy in Developed Countries and Developing Countries

A great deal of descriptive data and trend analysis are available on student aid internationally, but no prior studies have examined the statistical associations between funding for student aid and college enrollment rates using international indicators to control for economic and demographic factors. Before presenting this analysis, it is

important to note the patterns of public financing of higher education across nations, as well as to review key findings from prior studies.

While some European countries remain bastions of “free” higher education, depending heavily on public financing, increased privatization and cost-sharing were observed in the last two decades of the 20th century. In the early 1990s, in Germany, Denmark, Greece and Luxembourg, free access to college was common, and grants were the most common form of basic assistance (Eurydice European Unit, 1993; Psacharopoulos, 1992). However, Germany, Luxembourg and Greece now operate mixed systems of grants and loans, 18 countries offer unconditional loans, and only seven countries have means/merit loans. This wide variation in programs could dilute the measurable effects of loans, given the argument that income contingent loans are a more effective way to equalize opportunity (Lleras, 2004). In addition, many countries are beginning to charge or are increasing tuition (Vossensteyn, 2004). For example, the U.K. introduced tuition fees and income-contingent loans for higher education in 1998 (Barr, 2004). Sweden was one of the few European countries (e.g., Denmark, Finland, Norway) that did not charge tuition and fees for Swedish citizens from the 1990s to the beginning of the 21st century (Vossensteyn, 2004). In 1985, Sweden introduced income-contingent loans that took effect between 1989 and 2001, but replaced them with ordinary annuity loans largely due to increased labor mobility and the inconvenience of cooperating with foreign tax authorities (Johnstone, 2000; Poutvaara, 2004; Reuterberg & Svensson, 1994).

Following the Washington Consensus, many developing countries introduced tuition fees and student loans as a means of financing higher education to overcome public financial austerity (Collins & Rhoades, 2008; Heyneman, 2003). In Russia, while

attending university is legally free, dual tuition systems (free higher education for the regularly admitted, state supported students, and a special tuition-paying track) allow up to one-half of all Russian university revenue to come via tuition and fees (Johnstone, 2004). Most Sub-Saharan African countries introduced tuition and fees along with student loans for higher education (Johnstone, 2003b). However, difficulties in assessing the financial means and collecting payments made successful implementation of loan systems problematic in some developing countries (Li & Bray, 1992; Tilak, 1993).

Economic research on student outcomes focuses on the direct effects of student aid and tuition costs, but largely ignores other influences. Barr (1993; 2004) examines the financial policies of the U.S., Canada, Sweden, Australia, and New Zealand, and finds that overall college participation in those countries increased after the introduction of loans, but the analyses do not take into account the role of economic growth. The author concludes that while the income-contingent student loans in Australia, Sweden, and New Zealand did not compromise student access to higher education, the mortgaged loans of the U.S. and Canada resulted in student indebtedness and high default rates. Vossensteyn (1999) investigates the effects of grants, indirect support, and loans on students' financial decisions to enter college in nine European countries (Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden, and the U. K). The author concludes that higher education was considered the most affordable in Denmark and Finland due to the high availability and considerable cost coverage of direct student support for most students. In contrast, Austria, Belgium, and the U.K. show the lowest affordability because direct support was available to a relatively small number of students, and covered only a small portion of the costs. In an international comparison of financial

aid programs and college access in 15 developed countries (Australia, Austria, Belgium, Britain, Canada, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Sweden, and the U.S.), Usher and Cervenak (2005) argue that the direct student grant is the most important means for covering a considerable part of student costs.

Overall, econometric research, particularly in the U.S. studies, indicates the positive impacts of tuition decreases, financial aid, and especially need-based grants on college access for disadvantaged students (e.g., Heller, 2001; St. John, 2006; St. John & Noell, 1989). International studies have provided comparative information but have not provided statistical analyses that control for economic factors across countries. Based on Friedman's concept of the moral consequences of economic growth, researchers must also consider whether nations maintain their investments in higher education at a sufficient level to provide access for low-income students when economies stagnate. Spending on reducing college costs for low-income students—through tuition reductions, need-based grants, or income-contingent loans¹ may be a necessary strategy for developed nations to weather bad economic times while still fueling economic restructuring.

A Comparative study of economic development, student aid, and access

This study aims to investigate the relationship between financial aid policy (e.g., scholarships, grants and student loans) and college access across countries, controlling for national economic conditions. The dataset and analytical methods of this study were developed for comparative studies of access and previously used by Kim, Yang and St.

¹ If loans are not income contingent, then they lack the means for equalizing (Lleras, 2004), a proposition that has been confirmed by trends in public finance and enrollment across racial/ethnic and income groups in the U.S. (St. John, 2003).

John (2010), Yang (2009) and Yang and colleagues' (2007) articles illustrating the role of education finance policy in college access in a broad range of developed, developing and least developed nations. Due to the limited availability of data, the study examines college access in 27 of the 30 OECD countries from 1998 to 2006: Australia, Austria, Belgium, the Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States (Canada, Germany, Luxemburg were excluded due to excessive missing data).

Specifically, the research question of this study is: Are scholarships and grants together as a percentage of public tertiary expenditure, loans as a percentage of public tertiary expenditures, and public expenditure per tertiary student as a percentage of GDP per capita (a ratio that compares public expenditure per student enrolled to the average GDP per capita) related to tertiary enrollment ratios in 27 OECD countries from 1998 to 2006, after controlling for national economy, basic education and population characteristics?

Dataset

The dataset used in this study is drawn from the online annual data collections of two international organizations, *Education at a Glance* 2000-2009 from the OECD and World Development Indicators (WDI) from the World Bank. The *Education at a Glance* dataset provides an array of indicators that reflect the current state of education internationally, including information on the human and financial resources invested in education, how education and learning systems operate and evolve, and the returns to

educational investments. WDI contains an extensive collection of developmental data, including social, economic, financial, natural resources and environmental indicators collected for over 40 years. In addition, the study refers to the published database by the Institute for Statistics of the United Nations Educational, Scientific and Cultural Organization (UNESCO) to examine the consistency of these indicators. From these sources, the study selected 15 variables (see Appendix 2.A, Definitions of the Select Variables and Data Sources). This cross-country, time-series (panel) dataset covers the data of 27 OECD countries from 1998 to 2006. Thus, the number of observations used in the regression models is 243 (27 countries by 9 years), before accounting for missing values.

Variables

The dependent variable is tertiary Gross Enrollment Ratio (GER), a combination of tertiary-type A and tertiary-type B education, which is calculated based on the number of young people in the five-year age group following the secondary school leaving age. According to the International Standard Classification of Education (ISCED) defined by UNESCO, Tertiary-type A education programs are largely theory-based and designed to provide sufficient qualifications for entry into advanced research programs and professions with high skill requirements, such as medicine, dentistry or architecture. Tertiary-type A programs have a minimum cumulative duration of a three-year full-time equivalent, although they typically last four or more years. Tertiary-type B programs focus on practical, technical or occupational skills for direct entry into the labor market; their minimum duration is a two-year full-time equivalent at the tertiary level.

The main education financial aid policy variables include scholarships/grants, student loans, and public expenditure per tertiary student as a percentage of GDP per capita. Scholarships/grants are, as defined by OECD, government scholarships and other government grants to tertiary students or households in the unit of percentage of total public expenditure on tertiary education. Student loans are loan programs for college students that are reported without subtracting or netting out repayments or interest payments from the students or households and measured as a percentage of total public expenditure on tertiary education. Public expenditure per tertiary student measures how much governments invest in each student, not only in student aid but also in institutions and administration, in relation to GDP per capita, thus indicating the governmental role in sharing college cost and student unit cost in allocating public resources. Based on the findings in the literature, the study hypothesizes that these financial aid programs impact tertiary enrollment ratios.

In addition to the student financial aid variables, three types of public expenditures that are not directly invested in college student aid are added into the models as confounding variables. The study considers the percentage of public spending on tertiary institutions as a fraction of the sum of private and public resources on institutions to examine the effects of cost-sharing on tertiary enrollment. In the previous literature, scholars have argued over which education sector—basic education or higher education—should be allocated a higher portion of public funds, since the two sectors may yield different social rates of return (Birdsall, 1996; Patrinos, 2000; Psacharopoulos, Tan and Jimenez, 1986; Psacharopoulos, 1994). Thus, the study includes public expenditure per secondary student in the model to examine whether the amount of

funding allocated to secondary education may affect tertiary enrollment. The study also considers public spending on education as a percent of GDP to test whether the way a country prioritizes education in relation to its overall allocation of resources to all social sectors (e.g., health) has an impact on higher education.

Numerous single country studies in higher education have found that the socio-economic variables (e.g., individual SES) are significant predictors for college enrollment (e.g., Astin & Oseguera, 2004; Walpole, 2003). In the cross-country comparisons, Friedman (2005) also finds that economic growth drives college access. Thus, the study uses national Gross Domestic Product (GDP) per capita for each country (calculated using the constant U.S. dollar in 2000²) in the analyses to control for socio-economic differences among the countries. The substitution of GDP per capita is appropriate because it roughly reflects the average income of a country's citizens and country's economic strengths and needs, as well as the affordability of education.

In addition to the above variables, this study also considers two groups of control variables. In prior research with single country analyses, personal demographics (e.g., race, gender, age) and basic education level are often controlled to investigate the influence of student financial aid policy on college enrollment (Reuterberg & Svensson, 1994; St. John & Noell, 1989). Some studies suggest that the demographics of OECD countries characterized by aging and a stagnant population growth rate and youth population employment have a critical influence on human capital growth and college attendance (Blanchflower & Freeman, 2000; Lindh & Malmberg, 1999). Therefore, four

² The data on GDP per capita in this study are in the unit of constant 2000 USD. The data in the unit of purchasing power parity in 2005 international dollars resulted in roughly the same results, which are available on request.

demographic variables are added into the models: percentage of citizens 65 years and older, annual population growth rate, size of total population, and youth population employment (15-24 years old). To control for the possible influence of basic education factors, the study includes gross primary enrollment ratios of the school-aged student population (usually 6-11 years old), gross secondary enrollment ratios of the school-aged student group (12-17 years old), and sex ratio (girls:boys) in primary and secondary education.

The study checked the histograms of the variables and found the distributions of total population and GDP per capita are both positively skewed. Thus the data of these variables are transformed using the natural logarithm to reduce skewness. Details about the definitions of all variables can be found in Appendix 2.A.

Research Approach

The data of this study has two dimensions: group (or country) and time. Two frequently employed models of cross-sectional time-series data (or panel data) design include fixed-effects and random-effects models. A fixed-effects model (least square dummy variable [LSDV] estimation method) estimates a separate intercept for each country or time, whereas a random-effects model allows the study to fit separate slopes and intercepts for each country (Greene, 2003; Hausman, 1978; Park, 2005). Generally, the functional forms of one-way panel data models are as follows:

One-way fixed group effects model:

$$y_{it} = (\alpha + \mu_i) + X'_{it}\beta + v_{it}, \text{ where } v_{it} \sim IID(0, \sigma_v^2) \quad (1)$$

One-way random group effects model:

$$y_{it} = \alpha + X'_{it}\beta + (\mu_i + v_{it}), \text{ where } v_{it} \sim IID(0, \sigma_v^2), \mu_i \sim IID(0, \sigma_\mu^2) \quad (2)$$

Here, i denotes the group, t denotes the time. The dummy variable μ_i is a group-specific constant term and a part of the intercept in the fixed-effects model, where α represents the model intercept and v_{it} represents the remainder of the error terms. In the random-effects model, μ_i is a part of the error terms and is assumed to be independent of v_{it} and X'_{it} , which are also independent of each other for all i and t , $\mu_i \sim IID(0, \sigma_\mu^2)$. X'_{it} is the observation of the i th group at time t on the regressors. By assumption, $E(v_{it}) = 0$ and $\text{Var}(v_{it}) = \sigma_v^2$, while $v_{it} \sim IID(0, \sigma_v^2)$ indicates that errors are Independent and Identically Distributed (IID).

The treatment of the country and time effects is crucial in this study. A group effects model can reflect unobservable and time-invariant heterogeneity among countries, such as national history and culture that shape educational institutions and policy systems, and educational values that may influence citizens' access to, and spending patterns on, higher education. In addition to country effects, time may potentially influence the dependent variables, as some variables (e.g., GDP per capita) have an apparent tendency to increase annually over the period 1998-2006. Therefore, including the time effect into the group effects models can provide a more powerful study, with both spatial and temporal dimensions, and enhance the quality of the study in ways that would be impossible using only one of these two dimensions. The study uses the following equation to estimate the effects of different financial aid policies and other factors on the tertiary enrollment ratios:

$$y_{it} = \alpha + \beta_1 x_{1it} + \dots + \beta_k x_{kit} + \mu_i + \gamma_t + \varepsilon_{it} \quad (3)$$

In equation (3), the term γ_t denotes the time effect and ε_{it} is the error term with group and time dimensions. By varying the structure of equation (3), the following models can be fitted: (1) disregarding the time effect γ_t , the study estimates a one-way random-effects model (Model 1) and a one-way fixed group effects model (Model 2); and (2) time dummies γ_t are added into the models so that a one-way random-effects model with time dummies (Model 3) and two-way fixed group and time effects model (Model 4) are estimated. This study reports and compares results for all the four models, and conducts a Hausman test to check the independence assumption of the random-effects model.³

Both fixed and random-effects models have pros and cons. Fixed-effects models allow time-invariant country-specific effects to be correlated with the other regressors. But the model may contain too many dummy variables (26 country dummies plus 8 time dummies) for specifications of cross-sectional or time-series units, using up many degrees of freedom and reducing available power (Helms, 1985). A random-effects model, then, is appropriate when dealing with a large number of countries, and it is asymptotically efficient relative to the fixed-effects model (Gustafsson & Johansson, 1999). A random-effects model has the distinct advantage of being able to capture between-group variation and, and if between-group variation does exist, the serial

³ The Hausman specification test compares the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model (Hausman, 1978). Hausman's essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero (Greene, 2003). $m = (b_{Robust} - b_{Efficient})' \Sigma^{-1} (b_{Robust} - b_{Efficient}) \sim \chi^2(k)$, where $\Sigma = Var(b_{Robust}) - Var(b_{Efficient})$ and k is the number of regressors. A fixed-effects model allows correlation between the exogenous variables and μ_i , while μ_i is assumed to be uncorrelated with the exogenous variables in a random-effects model. If correlated (H_0 is rejected), a random-effects model produces biased estimators, violating the assumption, so a fixed-effects model is preferred (Hausman, 1978).

correlation can also be captured. Random-effects models also allow the study to make some unconditional inferences about a larger population due to the fact that the selected countries would be treated as random draws from a larger population. However, the model may lead to biased results if the random effect is correlated with other independent variables.

Since the previous literature often reported an endogeneity problem (or bilateral causality) between economic growth and education outcome in time-series analysis (e.g., Barro, 1991; Mankiw, Romer, & Weil, 1992; Rebelo, 1991), a Durbin-Wu-Hausman endogeneity test for each model was conducted to determine whether the GDP per capita variable is endogenous. If subject to endogeneity, the GDP per capita variable would violate the assumption that an explanatory variable is uncorrelated with errors for ordinary linear regression, resulting in biased and inconsistent estimates.

To resolve the endogeneity problem, an instrumental variables (IV) method is a general solution (Wooldridge, 2002). The method relies on finding one or more appropriate instrumental variables, z_1, z_2, \dots, z_M , that affect the endogenous variable x_{Kit} —GDP per capita in this case—but do not affect the dependent variable at the same time. The study tried many potential IVs⁴ and this study finally uses the following three types of IVs: (1) electric power consumption per capita as a single instrument ($r_{\text{GDP per capita}}=0.65$, $p<0.001$, see Appendix 2.A for definition) because it boosts GDP and is less likely to directly affect higher education enrollment; (2) the first order lag of the GDP per capita ($r_{\text{GDP Per Capita}}=0.99$ ($p<0.001$)) as a single instrument because it reduces the

⁴ Potential IVs the study tried include net export, and the second and the third lags of GDP per capita. The export variable was finally abandoned due to its low correlations with GDP per capita ($r_{\text{export}}=0.14$). Since the second and the third order lags of GDP per capita both yield nearly the same results as those from IV models instrumented with the first order lag, the study only keeps the first order lag of GDP per capita as an IV to avoid redundancy.

contemporaneous error problem in the regular panel models; and (3) the linear combination of (1) and (2) as multiple instruments.

Wooldridge (2002) suggests that the 2 two-stage least squares (2SLS) estimator is the most efficient IV estimator, conditional on using a linear combination of multiple instruments. The first stage of the two-stage least squares estimation is to regress the endogenous variable x_{Kit} on the instruments and other exogenous variables:

$$x_{Kit} = \delta_0 + \mu_i + \delta_1 x_{1it} + \dots + \delta_{K-1} x_{K-1it} + \theta_1 z_{1it} + \dots + \theta_M z_{Mit} + r_{Kit} \quad (4)$$

The predicted value of the endogenous variable is then calculated:

$$\hat{x}_{Kit} = \delta_0 + \mu_i + \delta_1 x_{1it} + \dots + \delta_{K-1} x_{K-1it} + \theta_1 z_{1it} + \dots + \theta_M z_{Mit} \quad (5)$$

The second stage then uses the predicted value \hat{x}_{Kit} in place of the endogenous variable x_{Kit} itself:

$$y_{it} = \alpha + \mu_i + \beta_1 x_{1it} + \dots + \beta_{K-1} x_{K-1it} + \beta_K \hat{x}_{Kit} + v_{it} \quad (6)$$

For each of the three types of IVs, the study uses the 2SLS approach to estimate four IV models that correspond to the four regular panel models specified earlier. Then the results of the three sets of IV models are compared, and the Hausman test is followed to choose the preferred models.

Limitations of the Data

This study is the first trial to test the utility of the international indicators. Although the data quality has been continuously improved upon by the data collecting agencies, i.e. the OECD and the World Bank, there are still inherent data problems in the research of the international indicators. First, the variables of interest are selected from all available databases published by the two international organizations, but some important

variables, such as tuition, and enrollment ratios for tertiary A or tertiary B, respectively, are not available in the current databases of OECD and WDI, and these could not be taken into consideration in the model.

Second, some indicators are not clearly defined or classified, possibly leading to problems of interpretation. For example, as illustrated in the literature review, dramatically different approaches to grants and loans are used across nations. Some nations, such as Germany, provide grants for all students, regardless of financial need, while other nations, such as Sweden and the U. S., have a history of relying on need-based grants. Thus, the inclusion of all types of grants in one indicator may be misleading. In addition, there is great variability in the way that nations finance student loans and organize repayment. Comparing types of loan schemes (e.g. Lleras, 2004) may be a better way to assess the impact of loans than simply using a single indicator, but such data are not yet available.

Third, the sample contains a considerable amount of missing data. Since the mechanism of the missing values is assumed to be completely at random, the study tried different imputation methods. However, multiple imputation methods produced several extreme values that far exceeded the range of the original data. Thus, the study imputed 172 (4.7% of all data points) missing points in total on the 15 variables, with either the average of two available data points in adjacent years, group means, or the value adjusted with an average growth rate.

Finally, the relatively small sample size (n=243) and non-representative country selection (OECD countries) might make it difficult to generalize the results to developing and least developed countries.

Findings

Trend Analysis

Table 2.1 summarizes the descriptive statistics and trend data on all variables across the 27 countries over 1998-2006. The average gross tertiary enrollment ratios in OECD countries was about 56.98 percent over the 9 years and, on average, increased by one to two percent annually. Figure 2.1 presents both the individual country profile over time and the overall trend of tertiary enrollment ratios, which increase following an approximately linear trend either at the individual country level or on average. The large within-group and between-group variations are observed in the baseline year 1998 and in

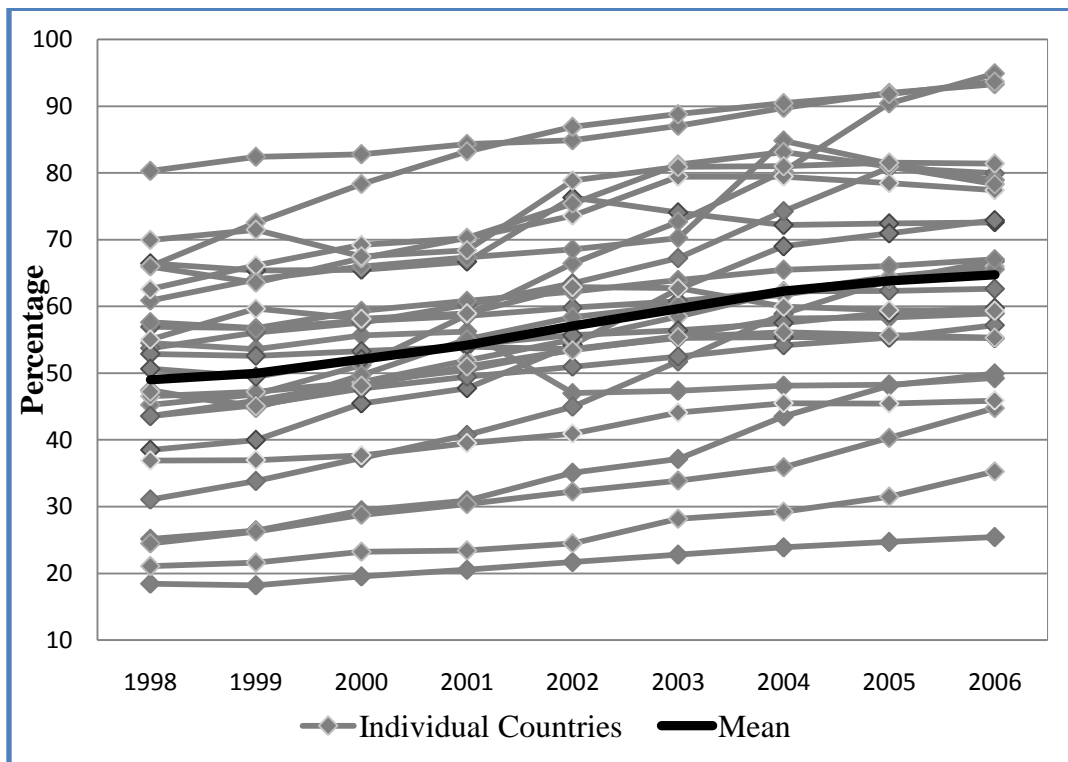


Figure 2.1. Individual Profile of Tertiary Gross Enrollment Ratios (GER) with the Average Trend Line (Number of Countries=27, N=243)

Table 2.1. Descriptive Results of the Variables (27 countries)

	N	Mean of All Countries by Year									Total Mean	SD
		1998	1999	2000	2001	2002	2003	2004	2005	2006		
Gross Tertiary Enrollment Ratio	243	48.99	49.95	52.06	54.20	57.06	59.66	62.31	63.82	64.73	56.98	17.35
Student Financial Aid												
Scholarship and Grants (as % of Public Tertiary Expenditure)	237	9.85	10.91	10.23	9.47	9.20	9.38	9.71	9.96	10.10	9.86	6.87
Student Loans (as % of Public Tertiary Expenditure)	231	5.63	5.57	6.69	8.32	7.99	7.33	8.80	8.07	8.85	7.47	9.45
Public Expenditure per Tertiary Student (as % of GDP per capita)	242	35.42	34.75	33.10	33.18	33.93	33.29	32.39	31.14	31.20	33.15	12.68
Other Public Spending on Education												
Public Spending on Tertiary Institutions	235	79.99	78.90	78.05	77.52	77.53	76.73	76.00	75.07	74.75	77.18	20.12
Public Spending on Education(% of GDP)	243	5.19	5.14	5.11	5.23	5.37	5.48	5.42	5.33	5.31	5.29	1.27
Public Expenditure per Secondary Student	237	22.70	22.98	22.47	22.93	23.44	24.02	24.88	24.14	24.51	23.58	5.60
Economy -GDP Per Capita (constant \$2000)	243	18424	18975	19656	19916	20153	20396	20986	21492	22064	20229	10905
Basic Education												
Gross Primary Enrollment Ratio	243	103.26	103.11	103.26	103.30	103.30	103.07	102.56	102.33	102.07	102.92	4.92
Gross Secondary Enrollment Ratio	243	107.94	106.74	107.25	107.79	108.32	109.21	103.88	104.89	104.96	106.78	18.44
Sex Ratio in Primary& Secondary Education	243	100.97	100.65	100.62	100.76	100.68	100.61	99.63	99.55	99.50	100.33	4.31
Population % of 65-year-older	243	13.48	13.59	13.71	13.82	13.94	14.05	14.17	14.29	14.42	13.94	3.47
Annual Growth Rate	243	0.49	0.51	0.52	0.54	0.63	0.64	0.64	0.66	0.74	0.60	0.54
Total Population (in thousands)	243	37000	37300	37500	37800	38100	38300	38600	38900	39200	38100	58400
Employment rates (15~24 years old)	243	44.48	44.69	45.11	44.20	43.39	42.70	42.42	42.33	43.14	43.61	14.41
Instrumental Variable--Electric Power Consumption (kWh per Capita)	243	7877.50	8066.31	8301.23	8434.95	8523.06	8542.42	8733.23	8820.03	9023.31	8480.23	6043.90

the follow-up years. In particular, the magnitude of increase in the enrollment ratios from 1999 to 2004 is considerably larger, while the increase is slower in the time periods 1998-2000 and 2004-2006. This pattern hints that both country and time effects should be taken into consideration in the model.

Figure 2.2 and the descriptive statistics in Table 2.1 show that while the scholarships/grants as a percentages of total public expenditure on tertiary education and the ratio of public expenditure per tertiary student to GDP per capita were undergoing a slight decline, student loans as a percentages of total public expenditure on tertiary education substantially increased during the 9 years but have experienced moderate fluctuations since 2001. While the amount of scholarships/grants was 9.86 percent (SD=6.87) of the total public expenditure on tertiary education, the average amount of student loans was 7.47 percent of the public expenditure on tertiary education and exhibited a greater variance among countries (SD=9.45). The decline in scholarships/grants and the increase in loans are consistent with the previous literature, which illustrate the widely discussed, gradual replacement of grants with loans in Western countries (Barr, 2004; Conlon, 2006; Vossensteyn, 2004). Public expenditure per tertiary student took an average 33.15 (SD=12.68) percent of GDP per capita and tended to decrease gradually. The changes in the three variables on public expenditure seem to be consistent with the global trend toward privatization and cost sharing (Johnstone, 2000, 2003a, 2004; Johnstone, Arora & Experton, 1998).

As shown in Figure 2.3, the proportion of public spending on tertiary institutions as a fraction of the sum of private and public expenditure on tertiary institutions also tended to decrease gradually, implying that private sources of funding for tertiary

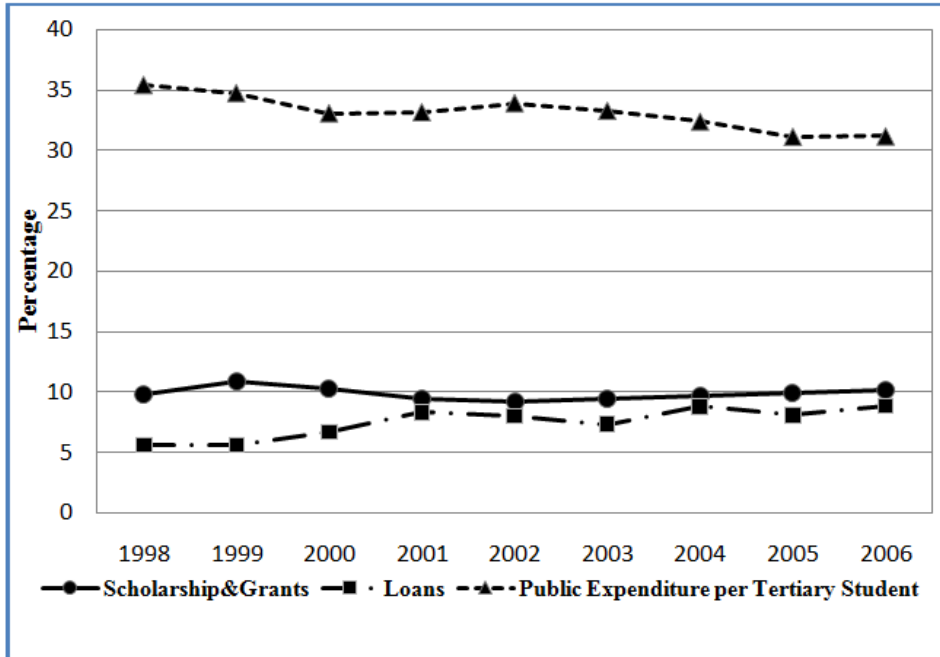


Figure 2.2. Trends of Student Financial Aid Variables (Number of Countries=27, N=243)

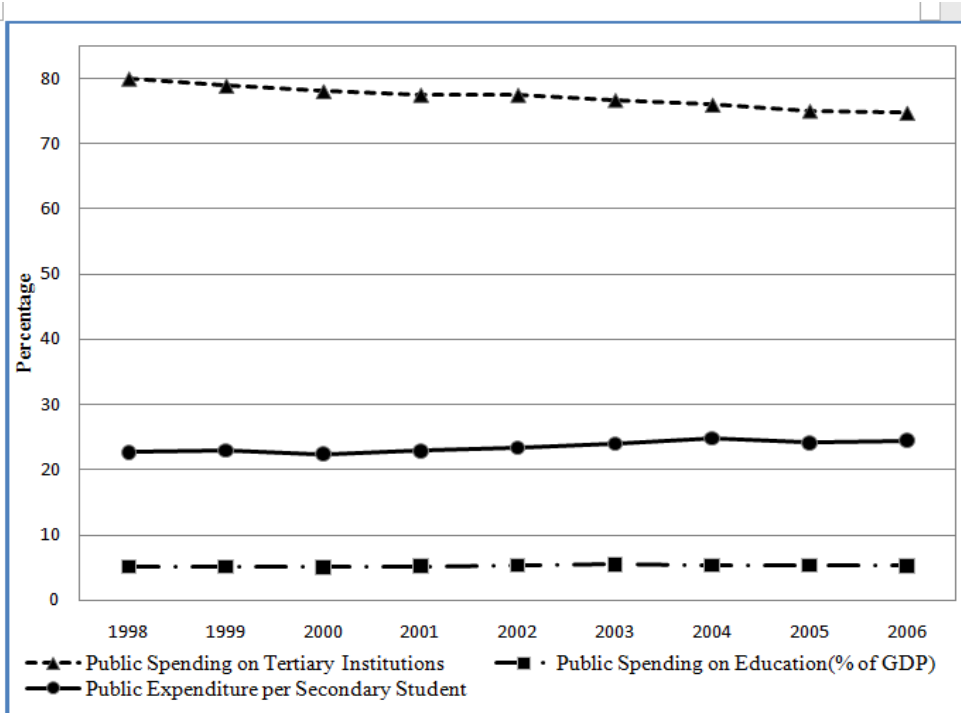


Figure 2.3. Trends of Other Public Spending on Education (Number of Countries=27, N=243)

institutions were increasing. However, overall, public expenditure took a considerably higher percentage to support higher education institutions than private resources (mean=77.18%). On average, the OECD's education investment remained stable at around 5.29 (SD=1.27) percent of their GDP over the 9 years. Public expenditure per secondary student for OECD countries showed a slight increase from 1998 to 2006, reaching an average of expenditure per student/GDP per capita of 23.58 (SD=5.60) and had much lower than the level and variation of public expenditure per tertiary student.

Figure 2.4 shows that the national economy of OECD countries, represented by GDP per capita gained, on average, noticeable growth, albeit with considerable variance (10,905 in constant 2000 US dollars) over the 9 years. From 2000 to 2003, the national average income showed slowed growth, but the growth accelerated from 2004 to 2006.

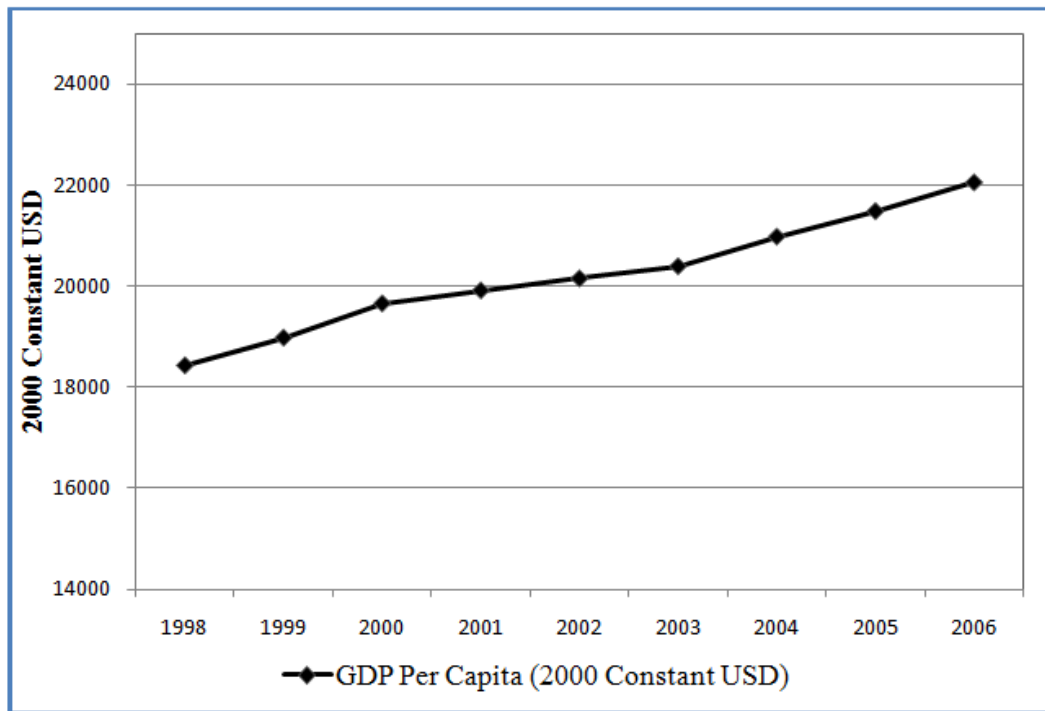


Figure 2.4. Trend of GDP Per Capita. (Number of Countries=27, N=243)

GDP per capita grew at a much higher rate than tertiary average tertiary expenditures inclusive of loans and grants. This illustrates the expected relationship between spending on higher education per student and the GDP per capita, given the growth in the average GDP per capita in OECD nations during the 9 years.

Table 2.1 also shows that, compared to tertiary enrollment ratios, the gross primary (mean=102.92) and secondary (mean=106.78%) enrollment ratios⁵ were much higher, but tended to decrease slightly, indicating less grade repetition or a smaller percentage of over- or under-aged students. Moreover, the average ratio of girls to boys in basic education was 100.97 in 1998, but this number has declined slightly since then (overall mean =100.33). With regard to demographic characteristics, while the total population and annual population growth rate slowly increased over the 9 years, the percentage of the population older than 65 years on average increased even faster than the growth rate, characteristic of the aging population trend in most OECD countries. In general, youth employment rates tended to decrease from 1998 to 2006 (mean=43.61).

An examination of these trends reveals two evident patterns. First, the growth of college enrollment ratios from 1998 to 2006 corresponds with an increase in the economy, albeit with economic stagnation from 2000 to 2003. Higher education enrollment flattens out from 2004 to 2006, a period in which economic growth experienced faster growth but the average public tertiary expenditure per student/GDP per capita reached its lowest level. In addition, there was a shift in public finance

⁵ As often cited on the World Bank and UNECO websites, the ideal Gross Secondary Enrollment Ratio is 100%. But ratios greater than 100 can occur when many students repeat a grade, fail to graduate, or are over- or under-age.

strategies after 1999, including a decrease in the percentage of costs paid for by the government and an increase in loans, strategies typically characterized as privatization. These trends analysis suggest that both the economic development and the movement toward privatization could explain the increase in enrollment rates over the 9 years.

Regression Results from Fixed and Random-effects Models

The study presents a thorough overview of alternative analyses of panel data and compares the advantages and limitations of the four panel data models (Table 2.2). The comparison provides a broader perspective on the results than using just one model alone.

As demonstrated in Table 2.2, when time effects were not included, most predictors in Models 1 and 2 exhibit similar coefficients in terms of signs and magnitudes. Based on the Hausman test statistic ($\chi^2_{(14)} = 51.86, p < 0.001$), the one-way fixed group effects model (Model 2) is preferred to the random-effects model (Model 1). Since the time effect has not been taken into consideration at this stage, scholars should be cautious with regard to the findings in Model 1.

After including time effects into Models 1 and 2, Models 3 and 4 account for more variance in the tertiary enrollment ratios, and their variance-explaining powers both increased by a statistically significant margin, as shown by the combined significance F-tests for the time dummies (F-test₃=6.76, p<0.001; F-test₄=2.000, p<0.05). Such results justify the necessity and importance of including time effects beyond group effects in the analysis. The regression coefficients of Models 3 and 4 demonstrated greater similarity and consistency compared with the differences seen between Models 1 and 2, likely because the time effects specifications in Models 3 and 4 remove from the analysis some

Table 2.2 Panel Data Models of Regressions on Tertiary Enrollment Ratios. (N=211, 27 countries)

	One-way Group Effects Models			Two-way Fixed Group and Time Effects Model 4
	Without Time Effect		With Time Effects	
	Random- Effects	Fixed- Effects ^a	Random-effects ^a	
	Model 1	Model 2	Model 3	
Student Financial Aid				
Scholarship and Grants (as % of Public Tertiary Expenditure)	0.020 (0.126)	0.002 (0.142)	0.041 (0.160)	0.054 (0.164)
Student Loans (as % of Public Tertiary Expenditure)	0.096 (0.115)	0.015 (0.100)	0.008 (0.085)	0.001 (0.079)
Public Expenditure per Tertiary Student (as % of GDP per capita)	-0.549*** (0.159)	-0.417*** (0.169)	-0.472*** (0.135)	-0.426*** (0.151)
Other Public Spending on Education				
Public Spending on Tertiary Institutions (as % of all public and private tertiary expenditure)	0.001 (0.084)	0.073 (0.093)	0.086 (0.081)	0.122 (0.089)
Public Spending on Education(% of GDP)	5.064*** (2.279)	4.055** (2.218)	3.819** (2.354)	3.444* (2.441)
Public Expenditure per Secondary Student (as % of GDP per capita)	0.021 (0.264)	-0.112 (0.255)	0.065 (0.256)	-0.072 (0.191)
Economy				
GDP Per Capita (constant 2000 USD)	25.789*** (5.991) ^b	39.187*** (9.204)	13.659*** (5.000)	27.965** (14.141)
Basic Education				
Gross Primary Enrollment Ratio	-0.090 (0.304)	-0.214 (0.276)	-0.211 (0.308)	-0.169 (0.285)
Gross Secondary Enrollment Ratio	0.065 (0.071)	0.031 (0.083)	0.106 (0.056)	0.054 (0.075)
Sex Ratio in Primary & Secondary Education	-0.476* (0.253)	-0.235 (0.267)	-0.250 (0.228)	-0.160 (0.267)
Population % of 65-year-older				
Annual Growth Rate	1.797** (0.967)	2.364** (1.524)	0.372 (0.741)	0.834 (1.664)
Total Population	3.832** (1.858)	1.279 (1.991)	0.451 (1.834)	0.257 (1.959)
Employment Rates (15~24 years old)	1.605 (2.957)	29.941 (25.579)	0.605 (2.156)	-25.591 (38.511)
Intercept	-0.483 (0.180)	-0.389** (0.182)	-0.227* (0.145)	-0.163 (0.157)
	-185.827** (92.004)	-807.552** (414.482)	-54.293 (67.552)	227.118 (703.304)
Time Dummies (F-test for combined significance)	N/A	N/A	6.76***	2.000*
Adjusted R ²	0.470 ^c	0.967	0.577 ^c	0.968
P-value	.000	.000	.000	.000

Note. a. Model preferred by Hausman test. b. Clustered standard errors for panel data. c. Non-adjusted R² produced by STATA. p<.05, **<.01, ***<.001 (two-tailed tests).

systematic changes within the countries. The higher consistency of Models 3 and 4 not only reduces the bias of favoring only one model but also strengthens the findings and conclusions. The Hausman test statistic ($\chi^2_{(10)}=16.08, p=.097$) fails to reject the null hypothesis that country effect is not correlated with the other regressors, which means the random-effects model (Model 3) is preferred over the fixed-effects model (Model 4). Since Hausman tests often have low power to reject the null hypothesis, especially in small samples (Lamb, 2000; Lamb, 2003; Nakamura & Nakamura, 1985), the coefficients in Model 4, particularly those consistent with Model 3, are also highly valued in the study.

According to Model 3, scholarships/grants as a percentage of total public tertiary expenditure and student loans as a percentage of total public tertiary expenditure were not significantly associated with tertiary enrollment, but on the other hand, the public expenditure per tertiary student divided by GDP per capita was statistically significant and had a negative relation with higher education enrollment, after controlling for other public spending, economy, basic education and population. Specifically, a one unit decrease in the ratio of public expenditure per tertiary student to the GDP per capita was related to a 0.472 ($p<0.001$) percent increase in higher education enrollment, after controlling for other predictors. This relationship was expected, given the trends in GDP per capita and comparatively modest growth in the ratio of spending per student to the average GDP. The coefficients of the three variables have similar magnitudes and signs, which are consistent across all four models. Because similar results are produced from different estimation methods and different specifications, the results are unlikely to be simple artifacts of a particular estimation procedure.

In addition to these financial aid variables, the study found that public spending on education as a percentage of GDP bears a statistically significant, positive relation with higher education enrollment. All else being equal, a one percent increase in public spending on education as percentage of GDP is expected to increase tertiary enrollment by 3.819 percent ($p < 0.01$). On the other hand, the models show that public spending on tertiary institutions and public expenditure per secondary student do not have an impact on higher education access.

The consistent findings also support the premise that GDP per capita (in logarithm) is strongly and positively tied to tertiary enrollment ratios, and it is statistically significant, all else being equal. A one logarithm unit increase in GDP per capita is associated with a 13.659 percent increase in tertiary enrollment ($p < 0.001$). This finding suggests that the increase in higher education access is strongly fostered by an increase in the national economy.

In Model 3, while most control variables appear not to be significant, only one variable—youth employment rates—is found to have a statistically significant but negative relation with tertiary enrollment ($\beta = -0.227$, $p < 0.05$), holding all other variables constant. The consistent coefficients of both Models 3 and 4 indicate that gross primary and secondary enrollment ratios, sex ratio in basic education, percentage of 65-year-old population, population growth rate, and total population have no influence on tertiary enrollment. A number of these variables (e.g., percentage of 65-year-old) were once significant in Model 1 and 2, but including the time effects in Models 3 and 4 beyond the group effects substantially changes their estimated coefficients, indicating that the changes in the variables are largely affected by time.

The advantage of a random-effects model such as Model 3 is that it permits some unconditional inferences for the population and secures a larger degree of freedom than Model 4. If the study were to use the random-effects models for interpretation, this conclusion could also be generalized to some non-OECD member countries with similar economies and educational achievements. However, since policy indicators were not available for non-OECD countries, the study cautions against such generalizations.

Regression Results from Instrumental Variable Models

The Durbin-Wu-Hausman endogeneity tests⁶ showed that the two fixed-effects models are subject to endogeneity, whereas the two random-effects models are not. To be consistent, the study used instrumental variable (IV) regressions for all four models, among which the three types of IVs—electric power consumption per capita, the lagged GDP per capita, and the linear combination of these two variables—were used, respectively, as instrument(s) for GDP per capita. After controlling for the endogeneity problem, the study finds that using the three types of IV regression models leads to nearly the same results as those of the regular panel data models in terms of magnitude, signs, and significant levels of the predictors as well as the model preference by Hausman tests (please refer to Appendix 2.B for the regression results using the combined IVs as an example). Due to the high similarity across the IV and regular panel models, the study does not interpret the results from the IV models but uses the regular model results as summarized earlier to frame the discussion and draw conclusions.

⁶The Durbin-Wu-Hausman endogeneity test statistics are available on request.

Conclusion and Future Research

The analytic strategy of using four random and fixed-effects models provides a more conclusive answer to the research question than would be possible with a single model. The study finds that while scholarships and grants as a percentage of total public tertiary expenditure as well as student loans as a percentage of total public tertiary expenditure appear not to be significant, public expenditure per tertiary student divided by GDP per capita was statistically significant but negatively associated with tertiary enrollment under the economic conditions that prevailed in the 27 OECD countries between 1998 and 2006, after controlling for national economy, basic education and population characteristics. If relying on the random-effects models for interpretation, this study has implications for other countries with medium and high educational and economic levels, according to the recent rankings of UNESCO, WDI and OECD partner countries (i.e., non-OECD member countries). The study would expect to find a relationship between economic development and tertiary enrollment in other nations, but lack a sound basis for making judgments about prices and student aid.

There is, of course, a substantial body of research that indicates that investment in grants and income-contingent loans, especially need-based grants, could have a positive influence on enrollment rates (Heller, 1996; Reuterberg & Svensson, 1994; St. John & Noell, 1989; Usher & Cervenán, 2005; Vossensteyn, 1999). However, the trend analyses indicate a decline in international investment in grants, and an overall slow increase with moderate fluctuations in student loans, both of which do not corresponded to the growth in enrollment. Given these circumstances, it is not surprising that this study did not find a positive relationship between these public finance policies and college enrollment.

The negative relationship between public expenditure per tertiary-level student as a percentage of GDP per capita and gross tertiary enrollment for the OECD countries seems counterintuitive. Given the higher unit cost associated with providing higher education compared with basic education, the past moves to make higher education available to the masses—with an enrollment ratio at 56.98 percent on average—have made it difficult for governments to provide every college student with adequate funding. When governments spend too many public resources on one college student, compared with the national average GDP per capita, the resources and opportunities allocated to other students may be diminished. The competition for higher education resources under a fixed budget allocation system may lead to an inverse relationship between per student expenditure and college enrollment (Su, 2006). The negative relationship implies that for a fixed total budget on higher education and a rising enrollment, various nations have reduced average spending per student and drawn on more private resources to increase higher education access. Thus, the recent growth of tertiary enrollment in developed countries can be attributed in part to an increase in the number of individuals who can afford college.

In terms of other types of spending on education, considering the declining or stagnant trends of public spending on tertiary institutions and public expenditure per secondary student as a percentage of GDP per capita, it is not surprising that they do not exert any influence on higher education access. The finding that public spending on education as a percentage of GDP has a statistically significant, positive impact on college enrollment for the OECD countries is logical. Prioritizing education resources over other public sectors (e.g., health) and allocating a higher percentage of GDP on the

education sector can help improve the general education situation in a country that can benefit all education sectors, including higher education. In particular, since most OECD countries had virtually universal basic education (average primary enrollment rate=102.92%, average secondary enrollment rate=106.78%), an increase in public spending is more likely to be invested in higher education, to stimulate economic growth and equalize opportunities to higher education. Even in face of stagnant or perhaps declining higher education spending relation to GDP per capita, the relatively lower cost of college education and the higher income of citizens in the OECD nations may allow students and parents to share the cost of college education with government. Therefore, this finding strengthens the argument in the previous literature (Birdsall, 1996; Patrinos, 2000) that higher education, as an engine of economic growth, has gained priority over basic education for receiving public resources.

This study also finds that GDP per capita, a measure of average income and other economic factors, was the primary predictor of college enrollment. Connecting this result with the findings on the aforementioned education finance variables makes it clearer that the increase in tertiary education enrollment in the past decade relied largely on income growth. Increasing education expenditure as a percentage of GDP most likely benefited the sector of higher education because countries' basic education is complete. However, if there were too many college students and tertiary expenditure per student were too high, government ability to share the cost with every college student would become limited. In such cases, the national average income becomes the key to paying for college costs. Growth in GDP per capita, a condition that was evident in the nine-year time period studied, suggests that the average citizen or household might have more money available

to pay for college. When growth in income flattens out and net costs rise, it is not surprising that income would still play a role in access. This finding supports the hypothesis that economic development drives college access, consistent with Freidman's argument (2005).

It is important to note that relying only on the regression coefficients may underestimate the importance of public finance as a whole. From 2000 to 2003, tertiary enrollment increased despite the stagnant GDP per capita likely because of the relatively stable public expenditure during this period. However, from 2004 to 2006, when GDP per capita growth started speeding up, tertiary enrollment did not accelerate but flattened out. During the same period, most education finance indicators, such as per tertiary student expenditure, institutional expenditure and public spending on education as a percentage of GDP, during this period e also tended to decline, moving to the lowest point over the 1998-2006 period. Such a coincidence may hint at both the limitation of relying on solely citizen's personal income to boost higher education and the importance of public finance on education. However, more research is needed to confirm such findings.

These findings have implications for national policies on the financing of higher education in developed and developing countries. It appears that the use of privatization (i.e., raising tuition rates and the number of loans simultaneously) as the primary means of expanding college access in the past decade did not mitigate economic influences on inequality and may have undermined economic development. In fact, Friedman (2005) argues investments in student aid for low-income students may be necessary for economic growth.

Targeting grant aid and scholarships for low-income students provides a means of equalizing enrollment opportunities for qualified low-income students. However, between 1998 and 2006 the OECD nations migrated away from education finance policies that would equalize educational opportunity and fuel economic development. According to Lleras (2004), if loans become a primary means used to finance public access to higher education, it is vitally important that income-contingent repayment be implemented (i.e., future earnings along with amount borrowed, a condition of fairness), a policy currently not in place in many countries, including the U.S. before 2010. At the very least it is critical that OECD countries review their public finance policies with an explicit focus on developing strategies for equalizing enrollment opportunities for prepared low-income students.

Since grants were not positively associated with enrollment rates in any of these analyses, there is reason to question the structure of grant programs as implemented in OECD nations during the time period studied. Some nations provided grants for all students, others emphasized merit grants, and still others emphasized need-based grants. Research in the U.S. strongly supports the contention that targeting grants for low-income students has a more substantial positive influence on enrollment rates than merit aid (Heller & Marin, 2004; St. John, 2006). It is possible that the U.S. and other nations should target grant aid for low-income students as a supplement to the use of loans in response to rising tuition. Unfortunately the international data in this study did not sufficiently classify grants as to whether they were based on need, merit, or other award criteria, so it was not possible to test this proposition.

In addition, the statistically significant coefficient estimate associated with one control variable may also shed light on the entire picture of higher education development. The negative relationship between youth employment and college access suggests that the college financial burden may deter many youths (15-24 years old) from attending and completing high school and enrolling in a higher education institution, forcing them to enter the job market. Thus, when a large portion of the college-aged population is in the labor force, the pool that is academically prepared to attend college and university is reduced. As shown in Table 2.1, the recent decade witnessed a decline in the proportion of youth employment and an increase in higher education enrollment. Supporting this financially needy youth population and reducing youth employment represents a realm that needs indirect support from governments to promote higher education.

This study has implications for future policy practices on student aid and college access. The analysis strategy of five random and fixed-effects models enables this study to provide a more conclusive answer to the research question. The study finds that scholarships and grants as well as student loans do not have an impact on higher education access, whereas public expenditure per tertiary student bears a statistically significant but negative association with tertiary enrollment, after controlling for national economy, population characteristics and basic education. Although the study has no conclusive evidence that need-based scholarship aid will improve enrollment rates among low-income students when tuition increases, this alternative deserves a trial given its potential impact on both promoting access to higher education for low-income, college prepared students and furthering economic development.

This analysis of international indicators also has important implications for future improvement in data measurement and analytical methods. First, the finding that student aid programs do not have an impact on higher education access may be plagued by data problems. For example, in the OECD dataset, the indicator “scholarships/grants” collects information on both merit-based aid and need-based aid (grants) together as one category, overlooking the fact that these two aid programs have a differing effect on access (Heller, 2001, St. John, 2006). The data misclassification may result in errors in statistical analysis and misinterpretation. In this study, it is not yet possible to test the effects of need-based aid using international indicators, leaving much room for improvement in data collection. Second, the study initiates a new way to analyze access using international indicators, but the methodologies and alternative modeling for future research can be improved. For example, future research can convert some normalized independent variables (e.g., student loans as a percentage of public tertiary expenditure, and public expenditure per tertiary student as a percentage of GDP per capita) into real monetary values and test their relationship with college enrollment. Interpreting the converted results can make it easier to understand and interpret. Moreover, given that the sample size is small, future research may try alternative modeling by reducing the number of independent variables in the models.

Appendix 2.A. Definition of Select Variables and Data Sources

	Definitions and Source
Gross Tertiary Enrollment Ratio	<p><i>Gross enrollment ratio</i> is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. <i>Tertiary education</i>, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level. <i>Gross tertiary education enrollment ratio</i> is calculated based on the number of young people in the five-year age group following the secondary school-leaving age. Tertiary education includes <i>Tertiary-type A education</i> and <i>Tertiary-type B education</i>.</p> <p><i>Tertiary-type A programs</i> are largely theory-based and designed to provide sufficient qualifications for entry to advanced research programs and professions with high skill requirements, such as medicine, dentistry or architecture. These programs have a minimum cumulative theoretical duration (at tertiary level) of three years' full-time equivalent, although they typically last four or more years. These programs are not exclusively offered at universities. Conversely, not all programs nationally recognized as university programs fulfill the criteria of Tertiary-type A. Tertiary-type A programs also include second degree programs such as the American Masters. First and second degree programs are sub-classified by the cumulative duration of the programs, i.e., the total study time needed at the tertiary level to complete the degree.</p> <p><i>Tertiary-type B programs</i> are typically shorter than Tertiary-type A and focus on practical, technical or occupational skills for direct entry into the labor market, although some theoretical foundations may be covered in the respective programs. They have a minimum duration of two years full-time equivalent at the tertiary level. (Source: World Development Indicators (WDI))</p>
Student Financial Aid Scholarship and Grants as a percentage of public tertiary expenditure	<p><i>Scholarships/grants</i> are government scholarships and other government grants to tertiary students or households in the unit of percentages of total public expenditure on tertiary education. These include, in addition to scholarships and similar grants (fellowships, awards, bursaries, etc.), the following items: the value of special subsidies provided to students, either in cash or in kind, such as free or reduced-price travel on public transport systems; and family allowances or child allowances that are contingent on student status. Any benefits provided to students or households in the form of tax reductions, tax subsidies, or other special tax provisions are not included. (Source: OECD, Education at a Glance)</p>
Student Loans as a percentage of public tertiary expenditure	<p><i>Student loans</i> are loan programs with public subsidies to help college students pay for their college education, and are measured in the unit of percentages of total public expenditure on tertiary education. Student loans are reported on a gross basis, without</p>

	subtracting or netting out repayments or interest payments from the borrowers (students or households). (Source: OECD, Education at a Glance)
Public Expenditure per Tertiary Student (as % of GDP per capita)	<i>Public expenditure per tertiary student</i> is the current public spending on education divided by the total number of students at the tertiary level, as a percentage of GDP per capita. Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities). (Source: WDI)
<p>Other Public Spending on Education</p> <p>Percentage of Public Tertiary Expenditure on Institutions</p>	<p>This is the percentage of public tertiary expenditure based on the sum of private and public expenditures on institutions</p> <p><i>Private expenditure</i> refers to expenditure funded by private sources, i.e., households and other private entities. “Households” means students and their families. “Other private entities” include private business firms and non-profit organizations, including religious organizations, charitable organizations, and business and labor associations. Private expenditure comprises school fees; materials such as textbooks and teaching equipment; transport to school (if organized by the school); meals (if provided by the school); boarding fees; and expenditure by employers on initial vocational training. Note that private educational institutions are considered service providers, not funding sources.</p> <p><i>Public expenditure</i> refers to spending of public authorities at all levels. Expenditure that is not directly related to education (e.g., culture, sports, youth activities, etc.) is, in principle, not included unless the activities are provided as ancillary services by educational institutions. Expenditure on education by other ministries or equivalent institutions, for example Health and Agriculture, is included. (Source: OECD, Education at a Glance)</p>
Public Spending on Education as % of GDP	<i>Public spending on education</i> measures the current and capital public expenditure on education (including primary, secondary and tertiary levels) includes government (local, regional and national governments, including municipalities (household contributions excluded)) spending on educational institutions (both public and private institutions involved in delivering or supporting educational services), education administration as well as subsidies for private entities (students/households and other private entities), expressed as a percentage of the GDP. <i>Capital expenditure</i> includes expenditure for assets that last longer than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles. (Source: WDI)
Public Expenditure per Secondary Student (as % of	<i>Public expenditure per secondary student</i> is calculated by dividing total public expenditure in secondary level by the number of students enrolled at the secondary level, expressed as a percentage of GDP per capita. See the definition <i>public expenditure per tertiary student</i> for

GDP per capita)	the components of the public expenditure. (Source: WDI)
Economy GDP Per Capita	<i>GDP per capita</i> is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in 2000 constant U.S. dollars. (Source: WDI)
Basic Education Gross Primary Enrollment Ratio	The ratio of primary school enrollment to the number of primary school-aged children (usually 6-11 years old). Programs are typically six years long and represent the beginning of compulsory education in many countries. It can be higher than 100 percent because some students are younger or older than the corresponding age group. (Source: WDI)
Gross Secondary Enrollment Ratio	The ratio of secondary enrollment to the number of secondary school-aged children (usually 12-17 years old). (Source: WDI)
Sex Ratio in Primary and Secondary Education	The ratio of girls to boys enrolled at primary and secondary levels in public and private schools. (Source: WDI)
Population % of 65-years-older	Percentage of those 65 and older in the population. (Source: WDI)
Annual Growth Rate	<i>Population growth rate</i> means the annual increase in a country's population during a given period (usually one year) expressed as a percentage of the population when the period began. The population growth rate is the sum of the difference between the birth rate and the death rate (the natural population increase) and the difference between the population entering and leaving the country (the net migration rate). (Source: WDI)
Total Population	Total population of the country. (Source: WDI)
Employment Rates (15~24 years old)	The employment-to-population ratio is defined as the proportion of a country's working-age population that is employed; a high ratio means that a large proportion of a country's population is employed, while a low ratio means that a large share of the population is not involved directly in market-related activities because they are either unemployed or out of the labor force altogether. Ages 15 and older are generally considered the working-age population. Ages 15-24 are generally considered the youth population. (Source: WDI)
Electric power consumption (kWh per capita)	It measures per capita production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants. (Source: WDI)

Appendix 2.B. Regression Models Using Electric Power Consumption and the First Order Lag of GDP Per Capita as Multiple Instruments for GDP Per Capita. (N=211)

	One-way Group Effects Models			Two-way Fixed Group and Time Effects IV Model 4
	Without Time Effect		With Time Effects	
	Random-effects	Fixed-effects ^a	Random-effects ^a	
	IV Model 1	IV Model 2	IV Model 3	
Student Financial Aid				
Scholarship and Grants (% of Public Tertiary Expenditure)	0.025 (0.106)	0.001 (0.101)	0.045 (0.097)	0.050 (0.101)
Student Loans (% of Public Tertiary Expenditure)	0.115 (0.081)	0.014 (0.077)	0.010 (0.077)	0.000 (0.077)
Public Expenditure per Tertiary Student (% of GDP per capita)	-0.574 (0.084)	-0.415 (0.082)	-0.474*** (0.080)	- 0.423*** (0.082)
Other Public Spending on Education				
Public Spending on Tertiary Institutions (% of all public and private tertiary expenditure)	-0.017 (0.069)	0.071 (0.074)	0.089 (0.064)	0.115 (0.078)
Public Spending on Education(% of GDP)	0.059 (0.182)	-0.114 (0.171)	0.068 (0.170)	-0.084 (0.175)
Public Expenditure per Secondary Student (% of GDP per capita)	5.389 (1.336)	4.037 (1.336)	3.925** (1.261)	3.399* (1.357)
Economy				
GDP Per Capita (constant 2000 USD)	21.768 (3.877)	39.805 (6.633)	12.509*** (3.490)	30.083** (9.439)
Basic Education				
Gross Primary Enrollment Ratio	-0.090 (0.180)	-0.214 (0.174)	-0.219 (0.165)	-0.170 (0.172)
Gross Secondary Enrollment Ratio	0.079 (0.065)	0.029 (0.063)	0.109 (0.060)	0.049 (0.064)
Sex Ratio in Primary & Secondary Education	-0.536 (0.243)	-0.229 (0.239)	-0.256 (0.226)	-0.152 (0.235)
Population				
% of 65-year-old	1.629 (0.634)	2.326 (0.809)	0.454 (0.568)	0.825 (0.882)
Annual Growth Rate	4.278 (1.180)	1.247 (1.213)	0.517 (1.222)	0.202 (1.228)
Total Population	0.919 (1.971)	29.239 (16.616)	0.621 (1.615)	-24.559 (22.502)
Employment rates (15~24 years old)	-0.489 (0.104)	-0.386 (0.118)	-0.217* (0.101)	-0.162 (0.129)
Intercept	-129.176 (54.375)	-801.698 (252.853)	-44.757 (46.670)	190.008 (401.694)
Time Dummies (F-test for combined significance)	N/A	N/A	6.888***	1.845
Adjusted R ²	0.498 ^c	0.967	0.578 ^c	0.968
P-value	.000	.000	.000	.000

Note. a. Model preferred by Hausman test. b. Clustered standard errors for panel data. c. Non-adjusted R² produced by STATA. p<.05, **<.01, ***<.001 (two-tailed tests).

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CHAPTER III

World Education Finance Policies and Higher Education Access: A Statistical Analysis of World Development Indicators for Ninety-eight Countries

Introduction

Over the last decade, higher education around the world has generally expanded from serving the elite (under 15% of the college age group participating in postsecondary education) to the masses (20% to 30%).¹ This expansion occurred not only because of growing individual demand but also because of national goals to achieve social justice and enhance competitiveness in a global economy (Johnstone, 2004a; Premfors, 1984). Along with the expansion, a key issue now, however, is how to fund access to higher education in light of diminishing public resources (Chapman & Greenaway, 2003), as governments no longer can afford to subsidize mass higher education and the traditional approach of low or free tuition has come to be considered a regressive use of taxpayers' resources (Barr, 2002, 2005; Chapman, 1997; Johnstone, 2004a). Since the 1990s, many countries in the world have shaped their education finance policies to maximize the utilization of scarce resources to provide access to higher education.

Given the huge investment in higher education and the tension between growing demand and reduced public support, it is reasonable to ask: Have the recent education

¹ The cut-off points of elite and mass higher education was defined by Trow (1972, 1973).

finance policies across nations—represented mainly by public/government resources devoted to education—promoted access to higher education? And, does the effect of education finance policies on higher education access vary between developed and less developed countries? None of the existing literature has addressed the two questions. Therefore, this article employs panel data methods to investigate the relationship between public finance on education and college access among developed, developing and the least developed countries in the world. The empirical findings of this study have important implications for those government agencies involved in higher education policy.

Theoretical Framework and World-Wide Practices

In this section, the theoretical literature which gives a rationale for government or public spending on higher education is reviewed, followed by a summary of the international trends and practices of education finance policies across developed, developing and least developed nations.

Public Financing of Higher Education Access and Economic Growth

Many economic studies have reported a generally positive correlation between education and economic growth (e.g., Barro, 1991; Bils & Klenow, 2000; Diamond, 1989; Mincer, 1995; Patrinos, 2000; Temple, 2000). These studies have given great importance to government and private spending on education as an investment in human capital. According to Becker (1975), individual investment in human capital via education or training provides returns in the form of individual economic success and achievement. Human capital theorists also acknowledge that widespread private investment in schooling is associated with external benefits (i.e., externalities or

spillover) in a society, such as improved productivity of workers, greater tendency to adopt advanced technologies, better involvement in democratic society, healthier life, higher rates of family savings, and reduced crime and the associated social disruption (Cohn and Geske, 1992; Gradstein & Justman, 1995; Hall, 2006; Poterba, 1995). The society-wide externalities associated with the education of each individual have also served as the basic rationale for government investment in education.

Based largely on human capital theory, the new (endogenous) growth theory mainly builds macroeconomic models out of microeconomic foundations (Parente 2000). The theory has the advantage of analyzing the role of higher education in fostering economic growth at a national level, revealing the importance of public educational expenditure for sustained growth in a world of rapidly changing technology. According to the new growth theory, public financing to promote higher education access is crucial for producing more college-educated workers to increase national competitiveness and generating a higher national GDP (Gross Domestic Product) (Chapman & Greenaway, 2003; Corrado, Haltiwanger, & Sichel, 2005; Keefer & Khemani, 2005; Romer, 1990, 1994).

In economics, the new growth theory was developed in the 1980s in response to criticism of the neo-classical growth model (or exogenous growth model).² One of the most influential contributors to the endogenous-growth literature is Romer (1990, 1994) who noted that technological change—improvement in the instructions together with raw materials—lies at the heart of economic growth, and that it arises in large part because of

² In neo-classical growth models, the long-term rate of growth is exogenously determined by either assuming a savings rate (the Solow model) or a rate of technical progress. However, this begs the question, as the savings rate and rate of technological progress remain unexplained. Endogenous growth theory tries to overcome this shortcoming by building macroeconomic models on microeconomic foundations. For a detailed comparison of these two growth theories, please refer to Parente (2000).

intentional actions taken by people who respond to market incentives and translate new knowledge into goods with practical value. Thus, in Romer's view, long-run economic growth is not the result of exogenous technological changes or forces that impinge from outside, but an endogenous outcome driven largely by intentional decisions of human capital investment made by profit-maximizing agents.

One negative aspect of a recent endogenous growth model is the suggestion that individuals in firms may under-invest in education, resulting in slower economic growth. Rustichini and Schmitz (1991) developed a model in which individuals divided their time between production, acquisition of knowledge and original research. Individuals know that acquiring knowledge will raise their productivity in subsequent research. However, since individuals do not fully capture the technological advances and social benefits that research may lead to, they tend to spend too little time acquiring knowledge. Thus, Research and Development (R&D) may be difficult to implement and monitor, resulting in a slower growth rate relative to the socially optimal outcome. Given that under-investment in education may result in slower growth, Temple (2000) and Kopf (2007) suggest that governments subsidize not only R&D but also certain kinds of education—particularly higher education—to foster technological change and advances in R&D.

The new growth theory suggests that, in searching for the determinants of economic growth, policies related to higher education are a potentially fruitful area to examine. For example, public subsidies on R&D or education increase the growth rate by adding to an individual's incentive to respond to the market. The theory regards human capital as an important input in the creation of new ideas and provides a relatively appealing justification for viewing education as one of the central determinants of growth

rates. Moreover, the new growth theory differentiates two ways of raising human-capital stock (or educational achievement of a nation): 1) by improving the basic level of education for all workers (or improving literacy for some developing countries); and 2) by training some workers to higher education levels, such as university degrees or above. The former would appear to be normal educational practices, whereas the latter is more relevant for innovation and technological advances. It is not surprising that Chapman (2003) draws on the new growth theory to conclude that “the role of higher education is complex with educational improvements seen to facilitate technological progress, which is the engine of economic growth” (p. 7). For many countries, particularly developing countries, this increasing faith in higher education as an agent of growth has led to heavy educational investment (Paulsen, 2001).

Although the new growth theory rationalizes why educational spending may foster economic growth, it neither identifies different roles of varying education finance programs (e.g., loans, grants) in affecting higher education nor addresses whether the patterns of education finance may affect social equity. These issues are examined in Friedman’s (2005) research. Friedman analyzed the case of the U.S. and recognized the great financial difficulties that young, low-income Americans may not attend any college without a scholarship. He warns the current financing mechanism that adopts privatization strategies (e.g., charging tuition and using loans) is a serious problem in overcoming the disadvantages of family backgrounds. Thus, in Friedman’s perspective, government intervention via investment in education is a potential means of overcoming income inequality associated with economic development. He also recommends targeting

financial resources to the student population that is financially constrained at both high schools and college levels, probably starting from an even earlier stage.

Allocation of Government Spending on Higher Education vs. Basic Education

Despite the acknowledged importance of higher education for fostering growth, there is some controversy as to which education sector—higher education or basic education—should receive a greater allocation of public resources. The key issues in the controversy involve the efficiency of the two sectors and equity among different income groups. The difficulty in computing education costs with respect to social and private returns, especially non-monetary returns, has plagued the allocation argument.

The efficiency argument for reallocation of public funds from higher to lower levels of education is based on differences in the estimated social returns of various levels of education. Some scholars have found that basic education yields higher social rates of return than higher education, tending to benefit the poor more than the rich, and feel that allocation of scarce government funds should favor basic education. For example, Psacharopoulos, Tan and Jimenez (1986) and Psacharopoulos (1994) demonstrated that estimated social returns throughout the developing world are higher at the primary (and secondary) levels. These studies emphasized the efficiency and equity costs associated with relatively high public spending on higher education compared with primary education, and recommended the imposition of selective user charges at the university level and the reallocation of government spending on education towards basic education.

In contrast, Birdsall (1996) suggested that a higher portion of public funds go to higher education as the social return of higher education would be higher than that of basic education if many unmeasured social benefits (such as increased involvement in

public affairs and reduction in criminal activities), underestimated in the previous research, were taken into account. While social return to higher education is high, the social benefits of primary and secondary education, on the other hand has decreased over time in developed and developing countries because more students complete these levels and do not achieve advantages in the job market. Moreover, reforms in the financing and the governance of higher education in developing countries would raise quality and improve internal efficiency, thus greatly increasing the social benefits of higher education. For example, in some developing countries such as the Philippines, internal efficiencies in a higher education institution could be increased in terms of reduced repetition and more responsive teaching faculty if tuition and other charges were introduced. User charges would also help ensure that a higher proportion of public funds in the higher education field could go to the public goods of basic research and graduate training. Thus, Birdsall encouraged a reallocation of government resources for primary (and secondary) levels to higher education.

Similar to Birdsall's (1996) argument, Patrinos (2000) noted that government recognition of education as a tool for economic and social development is an underlying rationale for investing large shares of GDP in education. Having been regarded as an engine of economic growth in the information economy, higher education's priority for receiving government funds among all education sectors has increased.

Global Trends and Policy Practices of Privatization and Cost-sharing.

The recent comparative literature has widely reflected the trend of privatization and cost-sharing as the two most important trends in higher education finance policies worldwide. Privatization and cost-sharing both shift the burden of college costs from the

government or taxpayers to students and their parents through tuition and fees and result in a reduction in government grants, the replacement of grants with student loans, and the increase of tuition-dependent private sector institutions.

Developed Countries. In the United States, some scholars have agreed on the positive effects of some components of financial aid, particularly need-based grants, on college enrollment. For example, according to Heller (1996), tuition increases negatively influence college enrollments, especially for low-income and minority students, while some student financial aid programs have a positive impact on college access; specifically, government need-based grants have a much greater effect on enrollment than student loans. St. John and Noell (1989) estimated the effects of student financial aid offers on student enrollment decisions for three U.S. high school cohorts in the 1970s and 1980s. They separately analyzed the effects of each type of financial aid (grants, loans, and work study), along with a combination of two or more types of aid, controlling for students' social background, academic achievement, high school experience and postsecondary aspirations. They found that all forms of financial aid had a strong positive impact on students' decision to enroll in college.

Although many European countries remain bastions of "free" higher education, depending heavily on public financing, increased privatization and cost-sharing have become evident in recent decades. In the early 1990s in Germany, Denmark, Greece and Luxembourg, free access to college was common and grants were the most common form of basic assistance (EURYDICE European Unit, 1993; Psacharopoulos, 1992). However, the recent decade has witnessed a mixed system of grants and loans in Germany, Luxembourg and Greece; unconditional loans in 18 other countries; and means/merit

loans in seven countries. More countries are beginning to charge or increasing tuition for domestic students or students within the European Union (Vossensteyn, 2004). For example, in 1998 the U.K. introduced tuition fees and income-contingent loans³ for higher education (Barr, 2004). Sweden is the only country that has increased the availability of grants of grants to 30 percent of the total aid without charging tuition or fees (Reuterberg & Svensson, 1994; Vossenteyn, 2004). In 1985, Sweden introduced income-contingent loans that took effect between 1989 and 2001, but replaced with ordinary annuity loans largely due to increased labor mobility and inconvenience of cooperation with foreign tax authorities (Poutvaara, 2004).

Developing and Least Developed Countries. Many developing and least developed countries in Asia introduced tuition fees and student loans as a means of financing higher education while overcoming public financial austerity. In India, due to the continual financial constraints of the government, higher education has been increasingly subsidized by non-government money, including household expenditures, fees, student loans, and voluntary contributions (Tilak, 1993). In Southeast Asia, five states (Indonesia, Malaysia, Philippines, Thailand, and Vietnam) have expanded private higher education institutions to increase access. As a result, they have set high fee levels which preclude enrollment by the poor, who are now also being squeezed by rising fee levels at public higher education institutions (Welch, 2009). In the least developed countries such as Bangladesh, more than half of the enrollment in higher education has been absorbed by the private sector since the mid-1980s (Tilak, 1991). In Cambodia,

³ Income contingent loans are different from ordinary loans to students because they have no fixed interest and repayment terms. If loans are not income contingent, they do not equalize opportunity (Lleras, 2004).

private institutions have experienced remarkable growth because of the urgent need for higher education (Altbach, 1999).

In Latin America, the ideology of free higher education has disappeared in recent decades. For example, in Colombia financial constraints and student unrest during the National Front (1958-1974) led to an increase in private higher education to meet the sharp increase in demand that followed. However, public universities did not expand at the same time. Admittance into the elite private universities is associated with family income, so students from the lower-middle-class have recently been channeled into low-cost, low-quality institutions of higher learning. In Brazil, private universities have become the government's instrument for expanding access to higher education, although they are self-financing and generally provide a lower quality of education (Eisemon & Holm-Nielsen, 1995). In the early 1980s, the Chilean government changed procedures for financing public universities to encourage income-generating activities and cost savings, requiring public institutions to impose fees (Eisemon & Holm-Nielsen, 1995); such changes greatly expanded the number of tuition-charging private colleges and universities, led to the establishment of a loan scheme for students in public institutions, and gave "vouchers" to the most talented secondary school graduates negotiable at either public or private institutions.

Africa has also encountered the problem of inadequate resources to fund the growing demand for higher education, resulting in the introduction of tuition and student loan programs in both developing and least developed countries (e.g., Ghana, Lesotho, Kenya, Uganda, Zambia) (Johnstone, Arora, & Experton, 1998; Teferra & Altbach, 2004). Johnstone (2004b) reveals that African governments are increasingly unlikely to raise

enough revenue by taxation to meet currently underfunded social needs and simultaneously provide substantially more access in the face of rising costs of higher education. Thus, charging tuition and fees together with student loan programs are widely recognized as both necessary and sound (Johnstone, Arora, & Experton, 1998). Overall, the implementation of education finance policies in Africa has generally been slow, sporadic and uneven, creating problems for program evaluation and improvement.

In sum, the literature illustrates the trend toward increased privatization and cost-sharing accompanied by simultaneous growth in college enrollment in most developed countries. In general, increasing college costs negatively affect access, whereas some financial policy components, particularly grants, have a positive influence, especially for low-income students. In addition, although successfully implemented in developed countries, education finance policies might not be successfully implemented and evaluated in developing and least developed countries due to the lack of a necessary economic infrastructure and the absence of carefully designed programs.

Research Question

Despite the important contributions of the aforementioned studies in framing theories and analyzing the world-wide trend, none of the existing research has provided empirical evidence as to whether public expenditures on education, both on the whole and separately in different sectors, has promoted higher education expansion in the past decade across developed, developing and least developed nations. Furthermore, the analytical approaches of the existing comparative studies on the impact of financing policy on access are mostly descriptive in nature, implying that these results are only suggestive—rather than definitive—for the effect of various factors on access. To address

these two problems, this article will use statistical methods to examine the relationship between public finance policies and college access across countries.

Specifically, the research questions are: 1) Are education finance policies, such as public expenditure on education as percentage of GDP, and public expenditures per tertiary student and per secondary student as a percentage of GDP per capita (a ratio that compares public expenditure per student enrolled to the average GDP per capita), related to tertiary enrollment ratios in 98 countries from 1998 to 2006, after controlling for the strength of the national economy, secondary and primary enrollment, and population characteristics? 2) Does the effect of education finance policy on higher education enrollment differ between the developed countries and less developed countries?

Methodology

The analytical framework of this study is largely based on the previous chapter that integrates economic and social-demographic factors in illustrating the role of financial aid policy in college access within OECD countries. Unlike the OECD paper, this chapter expands the dataset from a small group of high-income OECD countries to 98 countries of both developed and less developed economies. Given that the financial aid indicators (e.g., scholarships/grants, student loans) used for the OECD data analyses are not available for most of the 98 countries, this paper uses a set of fixed- and random-effects models that exclude the financial aid predictors. This chapter then specifies a set of panel data models and selects the best performed models, followed by discussion on data limitations.

Dataset

The dataset is drawn from the World Development Indicators (WDI) published by the World Bank. The study examines college access in 98 countries with sufficient data from 1998 to 2006 and forms a cross-country time-series (panel) dataset with 882 data points before accounting for missing values. These countries include 31 developed, 49 developing and 18 least developed countries in Africa, the Americas, Asia, Australia and Europe (see Appendix 3.A, Country List by Continent and Economic Level).

Variables

This study selects 13 variables from the WDI (See Appendix 3.B, Definitions of the Variables). The dependent variable is the tertiary Gross Enrollment Ratio (GER), a combination of tertiary-type A and tertiary-type B education. The education finance policy variables include public spending on education as percentage of GDP, public expenditure per secondary student as percentage of GDP per capita, and public expenditure per tertiary student as percentage of GDP per capita. Public expenditure on education as a percentage of GDP gives an indication of how a country prioritizes education in relation to its overall allocation of resources. Public expenditure per secondary or tertiary student provides an insight into how much money is invested in each student, in relation to GDP per capita, so that the indicator can be a comprehensive estimate for secondary or higher education unit cost and governments' role in sharing the cost. GDP per capita⁴, a measure of average income and other economic factors, is of

⁴ Since other economic indicators (e.g., national average income) are not available or have too many missing data in the WDI dataset, this study chose GDP per capita as a proxy for economic development. The data on GDP per capita in this study are in the unit of constant 2000 USD. The data in the unit of purchasing power parity in 2005 international dollars resulted in roughly the same results, which are available on request.

primary interest in this study mainly because of its importance in covering the rising cost of college education.

The literature review showed that education finance policies vary widely in their size and emphasis between developed and less developed countries. Thus, the study generates a dummy variable to classify the economic development level of the 98 countries (1=Developed countries; 0=less developed including developing and least developed countries) and create four interaction terms from the dummy variable, the three education finance variables and GDP per capita. The interaction terms allow the study to test whether the effects on college access by the manner in which a country finances its higher education depends on its economic development level.

Since the previous literature suggested that many other factors such as population characteristics (e.g., aging population (Lopez, 2006); population growth rate (Pascarella & Terenzini, 1998), rural population (Hu, 2003; James et al., 1999)), gender equity issues (Chanana, 2004; Chapman & Ryan, 2005), youth labor (Justesen, 2008), and prior education preparation (Jallade, 1989; Young, 1993) may also affect higher education access, two groups of control variables were added: 1) five demographic variables--the percentage of citizens 65 years and older, population growth rate, female population, rural population, population size, and employment rates of youth population (15-24 years old); and 2) three basic education variables--gross enrollment ratios of the primary school-aged student group (6-11 years old) and the secondary enrollment group (12-17 years old), and sex ratio (girls: boys) in primary and secondary education. Finally, due to their skewness, the three variables—total population, GDP per capita, and public

expenditure per tertiary student as a percentage of GDP per capita—were transformed using the natural logarithm function.

Statistical Models

Two frequently employed statistical models for panel data are fixed-effects and random-effects model. The fixed-effects model (least square dummy variable (LSDV) estimation method) estimates a separate intercept for each country (and year), whereas a random-effects model draws country-specific intercepts for each country from a specified distribution. Generally, the equation characterizing the one-way panel data models are as follows:

One-way random-effects model:

$$y_{it} = \alpha + \beta_1 x_{1it} + \dots + \beta_k x_{kit} + (\mu_i + v_{it}), \quad \text{where } v_{it} \sim IID(0, \sigma_v^2), \mu_i \sim IID(0, \sigma_\mu^2) \quad (1)$$

and one-way fixed-effects model:

$$y_{it} = (\alpha + \mu_i) + \beta_1 x_{1it} + \dots + \beta_k x_{kit} + v_{it}, \quad \text{where } v_{it} \sim IID(0, \sigma_v^2) \quad (2)$$

where $i (= 1, 2, \dots, N)$ denotes the i^{th} country; $t (= 1998, 1999 \dots, 2006)$ represents each year; α is the intercept of the model; β_k is the coefficient associated with the independent variables x_{kit} ; μ_i are country specific intercepts which are either random or fixed and v_{it} denotes the error term. In equation (1), the country dummies μ_i are considered as a part of the error term and assumed to be independent of v_{it} and x_{it} , which are also independent of each other for all i and t ($\mu_i \sim IID(0, \sigma_\mu^2)$). In equation (2), μ_i is considered part of the intercept. By assumption, $E(v_{it}) = 0$ and $\text{Var}(v_{it}) = \sigma_v^2$, while $v_{it} \sim IID(0, \sigma_v^2)$ indicates that errors are Independent and Identically Distributed (IID).

The panel dataset can capture variations along not only group (country) but also time, which are both important to the study because: 1) unobservable and time-invariant effects may exist for each country (e.g., national culture, political structure, education values and spending pattern on higher education); and 2) time may have a potential influence, as some variables (e.g., total population) tended to increase annually during 1998-2006. Including both the group and time effects into fixed or random-effects models could provide a more powerful study with both spatial and temporal dimensions, thus enhancing the quality of study. Therefore, this study follows a general equation that contains both country and time effects to estimate the impacts of education finance variables and other predictors on tertiary enrollment ratios:

$$y_{it} = \alpha + \beta_1 x_{1it} + \dots + \beta_k x_{kit} + \mu_i + \gamma_t + \varepsilon_{it} \quad (3)$$

In equation (3), the terms γ_t denotes the time effect. By varying the structure of equation (3), the following four models can be specified. First, disregarding the time effect γ_t , a one-way random-effects model (Model 1) and a one-way fixed group effects model (Model 2) can be estimated. Second, by adding the time dummies γ_t in Model 1-2, a new one-way random-effects model (Model 3) and a two-way fixed group and time effects model (Model 4) are estimated. Two-way random-effects model was tried but not included in this study mainly due to difficulties of execution on statistics software programs.

Both fixed and random-effects models have pros and cons. Fixed-effects models can capture the time-invariant country-specific effects and allow these effects to be correlated with the other independent variables. However, the model does not yield coefficient estimates for any independent variables that are time-constant. Random-

effects models can capture the between-group variation, allow time-constant independent variables to be included in the regression and produce efficient estimates if the assumed parametric distribution of the random effects is correctly specified. Additionally, random-effects models would treat the selected countries as random draws from a larger population and allow making unconditional inferences to a larger population. However, if the random effect is correlated with the other included regressors, the random-effects estimates will be biased.

This study reports the results from all four models. However, a Hausman test is calculated to check the independence assumption of the random-effects model.⁵ It is important to note that some researchers have found that the Hausman test has low power for rejecting the null hypothesis (Lamb, 2000, 2003; Nakamura & Nakamura, 1985).

Since this study is rooted in endogenous growth theory and the previous literature often reported endogeneity problem (or bilateral causality) between economic growth and education outcome in time-series analysis (e.g., Barro, 1991; Mankiw, Romer, & Weil, 1992; Rebelo, 1991), the study conducts a Durbin-Wu-Hausman endogeneity test for each model to determine whether the GDP per capita variable is endogenous. If the tests reveal significant endogeneity, the assumption for ordinary linear regression that explanatory variables are uncorrelated with errors is violated, leading to biased and inconsistent estimates.

⁵ The Hausman specification test compares the fixed effects versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model (Hausman, 1978). Hausman's essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero (Greene, 2003). $m = (b_{Robust} - b_{Efficient})' \Sigma^{-1} (b_{Robust} - b_{Efficient}) \sim \chi^2(k)$, where $\Sigma = Var(b_{Robust}) - Var(b_{Efficient})$ and k is the number of regressors.

A general solution to the endogeneity problem is to apply an instrumental variables (IV) method (Wooldridge, 2002). The method relies on finding one or more appropriate instrumental variables, z_1, z_2, \dots, z_M , that affect the endogenous variable x_{Kit} —GDP per capita in this case—but do not affect the outcome variable at the same time. The study tried many potential IVs⁶ and this study finally uses the following three kinds of IVs: 1) electric power consumption per capita as a single instrument ($r_{\text{GDP per capita}}=0.82$, $p<.001$. Please see Appendix 3.B for definition) because it boosts GDP and is less likely to directly affect higher education enrollment. Durbin-Wu-Hausman tests also indicate that the models instrumented with this IV provide more consistent estimation than regular panel models ($\chi^2_{(16)} = 1216.53$, $p<.001$; $\chi^2_{(24)} = 3987.92$, $p<.001$); 2) the first order lag of the GDP per capita ($r_{\text{GDP Per Capita}}=0.99$ ($p<.001$)) as a single instrument because it reduces the contemporaneous error problem in the regular panel models; and 3) the linear combination of 1) and 2) as multiple instruments.

Wooldridge (2002) suggests two-stage least squares (2SLS) estimator is the most efficient IV estimator, conditional on using a linear combination of multiple instruments. Recall that two-stage least squares estimation first regresses the endogenous variable x_{Kit} on the instruments and other exogenous variables:

$$x_{Kit} = \delta_0 + \mu_i + \delta_1 x_{1it} + \dots + \delta_{K-1} x_{K-1it} + \theta_1 z_{1it} + \dots + \theta_M z_{Mit} + r_{Kit} \quad (4)$$

The predicted value of the endogenous variable is then calculated:

⁶ Potential IVs the study tried include net export, foreign direct investment, and the second and the third lags of GDP per capita. The first two were finally abandoned mainly because their correlations with GDP per capita are relatively lower ($r_{\text{export}}=0.75$, $r_{\text{investment}}=0.42$), and because Durbin-Wu-Hausman tests cannot confirm the IV models are more consistent than regular panel models. Since the second and the third order lags of GDP per capita both yield nearly the same results as those from IV models instrumented with the first order lag, the study only keeps the first order lag of GDP per capita as an IV to avoid redundancy.

$$\hat{x}_{Kit} = \delta_0 + \mu_i + \delta_1 x_{1it} + \dots + \delta_{K-1} x_{K-1it} + \theta_1 z_{1it} + \dots + \theta_M z_{Mit} \quad (5)$$

The second stage then uses the predicted value \hat{x}_{Kit} in place of the endogenous variable x_{Kit} itself:

$$y_{it} = \alpha + \mu_i + \beta_1 x_{1it} + \dots + \beta_{K-1} x_{K-1it} + \beta_K \hat{x}_{Kt} + v_{it} \quad (6)$$

Using the 2SLS approach, four IV models that correspond to the four regular panel data models specified earlier are estimated for each of the three IVs: IV Model 1 for one-way random group effects, IV Model 2 for one-way fixed group effects, IV model 3 for a new random group effects model with time dummies, and IV Model 4 for two-way fixed group and time effects. Hausman test is followed to choose preferable models. Then the results of all IV models using the three kinds of instruments are compared.

Additionally, the study suspects that previous years' public expenditure may also have an impact on the current year's college enrollment. Such time lag exists largely because those primary or secondary students who received government financial support one or more years ago are currently attending college (Mogues, Ayele & Paulos, 2008). However, after estimating several models that included the first or second lagged variables of education finance, the study decided to exclude these lagged terms given their lack of statistical significance.⁷

Limitations of the Data

Several limitations restrict the analysis. First, unlike the OECD dataset, which provides detailed information on subcategories of public spending for the 33 member countries, the World Development Indicators by the World Bank provide information

⁷ Results with these lagged variables included are available on request.

mostly measured on a macro scale for approximately 200 countries/regions and lack a necessary classification into components. For example, the available education finance variables in the WDI dataset are all aggregate measures that are not classified into the components of institutional expenditure and student aid programs, two measures that are provided in the OECD dataset. This problem restricts this study from more specific investigation of the roles of different spending items in the world-wide trend of privatization and cost-sharing. Second, the dataset contains considerable missing values for some variables. Given that the mechanism of missing data is completely at random, different imputation methods were tried. Since multiple imputation methods produced several extreme values that far exceeded the range of original data, the study imputed 112 (1%) missing points in total on the 13 variables with either the average of two available data points in adjacent years, group means, or the value adjusted with an average growth rate. Third, the countries for analysis were those with sufficient data and were mostly middle- or upper-income countries, with fewer least developed countries. Hence caution should be used when generalizing the results to all countries in the world.

Findings

Trend Analysis

Table 3.1 and Figures 3.1 and 3.2 illustrate that tertiary enrollment of the 98 countries from 1999 to 2006 has increased into a stage of mass access (unweighted mean=32.17%, weighted mean (representing total enrolled students in the entire population of the 98 countries) =29.42%). The enrollment follows an approximately linear trend over years, varying greatly across different continents and income groups.

Figure 3.1 demonstrates that Oceania, North America and Europe, where developed countries are concentrated, enjoy the highest tertiary enrollment ratios, as high as 75%. Higher education attendance in Africa and Asia continents that include mainly lower- income countries is below the sample average over all years, with Africa having the lowest level of attendance. South America is very close to the world mean in college access. Regarding the changing rate of enrollment, Europe and South America achieved the fastest growth, while Africa gained very little over the period. Most continents expanded higher education steadily, except that Oceania and North America both experienced a sharp increase in 2002. Consistent with Figure 3.1, Figure 3.2 marks enormous gaps in college enrollment: the richest countries have the highest college enrollment ratios and the fastest growth, whereas the poorest countries have the lowest education achievement and the slowest growth.

Table 3.1 and Figures 3.3-3.5 show little evidence of a corresponding increase in education finance variables. Generally speaking, the 98 countries spent 4.68% of their GDP on education with a slight positive trend. The developed countries are the most generous in financing their education with a peak of 5.6% in 2003, whereas the proportion of GDP spent on education in the least developed countries was the lowest, fluctuating between 3.5% and 4.6% (Figure 3.3).

Public expenditure per secondary student as a percentage of GDP per capita has stagnated over the nine years with an average of 21.83%, and the differences across groups are relatively small. Financing an enrolled secondary student reached as high as 35 in the ratio of average expenditure per student/GDP per capita for least developed countries in 1999, but declined steeply to 25 in 2001. It is surprising that developed

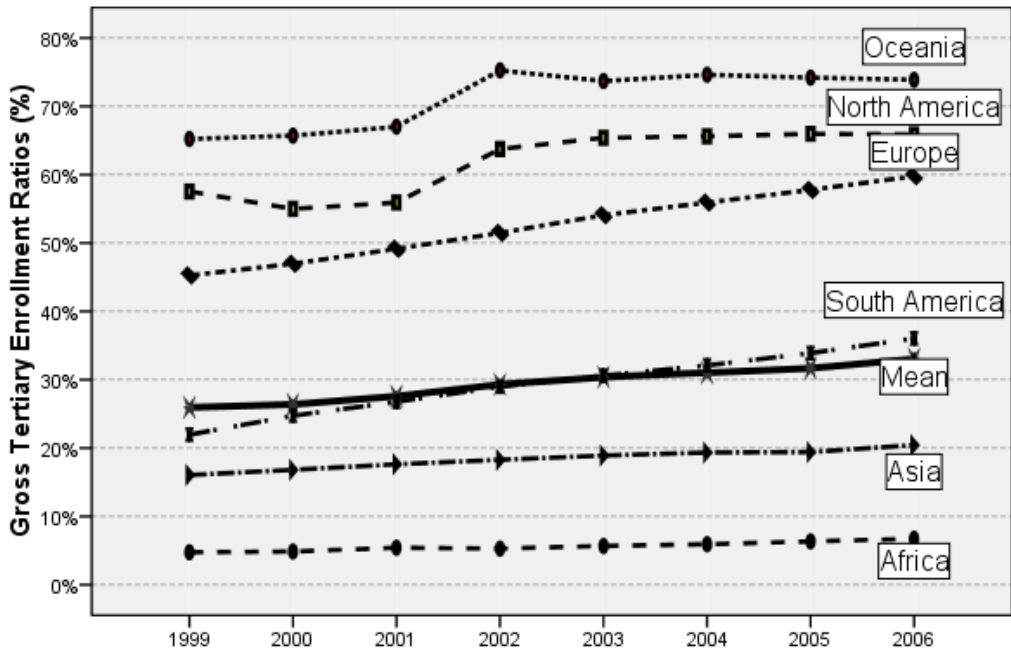


Figure 3.1. Tertiary Gross Enrollment Ratios (GER) across Continents from 1999-2006. (Note: GER are weighted to adjust for the representation of college student population in the entire population of each continent or economic group)

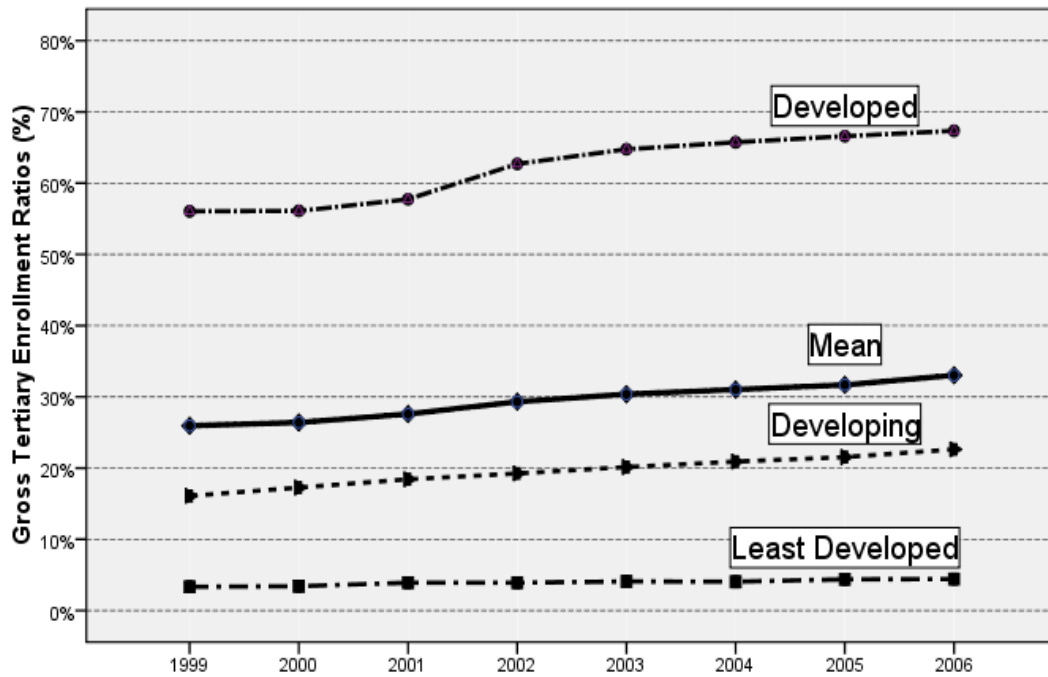


Figure 3.2. Tertiary Gross Enrollment Ratios (GER) across Economic Development Groups from 1999-2006. (Note: The data of 1998 are removed due to missing data, which are vulnerable to the computation of weighted enrollment ratios)

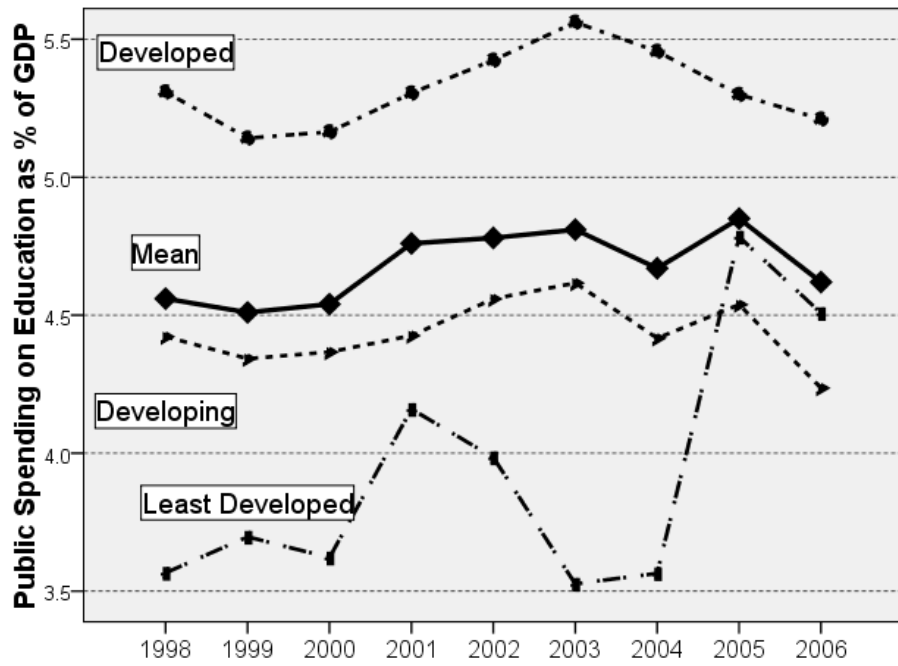


Figure 3.3. Public Spending on Education as Percentage of GDP

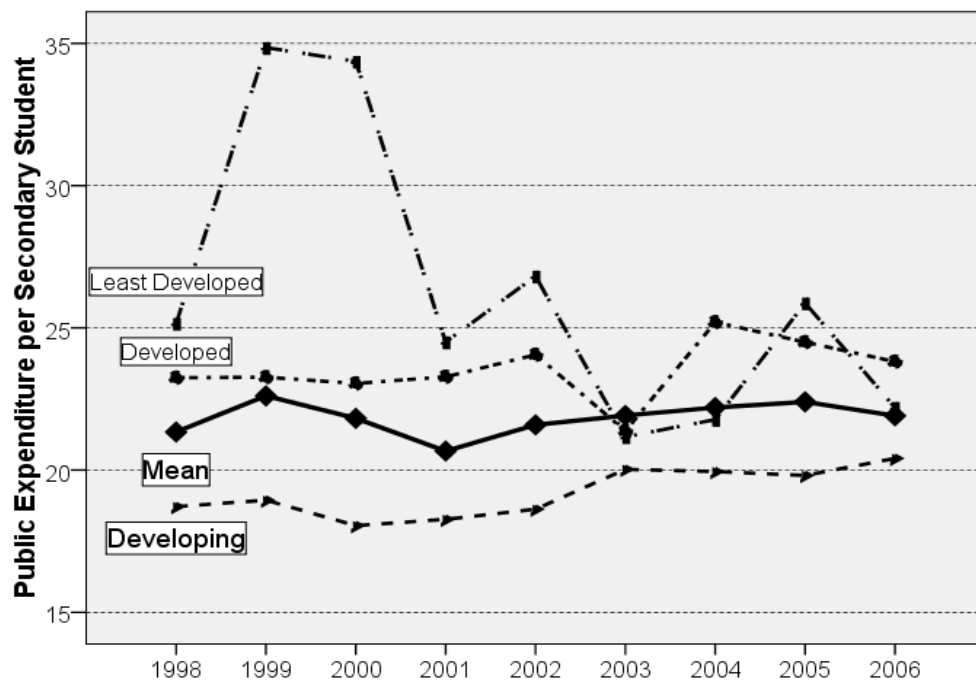


Figure 3.4. Public Expenditure per Secondary Student as Percentage of GDP Per Capita

Table 3.1. Descriptive Results of the Variables (98 countries)

		N	Mean of All Countries by Year									Total Mean	SD
			1998	1999	2000	2001	2002	2003	2004	2005	2006		
Gross Tertiary Enrollment Ratio	Original	849	27.55	27.40	28.34	30.16	31.53	33.39	34.89	36.97	39.34	32.17	24.60
	Weighted	751	/	25.94	26.40	27.59	29.31	30.37	31.03	31.68	33.03	29.42	/
Education Finance													
	Public spending on education as % of GDP	759	4.56	4.51	4.54	4.76	4.78	4.81	4.67	4.85	4.62	4.68	1.70
	Expenditure per secondary student (as % of GDP per capita)	639	21.34	22.61	21.82	20.67	21.59	21.92	22.20	22.40	21.91	21.83	10.42
	Expenditure per tertiary student (as % of GDP per capita)	653	83.61	96.31	96.94	75.81	77.05	69.63	71.95	82.91	91.59	82.18	158.23
Economy													
	GDP Per Capita (constant 2000 USD)	882	7192.93	7341.80	7582.50	7680.90	7752.15	7910.52	8191.91	8436.80	8707.88	7866.38	10264.50
Basic Education													
	Primary Enrollment Ratio	876	99.07	99.04	99.89	100.51	101.14	101.29	102.60	102.81	103.33	101.07	14.24
	Secondary Enrollment Ratio	853	74.30	74.63	75.03	76.93	76.82	77.96	77.58	77.75	78.65	76.65	32.33
	Sex Ratio (girls:boys) in primary & secondary education	852	97.13	96.14	96.42	96.87	96.62	96.79	96.76	97.01	97.01	96.75	9.43
Population													
	% of 65-year-older	882	7.95	8.04	8.14	8.24	8.35	8.45	8.56	8.65	8.73	8.34	5.28
	Annual Growth Rate	882	1.35	1.41	1.34	1.27	1.26	1.25	1.24	1.25	1.24	1.29	1.25
	Female Population (%)	882	50.16	50.17	50.17	50.16	50.15	50.14	50.13	50.13	50.18	50.16	2.50
	Rural Population (%)	882	43.78	43.48	43.19	42.88	42.57	42.27	41.96	41.66	41.34	42.57	23.48
	Total Population (in thousands)	882	32517	32975	33437	33884	34329	34777	35214	35654	36100	34321	110861
	Employment rates (15~24 years old)	882	43.92	43.35	43.10	42.75	42.26	41.87	42.10	42.04	42.14	42.61	13.51
Instrumental Variable													
	Electric Power Consumption(kWh per capita)	747	4020.03	4099.93	4210.30	4284.62	4354.14	4429.72	4529.59	4618.66	4758.96	4367.33	4980.8

countries financed each enrolled secondary student with an average 3 point higher ratio of average expenditure per student/GDP per capita than developing countries, signaling an over-spending trend (Figure 3.4). It is surprising that the tertiary expenditure per student was 82.12% of average GDP per capita and has fluctuated considerably over time, with an overall decreasing trend from 2000 to 2004. This percentage reflects a relatively high cost of educating a college student in relation to their GDP per capita. In particular, tertiary education remains the most costly for the poorest countries, swaying abruptly from 2 to 4 times their average GDP per capita in the nine years. However, these countries often have very low tertiary enrollment ratios so that the country can concentrate resources on a small group of people to finance their college education. The pattern seems to be in agreement with the literature that reported higher costs for higher education than for secondary education and a global trend toward privatization and cost-sharing. The ratio of tertiary expenditure per student to GDP per capita was the lowest (mean=36) and relatively stagnant over time within developed nations (Figure 3.5).

There is a steady growth of GDP per capita in the world over the nine years (mean=7866), with an even greater growth rate after 2003. The gap between the developed and less developed world is enormous: while developed countries enjoy an average GDP per capita of around 20,000 USD over the years considered with big leaps in 2000 and 2004-2006, average GDP per capita of developing countries, while substantially lower, increased from 2,400 to 3,200 USD over the period. The level of GDP per capita for the least developed countries, on the other hand is only 600 USD on average and barely increased over the time period (Figure 3.6).

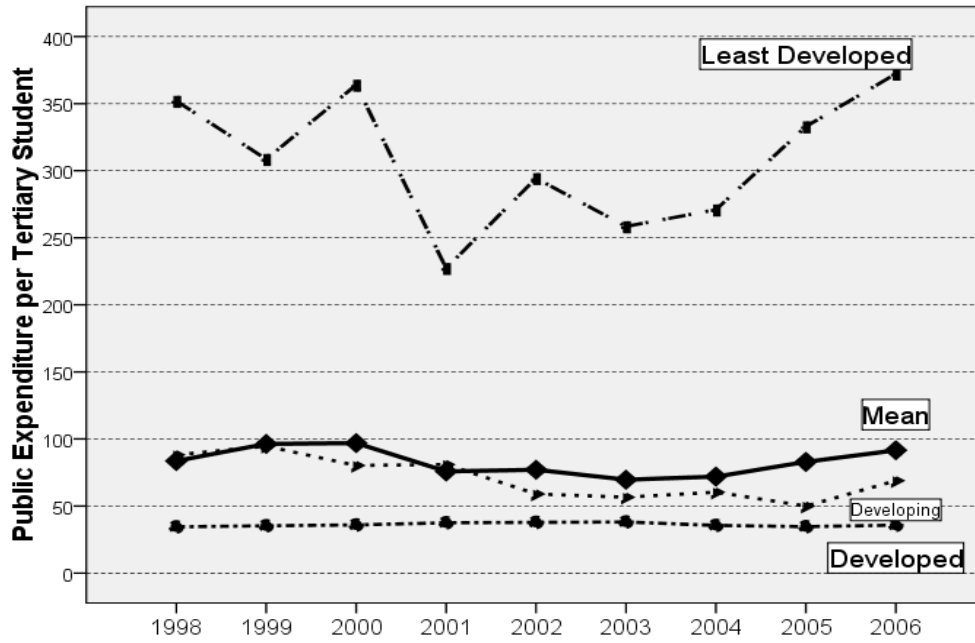


Figure 3.5. Public Expenditure Per Tertiary Student as Percentage of GDP Per Capita

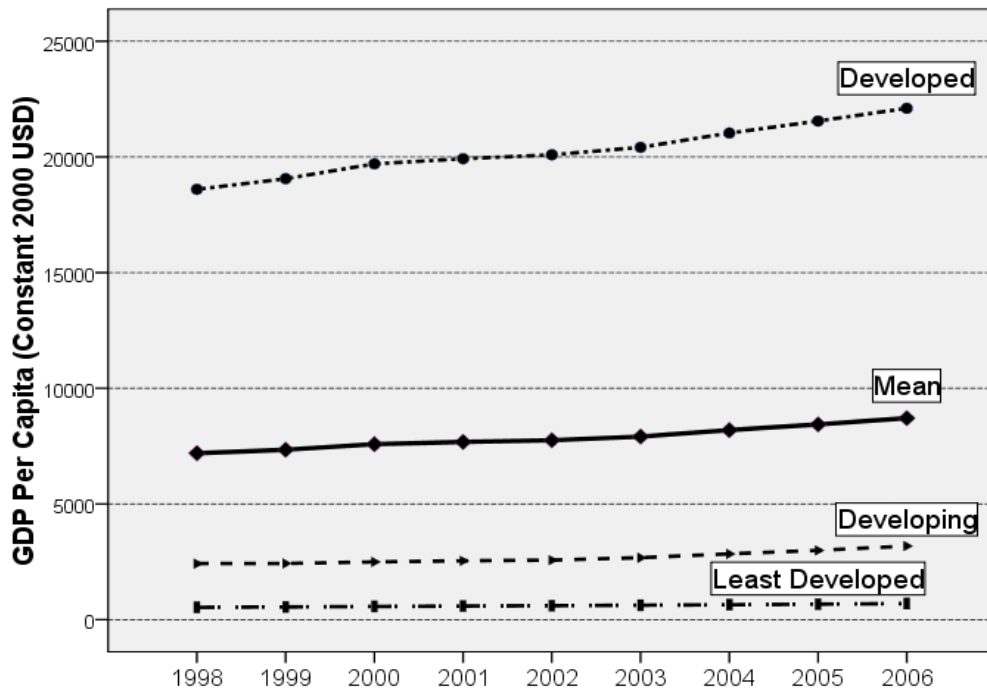


Figure 3.6. Trend of GDP Per Capita

The gross enrollment ratios for basic education are very high but increase slowly. Figure 3.7 shows a remarkable gap of gross secondary enrollment ratios: while the developed countries achieved secondary enrollment ratios that exceeded 100%,⁸ the least developed countries were below 40%. The secondary enrollment in developing countries is on average 76.65%. Figure 3.8 shows that after six-year's rapid growth in elementary education, least developed countries finally caught up with the higher-income countries in 2004 and realized full elementary education attendance. Table 3.1 also indicates that after falling in 1998, the ratio of girls to boys in basic education has slowly increased.

With regard to population characteristics, while the total population has steadily increased, the annual population growth rate and rural population slowly decreased and the percentage of the population over 65 years on average increased slightly over the 9 years. The percentage of females in the total population has been very stable and represents a largely balanced gender ratio. Additionally, the employment rates of the youth population slightly decreased.

The trend analysis reveals two evident patterns. First, college enrollment ratios grew from 1998 to 2006 both overall and for each economic development group, with the rate of increase at different times approximately corresponding to the rate of growth of the economy. Second, there was a shift in public finance strategies for higher education after 2000, including a decrease in the percentage of public expenditure by the government and an increase in the share by the students and their families, strategies

⁸ As it is often cited on the World Bank and UNECO websites, the ideal Gross Secondary Enrollment Ratio is 100%, but ratios greater than 100 can occur when there is a high number of students who repeat a grade, fail to graduate, or are over- or under-age.

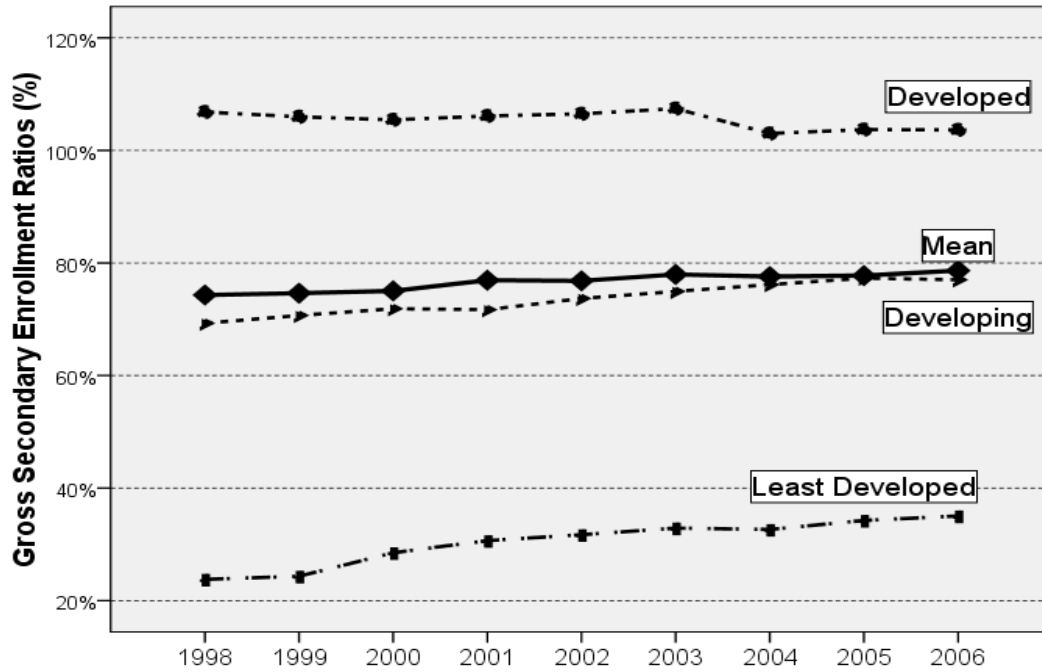


Figure 3.7. Secondary Gross Enrollment Ratios across Economic Development Groups

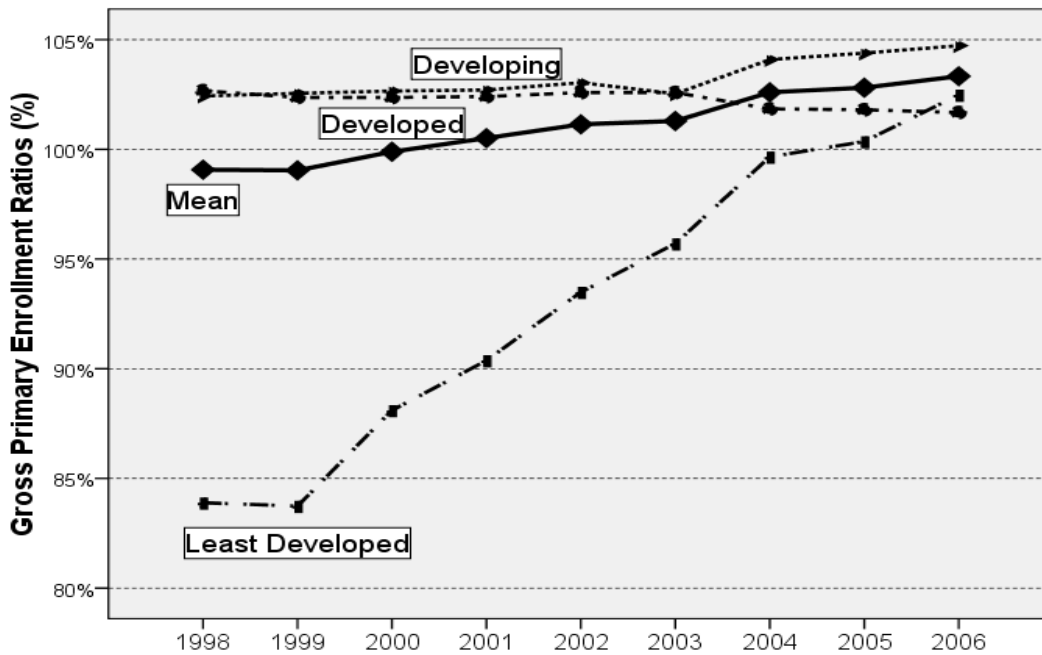


Figure 3.8. Primary Gross Enrollment Ratios across Economic Development Groups

typically characterized as privatization and cost-sharing. The trend analysis suggests that both economic development and the movement toward privatization could explain the growing enrollment rates between 1998 and 2006.

Results of Fixed and Random-effects Estimation

As shown in Table 3.2, all four models have good explanatory power. F-test statistics show that at least one of the coefficient estimates associated with the four interaction terms is different from 0 for all model specifications. In models with no time controls, the result of the Hausman test ($\chi^2_{(17)} = 357.51, p < .001$) indicates that the one-way fixed group effects model (Model 2) is preferred over random-effects model (Model 1). In Models 3 and 4 which include time dummies that are jointly significant, the variance-explaining powers of Models 3 and 4 are both increased by a statistically significant margin, as shown by the combined significance F-tests for the time dummies. The significant time dummies also suggest that including the time effects specifications in Models 3 and 4 remove from the analysis some systematic changes within the countries. The Hausman test did not reject the random-effects specification when time dummies were included, although the test did not yield a positive result ($\chi^2_{(17)} = -16.91$).⁹ Nevertheless, the model with country fixed-effects (Model 4) is preferred because Hausman tests have low power and Model 4 yields consistent estimates when the

⁹ The interpretation of a negative Hausman statistic is still controversial. The 2005 STATA software user guide noted that a negative Hausman statistic is not an unusual outcome in small samples. The negative result is caused by estimated parameter variance differences that are non-positive, semi-definite, and cannot be interpreted because the Chi-square distribution is non-negative (Bhansali, 2007). Schreiber (2008) suggests that using the absolute value of the Hausman test statistic be a remedy for a finite sample. However, not many panel data studies have been found to follow Schreiber's suggestion.

Table 3.2. Panel Data Models of Regressions on Tertiary Enrollment Ratios. (N=612)

	One-way Group Effects Models			Two-way Fixed Group and Time Effects Model 4
	Without Time Effect		With Time Effects	
	Random-effects	Fixed-effects ^a	Random-effects	
	Model 1	Model 2	Model 3	
Education Finance				
Public spending on education (% of GDP)	1.333** (0.381) ^b	0.666 (0.411)	0.646 (0.439)	-0.349 (0.354)
Expenditure per secondary student (as % of GDP per capita)	0.034 (0.054)	0.065 (0.057)	0.028 (0.064)	0.081 (0.066)
Expenditure per tertiary student (as % of GDP per capita)	-4.833*** (1.231)	-4.432*** (1.295)	-3.736*** (1.131)	-3.784*** (1.078)
Economy				
GDP Per Capita (constant 2000 USD)	5.593*** (2.433)	8.216*** (7.440)	3.263* (2.707)	-0.212 (7.015)
Interaction Terms				
Development * Public Spending	6.208*** (1.527)	6.154*** (1.851)	6.184*** (1.456)	5.411*** (1.963)
Development * Secondary Expenditure	0.035 (0.251)	-0.272 (0.246)	-0.095 (0.234)	-0.148 (0.253)
Development * Tertiary Expenditure	-19.483*** (4.579)	-7.801** (4.197)	-15.013*** (3.767)	-8.118** (3.887)
Development * GDP	-1.920* (1.712)	42.989*** (10.821)	-2.276** (1.486)	30.012*** (11.250)
Basic Education				
Gross Primary Enrollment Ratio	-0.026 (0.066)	-0.075 (0.061)	-0.078* (0.060)	-0.027 (0.056)
Gross Secondary Enrollment Ratio	0.013 (0.078)	-0.026 (0.064)	-0.023 (0.061)	0.003 (0.059)
Sex Ratio in Primary & Secondary Education	-0.353*** (0.178)	-0.1033 (0.144)	-0.151 (0.175)	-0.125 (0.151)
Population				
% of 65-year-older	4.143*** (0.617)	5.070*** (1.262)	3.027*** (0.582)	2.552*** (1.392)
Annual Growth Rate	2.400*** (0.19)	0.939* (0.618)	1.928*** (0.644)	0.552 (0.689)
Female Population (%)	-2.100*** (0.840)	-1.508 (2.768)	-0.739 (0.761)	-0.402 (2.483)
Rural Population (%)	-0.039 (0.112)	-0.263 (0.358)	-0.086 (0.114)	0.413 (0.366)
Total Population	1.927* (0.963)	5.584 (10.607)	0.963 (0.861)	-36.379*** (17.041)
Employment rates (15~24 years old)	-0.160* (0.109)	-0.357*** (0.141)	-0.129* (0.096)	-0.183* (0.136)
Intercept	85.292 (56.074)	-210.016 (242.371)	48.101 (53.297)	515.309** (353.327)
Time Dummies (F-test for combined significance)	N/A	N/A	26.38***	7.38***
Interaction Terms (F-test for combined sig.)	27.23***	47.00***	21.58***	27.87***
Adjusted R ²	0.745 ^c	0.982	0.788 ^c	0.984
P-value	.000	.000	.000	.000

Note: a. Model preferred by Hausman test. b. Clustered standard errors for panel data c. Non-adjusted R² produced by STATA. p<.05, **<.01, ***<.001 (two-tailed tests).

country effect is correlated with the other independent variables whereas the random-effects model produced biased estimates.

According to Model 4, two of the three education finance variables and national average GDP per capita, either alone or in interactions, are found to have a statistically significant impact on higher education access. First, although the main effect of public spending on education as a percentage of GDP is not significant on tertiary enrollment, the significance of its interaction term indicates that a one unit change in public spending on education as a percentage of GDP has a greater effect on college enrollment for developed countries than for less developed countries ($\beta=5.411$, $p<.001$). More specifically, all else equal, a one percent increase in public education spending/GDP is associated with a 5.062 (5.411 -0.349) percent increase in college enrollment for developed countries, but a 0.349 percent decrease in college enrollment for less developed countries (thus $5.062 -(-0.349) =5.411$).

Second, public expenditure per secondary student as a percentage of GDP per capita does not bears statistically significant relationship with tertiary enrollment for all countries. The insignificance of its interaction term also notes that the coefficient estimate for this variable remains nearly the same for both developed and less developed countries.

Third, public expenditure per tertiary student as a percentage of GDP per capita, a ratio that compares public expenditure per student enrolled to the average GDP per capita, is found to have a statistically significant, negative association with tertiary enrollment for all countries ($\beta=-3.784$, $p<.001$). The statistically significant interaction effects of public expenditure per tertiary student with economic development groups also indicates

that public tertiary expenditure per student has a smaller impact on college access for developed countries than for less developed countries ($\beta=-8.118$, $p<.01$). The results mean that a log unit increase in public expenditure per tertiary student as a percentage of GDP per capita is associated with a 11.902 (-3.784 - 8.118) percent decrease in college enrollment for developed countries, but associated with 3.784 percent decrease in college enrollment for less developed countries.

Fourth, while the main effect of GDP per capita is not statistically significant, the significant interaction term reveals that the growth in GDP per capita has a greater impact on college access for developed countries than for less developed counterparts ($\beta=30.012$, $p<.001$). While a log unit increase in GDP per capita is expected to increase 29.800 (30.012-0.212) percent of college enrollment for developed countries, it is only associated with 0.212 percent decrease in education outcome for less developed countries.

In Model 4, three control variables are found to have a statistically significant impact on higher education enrollment. First, a one percent increase in the 65 or older population is associated with a 2.552 percent increase in college enrollment ratios ($p<.001$), after all other factors are controlled for. This coefficient estimate was statistically significant and the same sign across all model specifications. Second, after taking all other predictors into account, one log unit increase in the total population of a country decreases the higher education enrollment by 36.379 percent ($p<.001$). Third, all else equal, for a one percentage increase in the youth population cohort (15-24 years old) employed in the job market, tertiary enrollment ratios decline on average by 0.183 percent ($p<.05$). Since the potential endogeneity problem associated with per capita GDP

was not addressed in these estimates, scholars should use caution in interpreting the results.

Results from Instrumental Variable Regression

After conducting Durbin-Wu-Hausman endogeneity tests, the study finds all models are subject to endogeneity. Thus, instrument variable regressions are conducted in which the three types of IVs, electric power consumption per capita, the lagged GDP per capita, and the linear combination of these two variables, were used respectively as instruments for GDP per capita. After controlling for the endogeneity problem, the study finds using the three kinds of IV regression models leads to nearly the same results as those of the regular panel data models in terms of magnitudes and signs of the predictors (please refer to Appendix 3.C for the regression results using the combined IVs as an example). Due to the high similarity across the IV and regular panel models, the study does not interpret the results from IV models but use the regular model results as summarized earlier to frame discussion and draw conclusions.

Discussion and Conclusion

The descriptive and regression analysis found evidence for the research questions. First, for all the 98 countries, while public spending on education as a percentage of GDP and public expenditure per secondary student as a percentage of GDP per capita have no statistically significant main effects on tertiary enrollment ratios, public expenditure per tertiary student as a percentage of GDP per capita bears a statistically significant but negative association with tertiary enrollment ratios between 1998 and 2006, after controlling for national economy, population characteristics, and basic education. Second, the estimates from the interaction terms in the models reveal that, GDP per capita and

public spending on education as percentage of GDP have greater impacts on higher education access for developed countries than for less developed countries, whereas public expenditures per tertiary student as a percentage of GDP per capita has a more negative impact on access for less developed countries than for developed countries. These findings are reasonably conclusive given the consistency across both the regular panel data models and the instrumental variable models.

Public expenditure on secondary education as a percentage of GDP per capita is not a significant predictor for higher education access for all countries. The insignificance can be attributed to two important facts. First, although most developed countries provide complete primary and secondary education, secondary education—including lower and upper secondary school levels—is still incomplete for some developing and least developed countries and represents a challenging area that needs funding to expand itself, not necessarily broadening the pool of college-prepared graduates for higher education. The insignificant predictor of secondary enrollment in the model also suggests that the link between educating more qualified secondary school graduates and attending higher education institutions is not established for the 98 countries. Thus, given the stagnancy of secondary expenditure over recent years as shown in Figure 3.6, it is not surprising that it did not contribute significantly to the rapid growth in higher education.

Second, in some countries (e.g., Brazil, Israel, the Netherlands, Switzerland, and Thailand) that offer a track of vocational/technical programs or schools at secondary level besides the general track for college preparation, a substantial amount of public secondary expenditure is expected to be allocated to vocational track. Unlike the general track, vocational secondary education mainly trains students to enter the job market

directly instead of attending colleges and universities. Previous literature reported that higher private or social rates of return drive the development of vocational secondary schooling (Arriagada and Ziderman, 1992; Neuman and Ziderman, 1991; Bennell, 1996), but the unit cost of vocational schools are more expensive than general schools (Psacharopoulos, 1987; 1994). Considering the incomplete secondary education and vocational track, it is possible that increasing public secondary expenditure is not necessarily associated with growth in higher education enrollment.

The negative relationship between tertiary-level public expenditure per student as a percentage of GDP per capita (a ratio that compares public expenditure per student enrolled to the average GDP per capita) and gross tertiary enrollment for all the 98 countries seems counterintuitive. Previous literature reveals that some public spending components on tertiary education, such as grants and scholarships, has positive effects on promoting college, particularly in developed countries like the U.S. (e.g., Heller, 1996). However, such a high-expenditure-high-access model is very unlikely to be applied to all the 98 countries, especially the less developed. As shown in Figure 3.7, in less developed countries, the ratio of public expenditure per student to GDP per capita has reached as high as 400. Such a high ratio of spending to GDP per capita is possible only for countries with very low college enrollment. When a country spends too many public resources on one college student compared with its GDP per capita, the resources and opportunities allocated to other students may be curtailed. The competition for higher education resources under a fixed budget allocation system may lead to an inverse relationship between per student expenditure and college enrollment (Su, 2006). Therefore, the negative relationship implies that for a fixed amount of total budget on

higher education and a rising enrollment, various nations have reduced spending on each student and drawn on more private resources to expand higher education access

The finding that public expenditure per tertiary student as a percentage of GDP per capita has a smaller impact on college access for developed countries than for less developed countries is logical. For less developed nations, although their governments have increased the use of private resources from students' families to fuel expansion of college access, college education costs are still large in comparison to average GDP per capita. In such situations, public tertiary spending may have a large impact on promoting college access by making college affordable for a larger portion of the college-aged population. This logic is in accordance with the new growth theory (Romer, 1990; 1994) aforementioned, which stresses that subsidizing higher education is an important means for governments to drive economic growth. However, for developed countries, past moves to make higher education available to the masses have made it difficult for governments to provide every college student with adequate funding. The recent growth of tertiary enrollment in developed countries should not be attributed only to increased public expenditures on higher education, but also to an increase in the number of individuals who can afford college as reflected by GDP per capita.

Public spending on education as a percentage of GDP does not have a statistically significant main effect on higher education enrollment, but has a greater impact on college enrollment for developed countries than for less developed countries. Given differences in the achievement of secondary education and the cost of higher education, such findings are not surprising. In lower-income countries where secondary education is limited and higher education is extremely costly, public resources are more likely to be

spent on secondary education, reducing financial support for higher education access. As Friedman (2005) noted, in the developing countries, without support from government, a large part of citizens even cannot afford secondary or even primary schooling. However, for developed countries where most individuals complete secondary education, an increase in public spending is more likely to be invested in higher education to stimulate economic growth. Even in the face of slowing or stagnant higher education spending, the relatively lower cost of college education and the higher income of citizens may increase the likelihood that students and parents can co-share the cost of college education with governments. Therefore, this finding strengthens the argument in previous literature (Birdsall, 1996; Patrinos, 2000) that higher education, as an engine of economic growth, has gained priority for receiving public resources over basic education, but such a priority seems practical for developed countries only.

Although some previous literature (e.g., Friedman, 2005) suggests that economic development drives college access, the study does not find a statistically significant association between the growth of the national economy, as reflected by GDP per capita, and higher education access for the 98 countries. However, the study concludes that the growth in GDP per capita has a greater impact on college access for developed countries than for less developed countries. Such results can be reasonably attributed to the fact that the fast growth in GDP per capita in developed countries in recent decades has enabled the average citizen/household to have more money available to pay for college education, thus increasing college participation. But the very slow growth in GDP per capita in less developed countries does not allow this expense. This finding has important implications for national policies on the financing of higher education, especially for

developed countries. While it might appear that the use of privatization and cost-sharing did not mitigate the development of higher education access in general, there is a substantial body of research that indicates that rising costs of higher education and some financial aid programs (e.g., student loans) may harm college access, particularly among low-income students. Because the current WDI indicator of public expenditure per tertiary student as percentage of GDP per capita did not distinguish between the various types of financial policy programs (e.g., loans, grants), improvement in data collection and exploration of college access for low-income students is needed.

The statistically significant coefficient estimates associated with three control variables may also shed light on the whole picture of higher education development. First, the positive association between the proportion of older population (aged 65 and older) and college access is likely due to the fact that the aging trend, together with the declining fertility rate, may have a positive influence on higher education access, largely through alleviated financial resources, because of fewer pupils (Lopez, 2006). Other scholars warn of a negative influence of the aging trend, mainly due to the fact that a growing proportion of the elderly may demand greater public resources, for example, for pensions and health care, thus shifting public priorities away from investment in education (Duderstadt, 2008; Grob & Wolter, 2005; Preston, 1984). But the latter argument does not generally apply to the 98 countries. Second, the negative association between total population and higher education enrollment means that countries with a larger total population may have a larger college-aged population accordingly, increasing the difficulty for governments with supporting the demand for higher education. Third, the negative relationship between youth employment and college access suggests that the

college financial burden may deter many youths from attending high schools and higher education institutions and may force them to enter the job market. In particular, for less developed countries, many factors such as parental wealth and education, family size, spending long hours on market-based activities (e.g., grain production for market) or domestic chores (e.g., taking care of younger siblings) may lead to youth employment instead of higher education (Godfrey, 2003; Levison, Moe, and Knaul, 2001). Thus, when a large portion of the college-aged population (15-24 years old) is in the labor force, the pool that is academically prepared to attend college and university is reduced. As shown in Table 3.1, the recent decade witnesses a decline in the proportion of youth employment and an increase in higher education. Supporting this financially needy youth population and reducing youth employment represent a realm that needs indirect support from governments to promote higher education.

In addition, this analysis of the World Development Indicators has important implications for analytical methods and future research. The study initiates a new way—using statistical methods—to analyze access using international indicators. Specifically, this study compares results for all the eight fixed- and random-effects models (including four models using instrumental variables), selects the best performing models and examines the cross-model consistence of statistical significance of the education finance variables. Such multi-modeling comparison reduces the bias that relies solely on a particular estimation procedure. In the future, researchers can improve the methodologies and alter the models for further investigation. For example, future research can convert some normalized independent variables (e.g., public expenditure per tertiary student as a percentage of GDP per capita) into real monetary values and test their relationship with

college enrollment, given that GDP per capita is already controlled for in the models.

Interpreting the converted results may facilitate understanding and interpretation.

Appendix 3.A. List of Selected Countries (N=98) by Continent and Economic Development Level (Based on Criteria of the United Nations):

	Developed (31)	Developing (49)	Least Developed (18)
Africa (25)	/	Namibia, South Africa, Burundi, Cameroon, Ghana, Mauritius, Morocco, Mozambique, Swaziland, Tunisia, Zimbabwe	Benin, Botswana, Burkina Faso, Cape Verde, Chad, Congo Rep., Eritrea, Ethiopia, Lesotho, Madagascar, Mali, Mauritania, Rwanda, Uganda
Asia (24)	Cyprus, Israel, Japan, Korea Rep., Kuwait	Armenia, Azerbaijan, India, Iran Islamic Rep., Kazakhstan, Kyrgyz Republic, Lao PDR, Lebanon, Malaysia, Mongolia, Oman, Philippines, Tajikistan, Thailand, United Arab Emirates	Bangladesh, Bhutan, Cambodia, Nepal
Europe (32)	Austria, Belgium, Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom	Albania, Belarus, Bulgaria, Croatia, Estonia, Latvia, Lithuania, Malta, Poland, Romania, Turkey, Ukraine	/
North America (6)	United States	Costa Rica, El Salvador, Mexico, Panama, Trinidad and Tobago	/
Oceania (2)	Australia, New Zealand	/	/
South America (9)	/	Argentina, Bolivia, Brazil, Chile, Colombia, Paraguay, Peru, Uruguay, Venezuela RB	/

Appendix 3.B. Definition of Select Variables from the World Development Indicators

	Definitions
<p>Tertiary Gross Enrollment Ratio</p>	<p><i>Gross enrollment ratio</i> is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. <i>Tertiary education</i>, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level. <i>Gross tertiary education enrollment ratio</i> is calculated based on the number of young people in the five-year age group following the secondary school-leaving age. Tertiary education includes <i>Tertiary-type A education</i> and <i>Tertiary-type B education</i>.</p> <p><i>Tertiary-type A programs</i> are largely theory-based and designed to provide sufficient qualifications for entry to advanced research programs and professions with high skill requirements, such as medicine, dentistry or architecture. These programs have a minimum cumulative theoretical duration (at tertiary level) of three years' full-time equivalent, although they typically last four or more years. These programs are not exclusively offered at universities. Conversely, not all programs nationally recognized as university programs fulfill the criteria of Tertiary-type A. Tertiary-type A programs also include second degree programs like the American Masters. First and second degree programs are sub-classified by the cumulative duration of the programs, i.e., the total study time needed at the tertiary level to complete the degree.</p> <p><i>Tertiary-type B programs</i> are typically shorter than Tertiary-type A and focus on practical, technical or occupational skills for direct entry into the labor market, although some theoretical foundations may be covered in the respective programs. They have a minimum duration of two years full-time equivalent at the tertiary level.</p>
<p>Education Finance</p> <p>Public spending on education as % of GDP</p>	<p><i>Public spending on education</i> measures the current and capital public expenditure on education (including primary, secondary and tertiary levels) includes government (local, regional and national governments, including municipalities (household contributions excluded)) spending on educational institutions (both public and private institutions involved in delivering or supporting educational services), education administration as well as subsidies for private entities (students/households and other private entities), expressed as a percentage of the GDP. <i>Capital expenditure</i> includes expenditure for assets that last longer than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles.</p>
<p>Expenditure per secondary student (% of</p>	<p>Public expenditure per secondary student is the public current spending on education divided by the total number of students at secondary level, as a percentage of GDP per capita (see below for</p>

GDP per capita)	components of public expenditure)
Expenditure per tertiary student (% of GDP per capita)	Public expenditure per tertiary student is the public current spending on education divided by the total number of students at tertiary level, as a percentage of GDP per capita. Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities).
Economy GDP Per Capita	<i>GDP per capita</i> is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in 2000 constant U.S. dollars.
Basic Education Gross Primary Enrollment Ratio	The ratio of primary school enrollment to the number of primary school-aged children (usually 6-11 years old). Programs are typically six years long and represent the beginning of compulsory education in many countries. It can be higher than 100 percent because some students are younger or older than the corresponding age group.
Gross Secondary Enrollment Ratio	The ratio of secondary enrollment to the number of secondary school-aged children (usually 12-17 years old).
Sex Ratio in Primary and Secondary Education	The percentage of girls to boys enrolled at primary and secondary levels in public and private schools.
Population % of 65-years-older	Percentage of 65-years-old and older in the population.
Annual Growth Rate	<i>Population growth rate</i> means the annual increase in a country's population during a given period (usually one year) expressed as a percentage of the population when the period began. The population growth rate is the sum of the difference between the birth rate and the death rate (the natural population increase) and the difference between the population entering and leaving the country (the net migration rate).
Female Population (%)	Percentage of the population that is female.
Rural population	The difference between the total population and the urban population.
Total Population	Total population of the country
Employment	The employment-to-population ratio is defined as the proportion of a country's working-age population that is employed; a high ratio

rates (15~24 years old)	means that a large proportion of a country's population is employed, while a low ratio means that a large share of the population is not involved directly in market-related activities because they are either unemployed or out of the labor force altogether. Ages 15 and older are generally considered the working-age population. Ages 15-24 are generally considered the youth population.
Electric power consumption (kWh per capita)	Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants.

Appendix 3.C. Regression Models Using Electric Power Consumption and the First Order Lag of GDP Per Capita as Multiple Instruments for GDP Per Capita. (N=549)

	One-way Group Effects Models			Two-way
	Without Time Effect		With Time Effects	Fixed
	Random-effects	Fixed-effects ^a	Random-effects	Group and
	IV Model 1	IV Model 2	IV Model 3	Time Effects ^a
				IV Model 4
Education Finance				
Public spending on education (% of GDP)	1.870** (0.641) ^b	0.762 (0.578)	1.274* (0.557)	0.404 (0.560)
Expenditure per secondary student	0.065 (0.127)	0.239* (0.119)	0.044 (0.110)	0.248* ^c (0.113)
Expenditure per tertiary student	-7.116*** (1.326)	-7.409*** (1.369)	-5.667*** (1.166)	-6.514*** (1.344)
Economy GDP Per Capita (2000 USD)	5.662** (1.722)	8.351** (2.796)	2.844 (1.576)	-1.562 (3.090)
Interaction Terms				
Development * Public Spending	5.555*** (1.151)	6.016*** (1.062)	5.649*** (0.996)	5.354*** (1.016)
Development * Secondary Expenditure	0.023 (0.208)	-0.433* (0.189)	-0.109 (0.180)	-0.290 (0.183)
Development * Tertiary Expenditure	-17.033*** (2.553)	-4.543 (2.702)	-12.902*** (2.227)	-5.215* (2.589)
Development * GDP	1.268 (1.033)	44.192*** (4.449)	1.909* (0.904)	30.462*** (4.664)
Basic Education				
Gross Primary Enrollment Ratio	-0.055 (0.055)	-0.089 (0.048)	-0.069 (0.047)	-0.022 (0.047)
Gross Secondary Enrollment Ratio	0.033 (0.041)	-0.021 (0.036)	-0.008 (0.036)	0.013 (0.035)
Sex Ratio, Primary & Secondary Education	-0.454*** (0.122)	-0.153 (0.113)	-0.280** (0.106)	-0.170 (0.107)
Population % of 65-year-older	4.146*** (0.394)	4.690*** (0.560)	2.807*** (0.361)	2.309*** (0.617)
Annual Growth Rate	2.631*** (0.639)	0.809 (0.581)	1.598** (0.554)	0.051 (0.562)
Female Population (%)	-2.258*** (0.645)	-1.905 (1.560)	-0.828 (0.595)	-0.978 (1.565)
Rural Population (%)	-0.095 (0.090)	-0.249 (0.270)	-0.058 (0.081)	0.532 (0.278)
Total Population	2.058* (0.940)	5.684 (8.284)	0.495 (0.862)	-38.003*** (9.962)
Employment rates (15~24 years old)	-0.180* (0.076)	-0.359*** (0.079)	-0.106 (0.067)	-0.174* (0.081)
Intercept	109.375** (40.942)	-212.628 (162.970)	78.814* (37.247)	589.902** (190.805)
Time Dummies (F-test for combined significance)	N/A	N/A	24.12***	6.52***
Interaction Terms (F-test for combined sig.)	75.61***	37.62***	14.13***	20.99***
Adjusted R ²	0.690 ^d	0.978	0.749 ^d	0.980
P-value	.000	.000	.000	.000

Note: a. Model preferred by Hausman test. b. Unclustered SEs produced by STATA for IV models. c. The statistical significance of “expenditure per secondary students” is largely due to the reduced sample size (N₁=549 vs. N₀=612 in regular models) caused by missing data on electric power consumption. If running regular panel models on the 549 data points only, the predictor would also appear significant. d. Non-adjusted R². p<.05, **<.01, ***<.001 (two-tailed tests).

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CHAPTER IV

China's higher education Policy and College Access in a World Setting

Introduction

In the last two decades China has gained the most dramatic growth worldwide, not only in national economy but also in higher education. China's integration into the world economy has been accompanied by historically unprecedented changes in economic structures (Cao, 2001). In the early part of the 21st century, the world viewed China as a potential giant, a major force in the world economy (Dicken, 2003). China is now transitioning from a central-planning economy to a socialist market economy.

China's participation in the global economy and its economic transition have driven changes in its higher education system. By adopting marketization and cost-sharing strategies to expand higher education access, China is undergoing changes similar to those of nations across continents.

Despite the growing influence of economic globalization, national distinctions in higher education still matter (Marginson, 2010). Truly, the long-lasting history, social traditions, education values, existing educational system and extremely large population of China together tend to present a unique case for its higher education. Thus, a detailed

country case study is needed to consider whether the research conclusions developed from aggregated data from multiple nations generalize to this nation.

Drawing on data from the OECD (Organization for Economic Cooperation and Development) countries and a broader group of countries including developed, developing and least developed economic levels from the WDI (World Development Indicators), I completed two investigations into the role of public finance in expanding higher education access in the two country groups. In this manuscript, I use the conceptual frameworks and conclusions from Chapters II and III to frame a case study of China focused on issues of access within this national context. Although China's data were not included in the datasets of the previous two chapters, it is appropriate to use the analytical model and statistical analysis to inform the case analysis.

Questions may arise, however, when using these conclusions to understand and inform the policy practices in the unique case of China: Do factors such as national economy, education finance policies, secondary and primary enrollment, and population characteristics included in the statistical models in the OECD and WDI manuscripts have an influence on China's higher education access? How do these factors affect Chinese higher education access across different social groups? Would the factors that appear statistically significant in the two manuscripts also have a similar role in Chinese higher education? And why?

This study is aimed at addressing these questions. In essence, this manuscript is an extension of the OECD and WDI manuscripts, drawing on their conclusions to generate insights into issues in higher education finance and access in China over the past two decades and provide implications for policy practices.

Consistent with the OECD and WDI manuscripts, the concept *access* in this paper indicates not only quantitative enrollment size for undergraduate students in both 4-year and 2-year higher education institutions but also equality issues related to the opportunity for higher education. Equality refers to opportunities that are not limited/constrained by factors that could influence equality, such as an individual's ethnicity, gender, and SES.

China's Economic Growth and the Large-Scale Expansion of Higher Education

In his book *Moral Consequence of Economic Growth*, Friedman (2005) concludes that a higher level of national income is associated with greater educational attainment, in large part because that a country can afford to provide more education for its citizens. Similar to this conclusion, both the OECD and WDI manuscripts indicate that economic growth is a driver of the expansion of higher education. In the WDI paper, although GDP per capita has no statistically significant main effect on tertiary enrollment ratios for all the 98 countries, it has a greater impact on higher education access for developed countries than for less developed countries. The OECD paper shows that, for high-income countries, per capita income has a statistically significant, positive influence on higher education enrollment. These differing results can be largely attributed to the feature that college is more affordable to in high-income countries, whereas citizens in low-income countries cannot pay the costs. Such logic suggests that in China, a developing country with low per capita income, its rapid economic growth over the last decade may not explain access to higher education.

China Economic Growth

The major historic, economic, and social background of China's economic development is its integration into the world economic restructuring (Cao, 2001). One

aspect of the global economic restructuring is that various nations build information technology to improve their international competitiveness. China has tried to catch up to Western science and technology and regards engineering as the central field for achieving this goal (Cao, 2001; Marginson, 2010). Beginning with Deng Xiaoping's open-door economic reforms in 1978, China has adopted American approaches to the management of its economy, based on free enterprise, private initiative, and mobile capital along with economic development (Friedman, 2005).

Shortly following the open-door policy, the State Council of China announced the beginning of the devolution of authorities and financial responsibilities, including funding universities, from the central government to regional units. In the socialist planned economy, government authority was highly centralized, resulting in severe bureaucracy and low efficiency of productivity that impeded economic development (Bo, 2006). The devolution was observed to promote an optimization of resource allocation and improve efficiency and productivity. In particular, after 1994, a decentralized tax system was established in which central and regional governments have separate tax systems and taxing authority, leading to more powerful regional governments as well as burgeoning regional economies (Ding, 2010).

Another important aspect of the global economic restructuring was the shifting of global manufacturing capacity from developed nations to China (Garnaut, 2003). The large, cheap and well-trained labor force is considered one of the main reasons for relocating the labor-intensive manufacturers (Zhao, 2009). The manufacturing industry has boosted China's economy, making China the world's largest exporter (WDI, 2010). The energetic integration into international trade and the influx of foreign investment

have contributed to China's economic growth. In Friedman's (2005) view, China's experience shows that in the modern era of globalization, participating in international trade has led to better economies and unambiguously helped most developing economies. In sum, China is now transitioning from an agrarian society to an industrializing one, and from a socialist central-planning economy to a market economy that is gradually integrating into the global economic restructuring.

Active participation in the global economy has helped China set a world record in improving national income and living standards. China's GDP achieved a fourteen-fold increase from 1978 to 2008, and its annual growth rates have been 8 to 12 percent, the fastest in the world. China's current GDP (based on Purchasing Power Parities (PPP)) ranked second in the world in 2009, following the U.S.

China's increase in per capita income has also been dramatic, though it is still low compared to that of other countries. As shown in Figure 4.1, GDP per capita of China and most other countries have all increased. There has been a nearly nine-fold increase in China's GDP per capita (\$1,641 [based on constant 2000 USD] in 2006 compared with \$186 in 1980), while many developed countries such as the U.S. achieved less than a two-fold increase. Nevertheless, since China's population is extremely large, per capita income of the Chinese people fell behind the average of developing countries, only slightly above the average of that of the least developed countries. Despite such national wealth, individual low-income status casts serious doubt on the affordability of higher education, if left without financial support from national and regional governments.

Economic Disparities

Along with the rapid rise of the national economy and average per capita income, income disparities have intensified in the last two decades. Friedman (2005) finds that the gap between the upper-income and low-income groups is enlarging in China. The top 10 percent of the population accounts for 33 percent of all consumer spending, not much different from the comparable American share (30 percent). The size of the Chinese middle-class is relative small. However, the bottom segment of the Chinese population is among the world's poorest. Friedman cites a World Bank investigation on measuring poverty that shows the share of a country's population living on as little as \$1-\$2 a day. The data indicate that 47 percent of the population in China lives on \$2 a day or less.

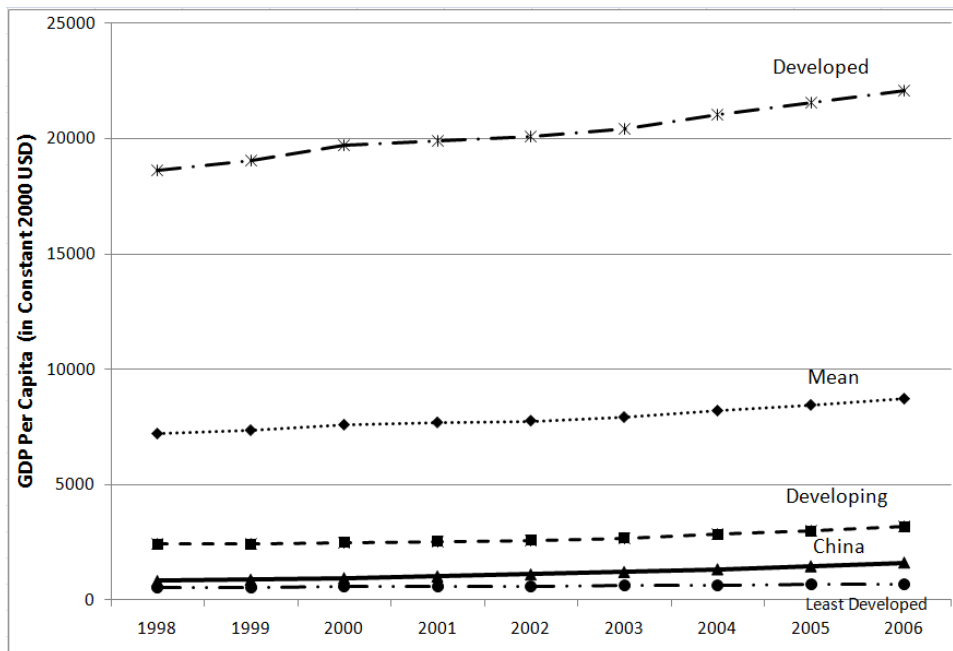


Figure 4.1. GDP per capita (in Constant 2000 USD). (Sources: WDI)

Scholars have attributed income disparities to a social divide of urban-rural residents and unbalanced regional economic development. Numerous researchers have attributed the urban-rural inequality to the binary social structure that was largely formed by the urban-rural divide of household registration system, or *Hukou*.¹ The binary economic structure has a relatively deep heritage in Chinese history, geography, politics, culture and economic growth (Liu & Shen, 2006). In the rapid urbanization process, the number of rural residents shrank speedily, but still accounts for approximately 60% of the entire population. Li and Luo (2007) report that the urban-rural income ratio increased from 2.47 in the year 1997 to 3.23 in 2003, substantially higher than that of most other countries. According to Lu and Chen (2006), the enlarging gap can be attributed to the transfer of richer rural residents to urban *Hukou*, the privatization of enterprises and government participation in economic activities. Huang's (2008) argument about the recent economic reform favoring urban industries over farmer business activities is also helpful in explaining the recent soaring urban-rural gap.

Rural-urban segregation in *Hukou* serves as a barrier for the rural population to move up to higher tiers in the stratified social tiers. According to Zhao (2009), transitions in the economic base gradually brought about fundamental changes in social structure. Zhao consents to a ten social strata model developed by Lu (2004) and an inverted T-Shape model by Li (2005a). In these two models, peasants, who account for more than 50% of the strata, are mostly concentrated in the lower to mid-lower classes, leaving relatively slim proportions to upper and middle classes. Zhao argues that the on-going

¹ *Hukou* refers to the system of residency permits in China. It is classified into agricultural and nonagricultural sectors or rural and urban sectors. *Hukou* is often considered to be the most important determinant of differential privileges and life chances in China, determining access to employment, housing, health care, retirement plans, and education for one's offspring, and etc. (Wu & Treiman, 2004; Zhao, 2009)

economic and social structural changes brought about both opportunities and risks of social/class mobility, and that people in the lower tiers are trying to accumulate social and cultural capital to grasp opportunities and move up. For rural residents, a central part of such upward mobility involves converting *Hukou* from rural to urban, and higher education is perceived as the most effective, or the only, channel for such a conversion.

In addition to urban-rural inequality, recent economic growth demonstrates a growing regional gap between the eastern and western regions. Rong and Chen (2010) point out that the eastern region, including nine coastal provinces and metropolitan cities (Beijing, Shanghai, and Tianjin), has benefited tremendously from the benign natural environment and the central government's preferential tax and industrial policies. As a result, although the eastern region accounts for only 13.5% and 44.9% of the land area and the population of China, respectively, they contributed 59.6% of the national GDP in 2001, and 63.8% in 2007. In contrast, the western region, including nine provinces and Chongqing City, with 56.0% of the land and 28.6% of the population, accounted for only 17.4% of the national GDP in 2007.

Friedman (2005) is concerned that income disparities such as the current situation in China may influence a country's economic growth, but a lack of conclusive research in this area leaves a great deal of uncertainty as to his concern. Friedman, nonetheless, remains convinced about the contribution of globalization—probably via the influence of international organizations, economic cooperation and other activities—in reducing economic inequality. If this is true, China's income disparities are likely to gradually narrow, along with its participation in the economic globalization process.

Although the impact of economic growth on the future is unclear, it is evident that the enlarging urban-rural and regional gaps may threaten life chances and equal access to higher education for low-income, rural, or western people. Since China does not have a social policy parallel to American affirmative action that can enhance college access for disadvantaged students, the economic disparities in China can be harmful to equal opportunities for higher education.

Expansion of Higher Education in China

The transition toward a global manufacturing center and involvement in world economic competition are two major global forces that have fostered the large-scale higher education expansion in China (Friedman, 2010; Zhao, 2009). In parallel with economic globalization, China has undergone dramatic changes in industrial modernization and the extensive use of information technology, both of which require human capital related to new knowledge and technology (Cao, 2001). To meet the needs of technological and scientific advancement in the information economy, China's intention is to educate more talent and expand higher education (Levin, 2010; Marginson, 2010). Since the end of the Cultural Revolution and the beginning of economic reform, China's higher education has been growing steadily. Around the turn of the century, China experienced the most remarkable expansion of higher education in the world.

This large-scale expansion has also been motivated by extensive demand from students. It is important to note that Chinese students have a particularly strong desire to attend college due to a thousand-year-long cultural heritage that emphasizes the role of education in upward social mobility (Han, 2000; Wang, 2004; Chung and Lu, 2003). Marginson (2010) further comments that in a modern society, extraordinary parental

willingness to pay for their children's higher education is a distinguishing feature of the Confucian Model of higher education that characterizes educational systems in East Asia. Middle class families in China and in other East Asian countries may spend as much on education as Western families spend on housing. Zhao (2009) points out that rural residents may have an even stronger desire to attend college because higher education serves as an important tool for geographic mobility from western to eastern China.

The WDI and OECD papers both point out that for most countries in the world, higher education privatization, either in the form of establishing more private institutions or charging greater tuition in public institutions, is the major means of enrollment expansion. This is also the case for China. The year 1998 marked the beginning of tuition-charging practices, which enabled the Chinese government and higher education institutions (HEIs) to expand higher education enrollment at an unprecedented rate. It is important to note that this expansion is attributed more to enlarging the size of regional institutions than creating private institutions. Regional institutions, rather than national universities, contribute most to the expansion by accommodating more students and using tuition revenue to maintain operations (Qiao & Hong, 2009). During the same period, although private higher education institutions were allowed to enter the education market to absorb the excess demand, their resources and quality were far from competitive, compared with public HEIs.

As demonstrated in Figure 4.2, China's higher education enrollment ratio has followed a steep linear path from 10.5% in 1999 to 22% in 2006, finally catching up to the average enrollment ratios of the developing countries in 2006. Particularly between 1999 and 2004, enrollment growth rates ranged between 7% and 20%, almost the fastest

in the world. In 2006, the State Council issued a new policy to restrict the annual enrollment growth rate to below 5%, largely due to the pressure of the rising unemployment rate of college graduates (MOE, 2011). As of 2009, China had a gross tertiary enrollment ratio of 24.2%, but with the world's largest college student body, 29.79 million.

It is worth noting that economic globalization and the developing global education market have fostered an increase in the number of Chinese students studying abroad. Accurate, detailed data on the enrollment trends and the composition of the overseas students are lacking. However, according to the U.S. Institute of International Education, Chinese students have become the largest international student group in the U.S., with undergraduate students increasing from 8,258, or 14% of total Chinese

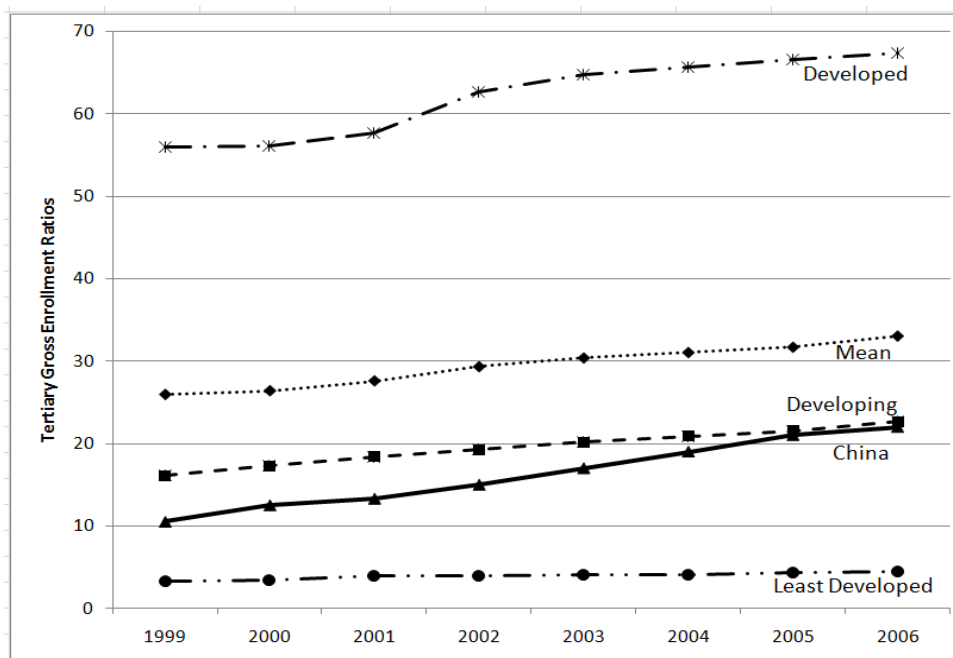


Figure 4.2. Tertiary Gross Enrollment Ratios. (Sources: WDI and China Education Finance Yearbooks)

students studying in the U.S. in 2000, to 39,921, or 31% in 2010 (IIE, 2011). Zhao (2009) notes that the study of subjects related to the global economy (e.g., English, business, and engineering) in an advanced industrial country to prepare for job opportunities in transnational or foreign corporations is particularly appealing to middle- and upper-class Chinese students. The development of the global education market in countries such as the U.S. and Australia has provided these students with opportunities for overseas studies (Marginson & Rhoades, 2002). However, the number of undergraduate overseas students, who take advantage of this opportunity, compared with the domestic mass in China is relatively small, and has limited impact on seats available for the remaining students.

Impact of Economic Growth on Higher Education

The above analysis presents a general picture of China's economic growth and income disparities, as well as higher education expansion, over the last two decades. Based on the conclusions of the OECD and WDI manuscripts, for a country in which per capita income falls between the average for developing and least developed countries—not even considering the income disparities—China's economic growth seems very unlikely to drive higher education expansion. However, the fact of China's rapid development of higher education contradicts such a hypothesis. As numerous studies have revealed, economic growth in China had a profound influence on students' access to higher education.

A number of articles recognize the positive influence of rising per capita income because it enables people to pay the costs of education (e.g., Marginson, 2010). Wang

(2004) analyzes the trend of the Engel coefficients² from 1998 to 2002 and finds that as people's living standards rise and their basic needs (e.g. food) are satisfied, people tend to invest more in education. According to Han (2000) and Chung and Lu (2003), the rising income made it possible for higher education to no longer be a luxury good. Particularly for those middle and upper class families, the amount of money they have saved can undoubtedly cover the cost of higher education. Even if tuition increases by 30-100%, the possibility of college enrollment for upper and middle income students will not be affected.

On the other hand, what most scholars report are income inequalities during the higher education expansion. One such voice is raised by Friedman (2005), who finds that for most countries, a higher level of per capita income and a higher growth rate of personal income are accompanied by more democratic freedom, including equal education. However, Friedman points out that China is an exception: although China has experienced the fastest economic growth in the world, it still ranks at nearly the bottom on civil liberties. Many Chinese researchers reported the striking influence of the economic inequality on higher education that closely mimics the economic patterns (e.g., Lei & Chung, 2005; Rong and Chen, 2010). Their research regards the urban-rural division and regional disparities as the largest barriers to students' access to higher education.

² The Engel coefficient is the proportion of family income that is spent on food. It receives its name in honor of the German statistician Ernst Engel. In a famous study using budget data of 153 Belgian families, Engel found that the lower a family's income, the greater is the proportion of it spent on food. Later studies have confirmed this empirical regularity that has been called Engel's law (Aguirregabiria, 2006).

1. Urban-Rural Disparities in Higher Education

In the urban-rural social structure, the unbalanced distribution of education resources to urban or rural areas has resulted in unequal access to opportunities in higher education. Many researchers (e.g., Liu & Shen, 2006; Jiang & Peng, 2008; Wang & Bi, 2007; Wang, 2004; Xia, 2000; Zhang, 2009) are concerned that high tuition level may destroy students' college dreams, especially for rural students. Lei and Chung (2005) find that rural students have a stronger desire to obtain higher education. Even though family resources are limited and the rate of private return from higher education has become relatively lower recently, rural students demonstrate a greater willingness to attend college than do urban students. Their strong desire may reflect the fact that higher education is the only channel through which they can leave the rural area for urban areas, move upward and change their social status. However, the current tuition scale exceeds their family's ability to pay. Wang (2004) estimates that tuition and fees (e.g., boarding, transportation fees) together account for 80% of urban residents' average annual income, but can be 200% among rural residents. Due to this tuition burden, many rural students give up on the college entrance examination or drop out of college.

Several studies find that students from urban areas become the over-represented group in HEIs. Rong and Chen (2010) find that in 2009, students from rural areas comprised only 17.7% of the student population in higher education, down almost 50% from the early 1980s, even though rural residents made up 60% of China's population. Zhao (2009) attributes the overrepresentation of urban students to marked advantages of urban students over rural counterparts in terms of their family background, parental influence, supportive resources, social network, and students' responses and perspectives

along their college pathway. Additionally, Liang (2001) contends that skewed high school resources can also account for urban overrepresentation. High school resources were heavily concentrated in urban areas and key high schools. They obtained even more resources and had better teachers and facilities than non-key high schools, even some non-key universities. These factors result in unequal life-time competition for university entrance examination between urban and rural students.

Cultural capital theory provides important insights into the unequal access of higher education for urban and rural students. According to Bourdieu (1973; 1977; 1984), cultural capital is the knowledge, experience and/or connections one has had throughout the course of their life that give them a higher status in society. The concept of cultural capital is fundamentally linked to “habitus” and “field”—two other concepts of Bourdieu’s. “Habitus” can be regarded as a student’s family and their social class background, which transmit the cultural capital to the students to help them succeed in the current educational system. Education can be regarded as a “field” because different social groups adopt pedagogical processes to reproduce themselves, and the motivation for this reproduction is to sustain the pre-existing class distinctions (Robbins, 1993). Thus, Bourdieu’s theory provides strong arguments about how social inequality formed a urban/rural inequality in access. On the one hand, social inequality affects access well before the college entry point, as a student’s families and social class background have largely determined their acquisition of cultural capital resources. On the other hand, college entry selection, particularly in an elite system, serves as a means of reproducing class privilege.

Lucas's (2001) theory of *effectively maintained inequality* (EMI) on processes of school continuation and track mobility can also help explain China's urban-rural inequality in access. EMI theory posits that socioeconomically advantaged actors secure for themselves and their children some degree of advantage wherever advantages are commonly possible. On the one hand, if quantitative differences are common, the socioeconomically advantaged will obtain quantitative advantage. On the other hand, if qualitative differences are common the socioeconomically advantaged will obtain qualitative advantage. In China's case, the quantitative and qualitative advantages mean that urban students not only obtain more opportunities to attend higher education than rural students, but also attend more prestigious universities.

2. *Regional Disparities in Higher Education*

The regional inequality in access to higher education is a direct result of the enlarging economic disparities between eastern and western areas. Along with the devolution of financial responsibilities from central to regional governments, a more prosperous economy in the eastern region allows eastern governments to spend more on higher education than western governments, which in turn widens the regional gaps in higher education. Regional inequality, when interacting with urban-rural disparity, can lead to worsening inequality in higher education access.

According to Rong and Chen (2010), in the recent years, the number of HEIs decreased substantially in the western area, while most of the Chinese HEIs and education resources have been concentrated in a handful of large metropolitan cities in the country's more affluent eastern areas. Indeed, nearly all the key national universities,

which are included the “211 Project” and the “985 Project” aiming to build world-class universities, were located primarily in China’s four metropolises.

The college entrance selection process reflects astonishing regional and urban-rural disparities via a quota policy. The key to success in China’s college entrance selection is its national college entrance exam (NCEE). Unlike the selection process in the U.S., which uses multiple application materials besides college entrance examination scores, China’s college selection process uses only the score on the NCEE, which is held only once a year. Many scholars (e.g., Rong and Chen, 2010; Wang, 2005; Zhao, 2009) reveal that admission to higher education institutions uses a quota policy or preferential enrollment practice. While students from Beijing, Shanghai or large urban cities are more likely to enroll in better programs at top universities, students with the same NCEE scores, yet from poorer regions or rural areas, can enroll in only lower-tier institutions. A rural student from the western region has to score much higher on the NCEE to enroll in the same university as a student from an urban background in the eastern region. In short, the current system has a preferential policy practice for students from big cities, while strongly discriminating against students from the rest of the country.

Since the opportunity for higher education and the location of universities significantly influence students’ future labor market performances, the current enrollment policy has a far-reaching, negative impact on students’ social mobility. As a result of regional disparities of HEI and the quota policy, prestigious universities tend to become exclusively for students from elite families. Since those top institutions charge lower tuition but are given more education resources, their elite students can enjoy the highest quality of higher education while paying less. To a certain degree, these institutions

become a means of maintaining the interests of the upper class group and facilitating the reproduction of social status attainment, neglecting the enrollment gap associated with social class and region.

Section Discussion and Summary

China's participation in the world economic restructuring has resulted in dramatic economic growth. Its economic growth is a double-edged sword: it does substantially increase individual living standards on average, but it also intensifies disparities between rural and urban areas as well as between eastern and western regions. The rapid higher education expansion closely mirrors these two such economic disparities: while China's economy has driven the large-scale higher education expansion, it also brought about disparities in higher education. Such findings contradict the earlier hypothesis based on the general conclusion in the WDI paper, but is consistent with the findings from the OECD paper, which is based on high-income countries. It seems that a high rate of economic growth for a low-income country does matter for its higher education.

A closer examination of the cost-sharing pattern of the recent higher education expansion reveals that while the upper class and middle-class students—most urban students—were the earliest beneficiaries from the expansion, low-income, or rural, students have great difficulties financing their college dreams. The combination of the cost-sharing strategy with the preferential enrollment practices tends to increase the urban-rural and regional inequalities in access, discriminating against more rural and western students.

Equal access to higher education, as Johnstone (2003) reiterates, would mean that academic ability, talent and motivation are the only acceptable principles that correlate

with higher education access, rather than family income or status. However, in China, higher education access bears a strong mark of students' family income and geographic locations. Without proper leverage of education policies to protect equal access, opportunities for the low-income, rural, western students to pursue college dreams will be restricted. According to Bourdieu's cultural capital theory and Lucas' EMI theory, in the long run, the educational inequalities may lead to a vicious cycle in which the children of the poor become the poorest permanently.

In China, higher education is not only education for advanced knowledge and skills, but also the means leading to upward social mobility and better life chances. In particular, it is the only channel through which rural students change their lives. Thus, expanding rural students' opportunities for higher education is an important means to narrow the rural-urban gap, and represents a challenging realm that needs reformation in financial policy and admission policies. These reformations are likely to benefit not only the students as individuals but also human capital production for societal growth.

China's Education Finance Policies and Their Impact on College Access

From a planned economy to a market economy, China has reformed its education policies to respond to the economic and social changes. In particular, its reformation in education finance policies has initiated and expedited the transition from elite to mass higher education. The OECD and WDI manuscripts focus on several indicators regarding education finance policies and explore whether these policies promote higher education access. The finance policy indicators in the WDI manuscript include public spending on education as a percentage of GDP public expenditure per secondary student and public expenditure per secondary student. The OECD paper adds three student financial aid

indicators: public expenditure on tertiary institutions, scholarships/grants, and student loans. This section first depicts the development of China's higher education finance policies in recent decades and examines whether and how each of these financial indicators affects China's higher education access.

China's Higher Education Finance Practice in the Last Three Decades

China's economic growth brought about profound changes in higher education policies. The policy changes in the last three decades can be characterized by decentralization and marketization, both of which have a crucial impact on education finance policies and college access.

Decentralization

China's decentralization transition from a planned economy to a market economy in the 1980s accordingly left a distinctive mark of decentralization on its higher education governance. In the old planned economy, all universities were fully funded by, and in direct control of, the Ministry of Education (MOE). The financial responsibility for higher education was one of the authorities that devolved from the central government to regional governments in 1980. A market mechanism was then introduced to the operation of higher education institutions. A decentralizing system of higher education finance is in formation, featuring that a handful of key national universities are co-funded by the central and provincial governments, and partial or full powers of governance and financial responsibilities of regional universities have devolved to regional governments (Cao, 2006; Chung, Gong & Lu, 1996).

Policy adjustments were issued in 1985, 1992 and 1996 to encourage HEIs to broaden revenue sources from tuition, enterprises and philanthropy, in addition to

government appropriation. In particular, since the introduction of the 1997 tuition policy, the role of government allocation in supporting student access has gradually been reduced, replaced by an increasing role for tuition and other revenues.

Although having granted and promoted the autonomy of regional governments and encouraged institutional revenue-earning activities, decentralization meanwhile also stimulated the blind expansion of institution size and the repetitive construction of programs. Given the shortage of education resources, however, the decentralization practice may result in low efficiency of resource usage. In addition, given the unbalanced economic structure between the east and the west, relying on regional governments to finance higher education may further intensify the regional disparities of higher education (Yang, Yuan & Chen, 2010).

It is worth noting that the decentralization process in China's higher education is relative to its centralization decades ago, and China may, in fact, still be highly centralized compared with its counterparts in Western society. Marginson (2010) uses the "New Public Management (NPM)" model to distinguish the modern higher education governance in China and other East Asian countries from the rest of the world. More specifically, the NPM model refers to the corporatization of public universities, the devolution of financial responsibilities, entrepreneurship and accountability mechanisms to enhance performance. The steering role of China's state in these activities is substantially stronger than those in Europe, Australia, and North America. Indeed, in China, for example, the government controls the number of public and private institutions, their enrollment sizes, and even the admission policies so that the supply side of Chinese higher education lacks elasticity (Zhao & Li, 2010). The size and structure of

government appropriation are also centrally determined together by the Ministry of Finance and the Ministry of Education. HEIs do not take any role in the budgeting process (Liu & Zhong, 2010). Moreover, private institutions, and parent and student tuition sharing, play a larger role in Europe (especially) and the English-speaking world than in China. Therefore, current higher education finance in China can more appropriately be called “quasi-decentralized.”

Marketization

In a market economy, the concept “user-pay” became influential and the practice of cost-sharing that successfully fueled higher education expansion in other countries has been widely accepted in China as well. Before 1997, China’s higher education was mostly free. Universal tuition began in 1997 and was set from 1500 to 3500 RMB (about \$190-\$340 in 1998 value). Large-scale expansion was then launched in 1999. The current tuition is still a flat rate but adjusted moderately to reflect regional income as well as disciplinary differences in education costs. In 2010, the regular undergraduate tuition for public four-year institutions ranges from 3000 to 7000 RMB (\$428-\$1000 in 2010 value), while arts, engineering and other special disciplines charge one to two times that of regular tuition. The universal university tuition in China largely reflects the “evolving market-sensitive ideology of Chinese Communism” (Johnstone, Arora & Experton, 1998, p. 20).

The influence of the market economy fills in new blood to higher education with market competition. In the 1980s, China’s higher education government initiated the reformation in appropriation budget toward higher efficiency. Before 1985, financial allocation had been based on the previous years’ expenditure, adjusted with additional

expenditures for the current year's new development. Thus, an increase in enrollment did not lead to increased appropriation. The new appropriation policy adopted in the 1990s included two components: "a lump sum" determined by the enrollment size and per-student education cost, and a supplementary allowance for designated projects that met special needs of the institutions (Liu, 2010; Zhang, & Yu, 1996). In Zhan and Chung's (2004) view, under the circumstances of excess demands while declining public resources, the performance-based model improves the efficiency of using public expenditure and allows greater autonomy for higher education institutions.

Chinese policy-makers and scholars believe that the introduction of tuition will also improve the efficiency of higher education (Ma, 2009; Wang, 1996). On the one hand, charging tuition helps strike a balance between fee-paying students and students who receive education but may not pay. In a highly-subsidized model, it is very likely that, although poorer families pay taxes, students from high-income families are more likely to receive more scholarships and other education resources and attend better HEIs. It is fair to charge those who attend HEIs. Thus, the user-pay model has a positive effect on equality of higher education opportunities. Second, when students pay their tuition, they care more about what they learn in college. In addition, the tuition revenue that did not exist before provides more resources for educating more students (Zhu & Bai, 2005).

However, a few scholars cast doubt on the efficiency associated with tuition. According to Wang, Zhang and Chen (2004), although tuition is charged in China, the unified tuition does not reflect the differences in education costs and quality. In many other countries (e.g., the U.S.), tuition charges follow market rules and reflect the costs involved and the quality of programs and institutions. Largely due to the immature

marketization of the higher education system in China, the price mechanism does not leverage the demand-supply relationship in higher education very well. Thus, the resources allocated to higher education institutions may not be used efficiently.

Since adopting the tuition policy, higher education finance in China has become a binary structure, with two major cost-sharing parties: government and students with their families. Li and Guo (2004) and Liu and Hu (2005) point out that although HEIs try to build a three-party cost-sharing structure by developing a fundraising mechanism, the goal of diversifying revenue has not been fully realized.

There has been widespread criticism of the negative role of tuition charges and the weakening role of government in maintaining social justice. Li and Ke (2006) state that the government's role is to promote social justice on the basis of efficiency. However, government did not realize the role of maintaining social justice. Using four groups of simultaneous equation models, Qiao and Hong (2009) examine the relationship between higher education enrollments and student tuition and fees so as to compare whether the role of governmental allocation to education is greater than tuition and fees in promoting higher education. They conclude that the recent large-scale expansion of higher education exhibits a tuition-dependent model, in which the role of tuition is greater than government allocation. Qiao and Hong point out that the regional universities, in particular, rely more heavily on tuition revenue to expand enrollment than do national universities. However, student academic qualifications, affordability, university teaching resources and students' future returns at regional universities are poorer than at national universities. Therefore, charging a universal tuition to regional students seems unfair and may harm equal access.

Public Spending on Education as percentage of GDP

Public expenditure on education as a percentage of GDP not only reflects how governments prioritize education in relation to other public sectors, such as health and the military, but also shows the size of public education spending in relation to economic growth. It is important to note that in the WDI database, the data for China are missing. The following analysis uses the data published by the Statistical Bureau of China and the MOE's Finance Division, which are also the data sources for numerous Chinese studies regarding educational spending.

In the WDI paper, although public spending on education as a percentage of GDP does not have a main effect on access, it is found to have a greater influence for developed countries than for less developed countries. The OECD manuscript further indicates that public spending on education indeed plays a statistically significant, positive role in promoting higher education among high-income OECD nations. Based on these conclusions, this manuscript hypothesizes that public spending on education in a low-income country like China is unlikely to have an influence on higher education access.

In 1993, the Central Government proposed that China gradually increase public spending on education to 4% of GDP by the end of the 20th century, approximate the average level for developing countries in the 1980s. However, it seems China has yet to reach that goal even now. The international comparison in Figure 4.3 demonstrates that China's public spending on education in general tended to increase between 1998 and 2006, implying the strategic importance placed on education. However, compared with the average education spending of 5.5% in developed countries, 4.5% in developing

countries, and 4% in least developed nations, China invested only 2.5% to 3.5% of its GDP in education in recent years, and falls far behind most other countries. This insufficient funding has been widely criticized by Chinese scholars.

According to the findings in the WDI paper, insufficient education spending for a developing country such as China is unlikely to have a significant influence on higher education enrollment. In particular, Li and Ke's (2006) research support this assumption. Li and Ke note that public spending on education may be too low to sufficiently sustain the function of public expenditure in maintaining equal opportunity for students regardless of gender, ethnicity, socio-economic status, and residential status. Consistent with Li and Ke's argument, numerous Chinese scholars have expressed their worries about a severe shortage of educational investment.

In fact, however, the data in Figure 4.3 may have underestimated actual Chinese educational spending, largely due to inconsistencies in measuring educational spending by the Chinese agencies and by the World Bank. The actual size of public education spending as well as its influence on China's higher education should have been greater (Yu, 2009). The current statistics calculated by the Chinese Bureau of Statistics and MOE's Division of Finance are based only on budgetary revenues and expenditures, whereas the statistics by the World Bank are based on not only budgetary but also off-budgetary revenue and expenditures as well as social security funding. Chinese government has great power extending to very broad economic sectors and gain off-budgetary and non-tax revenues such as social security, land sales, and a large portion of the profit from state enterprises. These non-tax and off-budgetary revenues have remained vague and are very difficult to calculate (Zhang, 2001). Adding together these

off-budgetary revenues and using the international standard of calculation by the World Bank, the actual education spending as percentage of GDP in China would be nearly 4%, which would be close to the average level of developing countries.

The WDI manuscript notes that when examining the influence of overall public education spending on higher education access, the structure of public spending also matters. The paper reasons that high-income nations have already completed basic education, which would increase the likelihood of improving higher education when there is an increase in the percentage of education spending in GDP. The increase in education spending as a percentage of GDP in developing countries, however, is less likely to influence higher education because a large portion of public spending is allocated to basic education. However, such logic does not apply to the case of China.

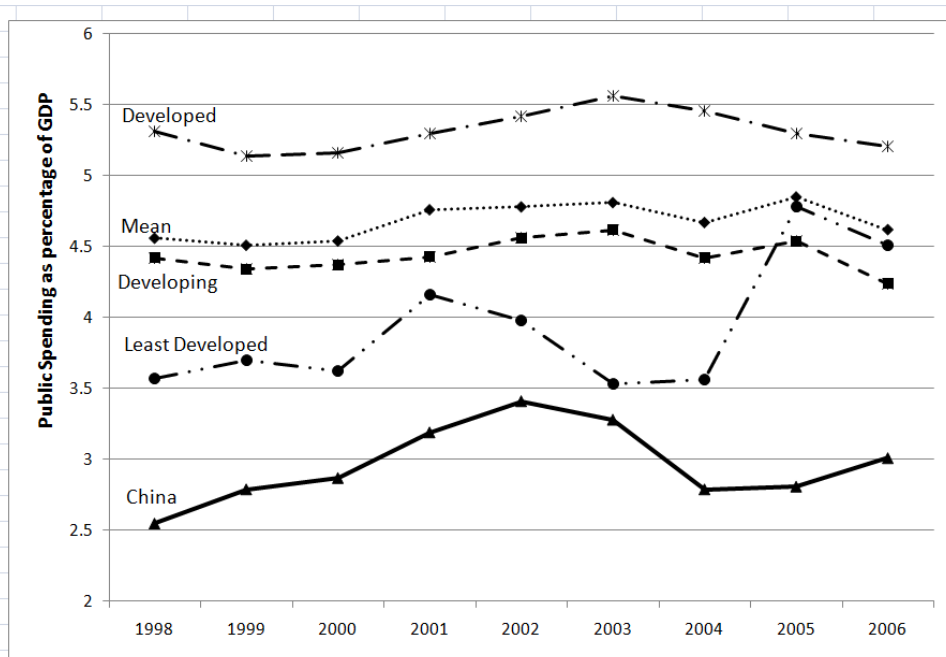


Figure 4.3. Public Spending on Education as Percentage of GDP. (Sources: WDI, China Education Finance Yearbooks)

Although China has not achieved full attendance ratios in basic education, China's strategic planning for developing higher education leads to a skewed resource allocation favoring higher education over basic education. While most developed and developing countries allocate a higher proportion of resources to basic education than to higher education, China's case reverses this ratio (Gu & Zhou, 2010; Li, 2004; Ma, 2006; PDRCTC, 2009). For example, in 2005, while higher education took up 31.57% of all education expenditures, secondary schools obtained 30.81% and elementary schools only 24.14% (Zhang, 2010b). As a result, the basic education allocation was declining in general. Despite the lower gross enrollment ratios in China compared with the universal level of higher college attendance in OECD countries, the high percentage of China's public spending allocated to higher education is close to the average level among OECD countries. Thus, these scholars conclude that the Chinese government has now overinvested in higher education, while the efficiency of using the resources remains low.

Based on the findings of the above research, this manuscript tends to reject the earlier hypothesis and conclude that the increase in public spending on education as a percentage of GDP around the turn of the century has played a positive role in boosting the recent large-scale expansion of higher education. However, given the overall low literacy levels in China, the skew towards elite higher education signals a strategic choice on the part of the government to drive economic growth instead of equality of education. The "overinvestment" in higher education can be harmful to the sustainable development of education as a whole and to the equality of education. International scholars (e.g., Psacharopoulos, Tan and Jimenez, 1986; Psacharopoulos, 1994) and Chinese researchers (Gu & Zhou, 2010; Li, 2004) have found that for developing countries, investment in

elementary and secondary education yields higher social rates of return than higher education, tending to benefit the poor more than the rich, and recommend that allocation of scarce government funds favor basic education. Indeed, although better basic education may help broaden the pool of academically prepared students for college, basic education itself requires a large amount of resources to expand enrollment to the poor. Therefore, in the case of China, if higher education were given more resources but denied more poor children, the degree of the aforementioned urban-rural and regional inequalities would be further intensified.

Public Tertiary Expenditure per Student as A Percentage of GDP Per Capita

Public expenditure per tertiary student as a percentage of GDP per capita (or the ratio that compares public expenditure per tertiary student to GDP per capita) is a comprehensive indicator for higher education unit cost and governments' role in sharing the cost. The OECD and WDI papers both conclude that public expenditure per tertiary student as a percentage of GDP per capita bears a statistically significant but negative relation with higher education enrollment. The WDI paper also shows that the effect of public tertiary expenditures is greater for less developed countries than for developed countries. Thus, this study hypothesizes that public expenditure per tertiary student may have a large but negative effect on higher education enrollment in China.

Figure 4.4 shows that the per student tertiary expenditure in China dropped dramatically between 1998 and 2006 from 174 down to around 90, the latter of which is around the average level for developing countries. The high college cost, along with a low GDP per capita, can contribute to explaining such large percentages of tertiary spending. In addition, since China only achieved 24% tertiary enrollment ratios, it is

possible to gather resources to heavily subsidize this small group of students. Compared with the average level of approximately 40% in developed countries, the overall level of tertiary expenditure in China remains quite high, and China's government investment in individual college students is very large in comparison to average income.

In such a situation, public tertiary spending in China may have a large impact on promoting college access by making college affordable for a larger portion of the college-aged population. However, the declining trend of public expenditure per tertiary student may signal the declining role of government in financing students' access to higher education in the face of an enlarging body of college students.

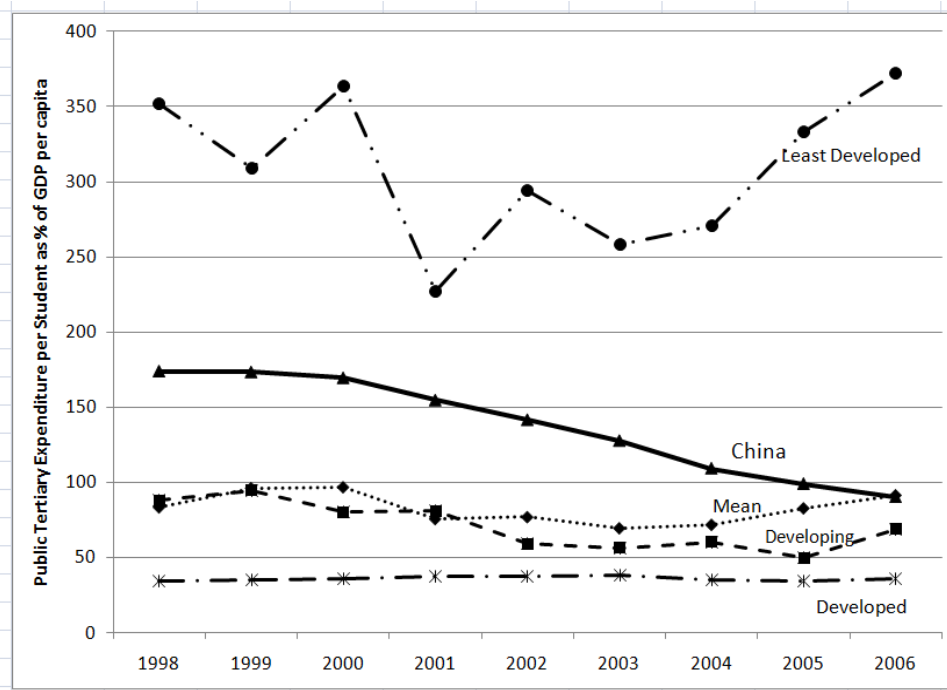


Figure 4.4. Public Expenditure per Tertiary Student as a Percentage of GDP Per Capita. (Sources: WDI, China Education Finance Yearbooks)

Given the rapid increase in higher education enrollment and steep decline in public tertiary expenditure per student, it is evident that there is a negative relation between the two indicators. This confirms the earlier hypothesis in this subsection. Such a negative relation allows this study to make a similar conclusion to that in the OECD paper: that is, the recent growth of tertiary enrollment in China should not be attributed only to increased expenditure on higher education in relation to basic education expenditure, but also to an increase in the number of individuals who can afford college as reflected by GDP per capita. In China, the earlier beneficiaries of the large expansion of higher education were students from the upper and middle-upper classes. Thus, the marketization of higher education led to an intensifying cost-sharing policy in higher education finance, during which time the state financial support for higher education declined proportionally, shifting the burden to students and parents. This conclusion is also consistently seen in numerous other Chinese studies (e.g., Johnstone, 2006; Zhao, 2009). Since an earlier section of this chapter has already analyzed the inequalities of college access that result from relying on students and parents to finance college, this subsection will not repeat this analysis.

Public Expenditure on Tertiary Institutions as A Fraction of the Sum of Private and Public Expenditure

The WDI paper does not include the proportion of public expenditure on tertiary institutions in the sum of public and private expenditure as an independent variable due to its unavailability in the WDI database. In the OECD manuscript, this indicator has no impact on higher education access. Unfortunately, the data on China's education expenditure on tertiary institutions at the national level are mixed with other types of

expenditure so that there are no clearly classified data for this category. Thus, the role of institutional expenditure on higher education access may be inclusive. However, given the dramatic decrease in government appropriation as a fraction of the sum of all public and private expenditures that is consistently reported by Chinese scholars (e.g., Hu, 2010), the manuscript predicts that the role of public institutional expenditure in China should be similar to that in OECD nations.

It is worth noting that the recent reforms of institutional budgeting practices tend to have a negative influence on equal access in China. The earlier part of this section has introduced the most recent reforms of financing mechanisms among HEIs and their positive role in promoting institutional efficiency and autonomy. This subsection thus focuses on two negative aspects of the reformations.

First, the component of supplementary, or project-based, budget in the current institutional budget model has resulted in the increasingly skewed distribution of research funding to national institutions. In China, there are two main types of four-year higher education institutions: national and regional universities. The central government not only limits the number of the national universities to about 70 but also determines their enrollment sizes. These institutions are highly ranked, research-focused and co-funded by the Ministry of Education and provincial governments. In contrast, regional universities are lower-tier and under the direct control of provincial governments. In the 1990s, to respond to the need to drive China's role in the world economy, China initiated the "211 Project" and "985 Project," which are aimed at building a group of top research institutions and world-class universities. The central and local governments concentrated support in a handful of elite national universities and the areas of world research

leadership. Thus, although only enrolling a government-determined, small number of students and charging flat rate tuition similar to regional universities, these few national universities have absorbed a great amount of government appropriations in order to develop their competitiveness (Chung et al., 1996). However, most regional universities have experienced a great insufficiency of financial support and rely more on tuition revenues (Li & Ke, 2006). Thus, students paying the same tuition do not receive an education with the same quality, with national universities gaining more public subsidies and receiving better quality of education. The skewed distribution of research funding has intensified institutional stratification.

Second, the revenue gap between national universities and regional institutions has been growing. The marketization reforms in China have given higher education institutions more autonomy to generate their own revenues. In the late 1990s and early 21st century, the national universities used their advantage in research to generate income from philanthropy, auxiliary facilities and entrepreneurial activities that make up to 11% of total institutional income. A diversified revenue structure in national universities is in the making. However, the provincial universities earned only 6% of their income from these sources, and have maintained a binary revenue structure composed of state appropriation and tuition revenue (Chu, 2007; Fan, 2005). The intensifying institutional stratification and enlarging institutional revenue gap, when interacting with the quota enrollment policy and urban-rural and regional disparities, can worsen the inequality of higher education access.

It is important to note that increasing institutional stratification mainly refers to public national and provincial universities. Although they have absorbed excessive

demand in the last two decades, private institutions do not receive government appropriation. Instead, at least 80% of their revenue is drawn from tuition and fees that are set by governments (Huang, 2006). Thus, the reformations of education finance policies barely exert significant influence on the private institutions.

Scholarships, Grants and Student Loans

While the WDI manuscript does not include these financial aid indicators, the OECD paper concludes that neither scholarship/grants nor student loans have a statistically significant impact on higher education access. Unlike other countries, China has allocated most resources directly to institutions, and has only recently begun to provide students with limited financial aid. As a result, the roles of each type of financial aid program are not fully recognized by Chinese researchers and policy-makers, and the only available data regarding these programs are in the format of a composite percentage of scholarships, grants and student loans. Individual proportions of these aid programs in the overall financial aid remain unclear.

As shown in Figure 4.5, the combined percentage of financial aid in total government expenditure on tertiary education in China was only slightly more than 4% in the most recent decade, and it has gradually declined. The level of China's student aid fell substantially below the average of OECD countries, which was approximately 10%. The low level of financial aid in China will likely to lead to lower coverage of students or fewer available per student resources.

Consistent with the findings in the OECD and WDI manuscripts, among all types of Chinese student aid programs, student loans seem to have emerged as a major aid program in China, gradually replacing grants. In China, these student aid programs have

either newly emerged or increased substantially along with large-scale enrollment expansion. Student loan schemes have emerged as a part of the student aid package associated with the introduction of universal tuition in 1997. To ease student financial burdens and facilitate higher education expansion, the Government-Subsidized Student Loans Scheme (GSSLS) was first piloted in eight major cities in the fall of 1999 and gradually spread nationwide. Since 2002, the central government has allocated approximately 200 million RMB (about 30 million USD) every year as scholarships for a total of 45,000 students who are academically excellent, full-time students but financially needy. The central government also requires that higher education institutions draw at least 30% from tuition revenue to distribute among students as scholarships, loans, grants and subsidy (Li & Guo, 2004).

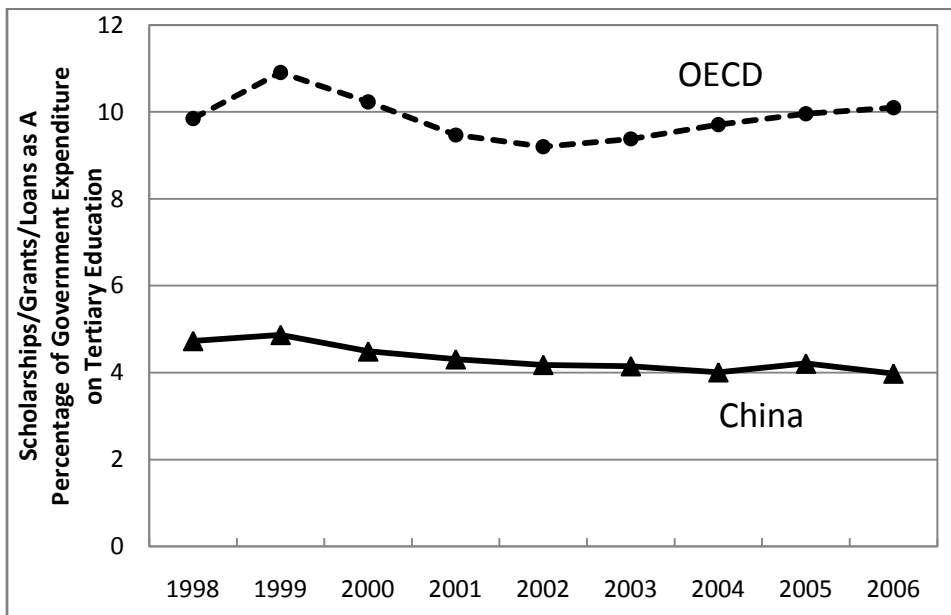


Figure 4.5. Combined Student Aid (Scholarships/Grants/Student loans) as Percentage of Government Expenditure on Tertiary Education. (Source: OECD's Education at a Glance, (Sources: WDI, China Education Finance Yearbooks)

Although a number of scholars critique a very low coverage of student aid, in reality there is a lack of statistical data regarding the proportion of students obtaining financial aid and the average amount obtained (Masayuki & Wang, 2006). Zhang (2010b) estimates that in 2003, approximately 8.4% of enrolled students received a GSSLS loan. Although the current student aid statistics are unclear, PDRCTC (2009) reports that by 2020, China aims to increase the coverage of financial aid to approximately 30% of enrolled students. The PDRCTC's number hints at substantially lower coverage of financial aid in current years.

The limited role of financial aid is also evident through a comparison of students' response toward aid programs and tuition. Li's (2005b) survey research in Yunnan province shows that students are more sensitive to changes in tuition than in financial aid. Tuition increase places low-income students at a greater disadvantage. Even so, these students do not give up on higher education, but may choose lower-tier institutions and programs. Li's research reveals similar findings to those of scholars of American higher education in the 1970s and 80s, a period during which American students were found to be more sensitive to changes in tuition than to student aid. However, in recent years, American students demonstrate the inverse response. Along with the increase in the amount and coverage of student aid in China, it is likely that the influence of financial aid may also become greater in the future.

Despite the fact that the current loan scheme partially increases the affordability of higher education and persistence, the borrowing culture, the size of the loans, administration restrictions and repayment policy in China largely restrict the role of loans in promoting access. In the current GSSLS, government subsidizes 50% of the interest

rate (PDRCTC, 2009). However, Johnstone et al. (1998) maintained that the reluctance to borrow money in Chinese culture made implementing the Chinese loan system difficult. Additionally, China's GSSLS has major problems in reach and equity, largely due to the fact that the loans do not well target students who are really needy, and because the average loan size is still too small (Johnstone et al., 1998; Ziderman, 2003). According to Wang, Zhang and Chen (2004) and Zhao (2009), the implementation of current Chinese student loans is restricted by the administration and repayment policy. Since HEIs are both the lenders and the administrators of the loans, they require student repayment by the time they graduate in order to avoid late repayment and extra administrative costs. Only a small portion of Chinese students can meet such strict requirements and repay on time.

Although income-contingent loans (ICLs) have been adopted in many Western countries and their advantages over current GSSLS in China have been widely recognized (He, 2008; He & Wan, 2005; Liu & Shen, 2006), China has yet to adopt an ICL scheme. Compared with the current loan scheme, ICLs postpone repayment after graduation and their payment is proportional to students' future income, thus relieving students' current financial pressure. Scholars argue that ICLs are more equitable and allow low-income students to be able to obtain higher education (Patrinos, 2000). However, ICLs are exceedingly complex and require thorough research, proper design and good execution. Liu and Shen (2006) compare international experiences of loans and warn that China's current financial system may not be ready to introduce ICLs, largely because of China's immature tax and credit system and lack of a tracking system for students' future career and job changes.

Section Discussion and Summary

This section focuses on four aspects of China's higher education finance policies and examines whether and how they affect China's higher education access. When using market mechanisms to expand higher education, higher education financial policies become important for leveraging equality of access, particularly in the case of their remarkable economic influence on the urban-rural and regional disparities in college access. The findings on the four aspects of China's higher education finance policies are summarized as follow.

First, public spending on the entire education sector has played a positive role in boosting recent large-scale expansion of higher education, largely because China's strategic planning for developing higher education led to skewed resource allocation favoring higher education over basic education. However, given incomplete secondary education and overall low literacy level achievement, the skew towards elite higher education suggests a strategic choice on the part of the government to drive economic growth rather than equality of education.

Second, this manuscript concludes that there is a negative correlation between public tertiary expenditure per student and higher education enrollment. It is evident that the cost-sharing policy in higher education finance, during which the state financial support for higher education declined proportionally, shifted the financial burden to students and parents.

Third, given the lack of data on China's education expenditure on tertiary institutions, the role of institutional expenditure on higher education access is unclear. However, the findings detect that the intensifying institutional stratification and the

enlarging institutional revenue gap have increased the inequality of higher education access.

Fourth, student loans have emerged as a major aid program in China, gradually replacing grants. However, the insufficient student financial aid programs in China have only a limited influence on higher education access.

Johnstone et al. (1998), in a large-scale country comparison, state that one of the aims of government reformation in education financial policy is to assure “access for those of high ability and motivation, from families otherwise unable to pay” (p. 28). However, given the above analysis of these four aspects of finance policies, it is clear that higher education financial policies in China are too limited or insufficient to mitigate the effect of economic growth on inequality of higher education access. Again, the lack of effective financial policies may leave market forces to dominate the distribution of higher education opportunities and further intensify social inequality.

The Linkage between Secondary and Higher Education

In addition to higher education finance policies, preparing students to be academically ready for college courses, and financing them along the college pathway, are also of great importance in examining college access. For a country that provides only nine years of compulsory education and where large numbers of students do not complete secondary education, the linkage between secondary and higher education is particularly important. In both the OECD and WDI chapters, both secondary enrollment and secondary student expenditure are considered potentially influential factors for higher education access. However, the two manuscripts conclude they are not statistically significant predictors. Moreover, the role of secondary student expenditure is not

statistically different between developed and developing countries. Thus, this manuscript hypothesizes that these two factors do not play a significant role in China's higher education.

Secondary Enrollment and Tracking System

Secondary schooling, both lower secondary (equal to junior middle school in the U.S.) and senior secondary enrollment (equal to high school in the U.S.), is a crucial stage in preparation for higher education. Unlike many high-income OECD countries that have universal upper secondary education, China has long maintained a binary structure—the academic track (high school) and the vocational track (including specialized secondary schools, vocational high schools, skilled worker schools)—in upper secondary education, following the nine-year free compulsory education (elementary and junior middle schooling). The academic track primarily prepares students for college entry, whereas the vocational track prepares students for immediate entry into the labor market. It is important to note that, unlike some developed countries (e.g., Germany), which offer opportunities for secondary vocational graduates to access higher education, Chinese vocational school graduates are not allowed to attend the National College Entrance Examination (NCEE) and are thus denied the higher education opportunities.

Figure 4.6 shows that secondary enrollment for both lower and upper secondary education in China experienced rapid growth in the past decade, growing from 60% to 75%. In the first decade of the 21st century, China's secondary education enrollment caught up quickly with the average enrollment of developing countries and of that of the world.

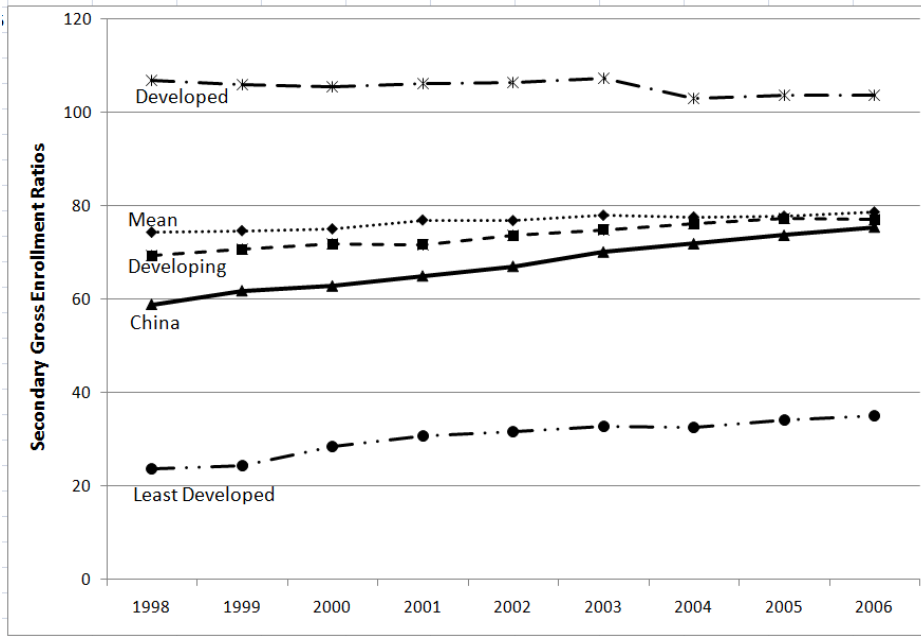


Figure 4.6. Secondary Gross Enrollment Ratios. (Source: WDI)

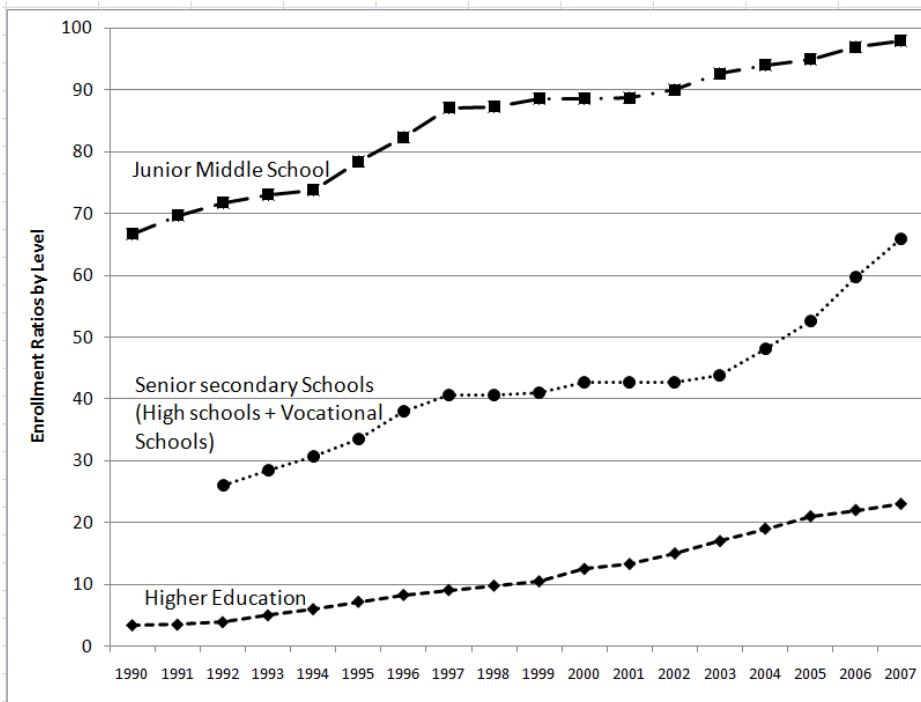


Figure 4.7. Enrollment Ratios by Level. (Source: Ministry of Education website, retrieved April 1, 2010 <http://www.moe.edu.cn/edoas/website18/96/info1261548667642896.htm>)

Concomitant with the dramatic expansion of higher education, the junior middle schools and senior secondary schools both achieved tremendous growth. As shown in Figure 4.7, junior middle school participation grew from 67% to nearly 100% in the past two decades, while senior secondary schools (including regular high schools and vocational schools) started from as low as 25% and achieved nearly 70% in the early 21st century. The growth scales of the two secondary education sectors far exceeded those at the level of higher education.

A closer examination of the structure of senior secondary education, as shown in Figure 4.8, however, reveals a complementary relationship between general high schools and vocational schools in the past two decades, one falling and the other rising.

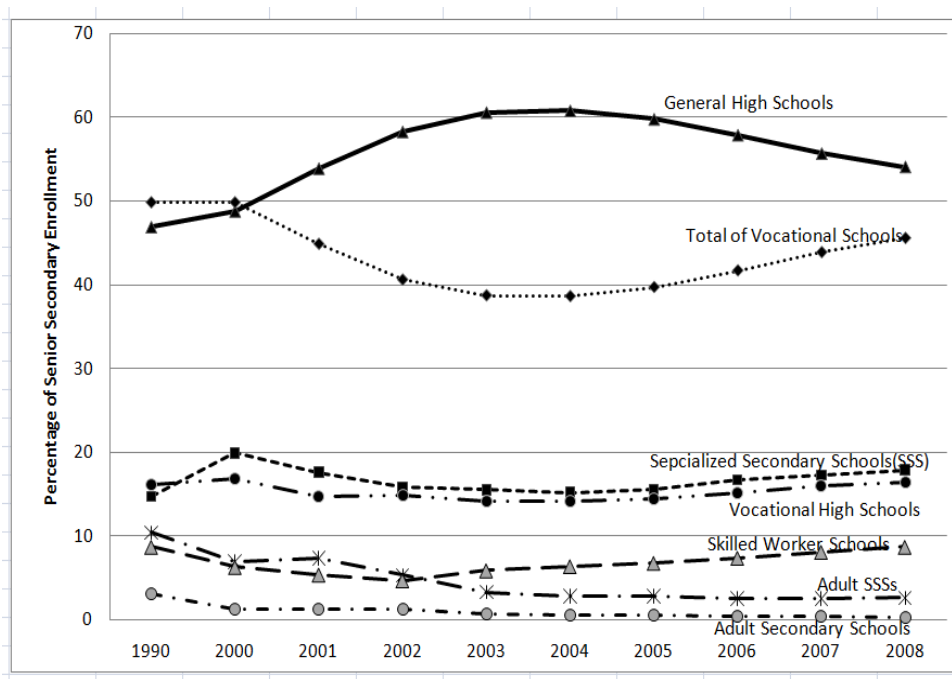


Figure 4.8. Senior Secondary Enrollment by School Type (Note: 1985 Adult SSS is imputed with average of two adjacent years).

Source (Ministry of Education website, retrieved April 1, 2010

<http://www.moe.edu.cn/edoas/website18/01/info1261475057200801.htm>

The rise in high school enrollment and decline in the vocational track in the 1990s and the early 2000s can mainly be attributed to two reasons. First, since the recent expansion of higher education created more places available in general senior secondary education, more and more graduates from junior middle schools tended to attend high schools, hoping to eventually enroll in higher education rather than go to secondary vocational schools (Liang, 2001). Second, the increase in family income and the only-child policy allowed families to devote more resources to supporting high school education, which is not free, and then higher education (Ge, 2010; Wang, 1998).

The inverted development of these two tracks since 2004 seems counterintuitive. First, the phenomenon can be partially attributed to the changing needs of the market and the rising unemployment rate of college graduates (Liang, 2001; Zhang, 2010c). With the rise of China's economy, the large emerging manufacturing enterprises created positions that require some professional skills on the production lines, but pay was not high. These positions were mostly taken by vocational school graduates, and college graduates were often considered over-qualified. Meanwhile, the rapid expansion of higher education enrollment since 1999 created tensions in the labor market. In 2009, while nearly 40% of the 6.1 million new college graduates were unemployed, secondary vocation education led, on average, to a better employment ratio (Chen & Gu, 2010). Thus, to avoid unemployment and low-paying positions, many students gave up on high school and college entrance examination opportunities, opting to attend secondary vocational schools instead of high schools. Second, the increase in vocational enrollment can also be attributed to recent vocational education policy reforms. The State Council decided to provide and increase financial aid to vocational schools in 2002 and 2005, respectively

(Ge, 2010). In addition, the government approved that some secondary vocational schools can admit students who failed the national college entrance examination in the recent few years. These reforms increased the attraction of the vocational track. Thus, the changes in the two tracks since 2004 reflected the result of market function and education policy adjustment.

Public Expenditure per Secondary Student as a Percentage of GDP Per Capita

In China, lower secondary education is compulsory and free of tuition, but all types of upper-level secondary schools charge tuition and fees. High schools charge flat rate tuition adjusted moderately for rural/urban location and regional income, and vocational schools typically charge 10% more tuition than high schools. Therefore, cost-sharing between government appropriations and student families is a common practice not only in higher education but also in upper secondary schools.

Figure 4.9 demonstrates that China invests a medium level of resources to secondary education, stably staying between 20 to 21 percent of GDP per capita. The secondary expenditure per student is nearly five-fold lower than that of the unit tertiary expenditure. This number, again, demonstrate a higher unit cost for educating a college student than a secondary student and a skewed resource allocation pattern favoring higher education than secondary education.

Given the multiple school types at the secondary level, decomposing the secondary education structure is necessary to depict the influence of secondary expenditure on higher education. Figure 4.10 shows that all kinds of per capita public expenditure for senior secondary schools are two to three times higher than that of the

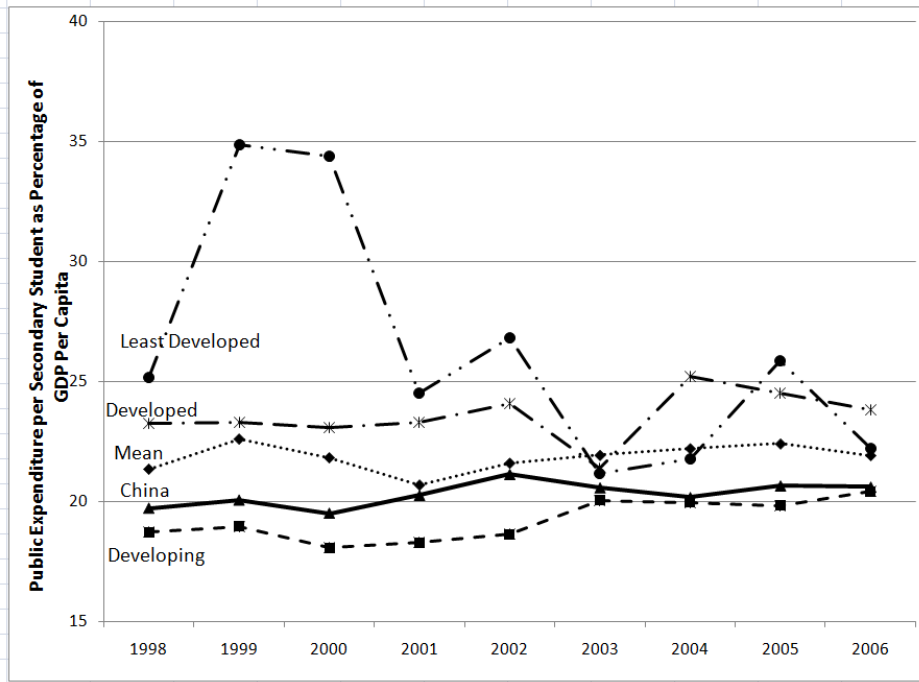


Figure 4.9. Public Expenditure per Secondary Student as Percentage of GDP per capita. (Sources: WDI and China Education Finance Yearbooks)

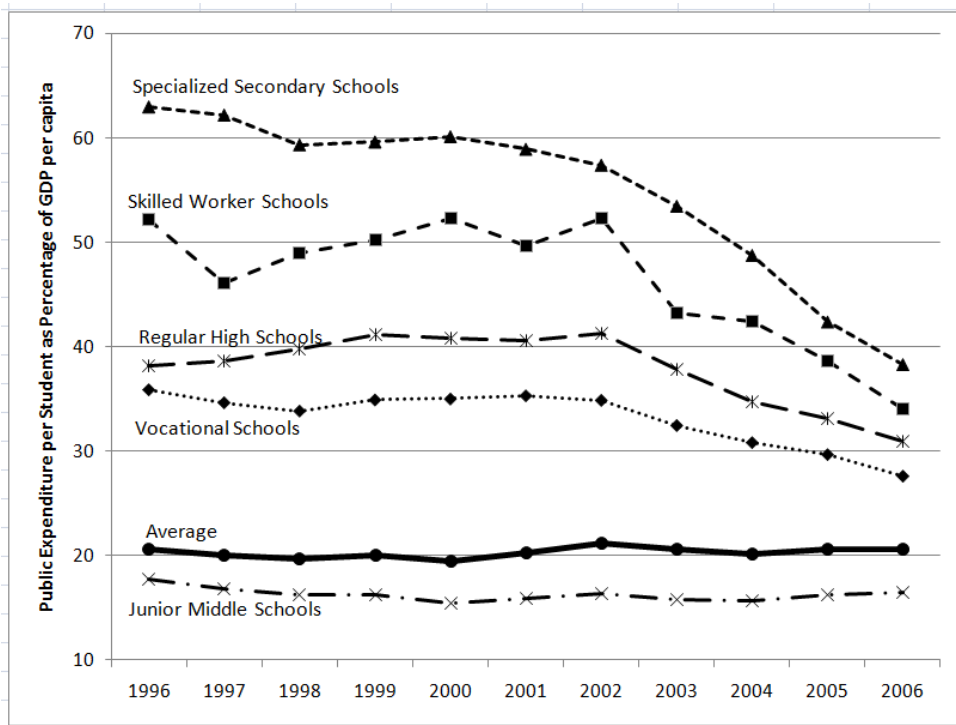


Figure 4.10. Public Expenditure per Student as Percentage of GDP per capita. (Source: China Education Finance Yearbooks)

junior middle schools. It is surprising that specialized secondary schools and skilled worker schools have been awarded vastly more per capita resources than regular high schools. In particular, per capita expenditure for specialized secondary schools occupied almost 62%, and skilled worker schools take up to 52%, of GDP per capita in 1996, nearly twice or 1.5 times higher than that for regular high schools. However, along with an overall declining trend of senior secondary education expenditure, the differences among these schools were dramatically reduced, particularly after 2002, and by 2006, per capita expenditures for specialized secondary schools were only 7% higher than those for regular high schools.

In China, secondary vocational education (SVE) is widely seen as a strategic focus that is equally as important as higher education in driving economic growth for a developing country, and thus should be allocated more resources (Ge, 2010). Based on current education attainment, China is still far from differentiating a vocational track at the higher education level, similar to the American practice of separating community colleges from 4-year HEIs. To meet the needs of the market economy, developing SVE is necessary to train sufficient technical and professional workers (Yu, 1995).

Considering the strategic choice of the government and the higher unit cost of secondary vocational education (SVE) than high schools, allocating it more financial resources is understandable. The mission of training practice-oriented, applied-type workers with beginning and intermediate level skills requires a greater amount of investment in labs, equipment and facilities than the theory-based instructional activities in high schools (Zhang, 2010a; Zhuang, 2002).

Bennell (1996) and Bennell and Segerstrom's (1998) reexaminations of the social rate of return (ROR) associated with SVE provide good theoretical support for China's strategic practice in developing SVE. These two authors rejected the earlier findings of Psacharopoulos (1984; 1987; 1994) that the academic secondary school curriculum provides higher social ROR than the technical/vocational track³. Instead, Bennell and Segerstrom drew on a larger group of countries than that included in Psacharopoulos's studies, and found that in the large majority of developing countries, social ROR for school-based vocational education are not significantly lower than for general secondary schooling.

The above analysis, together with the illustrations in Figures 4.9 and 4.10, indicate that a large enrollment size and a high unit cost together may lead to a large proportion of secondary expenditure going to vocational schools, diverting resources from the academic track for college preparation. Thus, an increase in secondary expenditure does not necessarily lead to an increase in higher education enrollment. Moreover, the existing literature from economic and sociological perspectives may hint at a negative influence of current SVE practices on equal access to higher education.

Based on the calculation of private rate of return, the Chinese scholar Liu (2010) argues that a higher private ROR on SVE than high school education may result in the fact that more high-income students attend high schools while low-income students are mostly channeled towards SVE. Liu (2010) computes the Mincerian Rates of Return of

³ Psacharopoulos's (1984; 1987; 1994) research followed approximately the following two short-cut formula in calculating social rates of returns of general and vocational secondary education: $r_{general} = \frac{\bar{Y}_{general} - \bar{Y}_{primary}}{4(\bar{Y}_{primary} + C_{general})}$, and $r_{vocational} = \frac{\bar{Y}_{vocational} - \bar{Y}_{primary}}{4(\bar{Y}_{primary} + C_{vocational})}$, using primary schooling as the control group. In the formula, Y denotes benefit, C denotes cost, and the number 4 denotes the duration of the four-year general or vocational education at upper secondary level.

the two tracks and finds that the return on one year of secondary vocation schooling is 1.5 times higher than that of receiving one year of high school education.

Although SVE may result in a higher private return than high school education, some researchers find that the private ROR to college education is on average higher than that of the SVE or high school education (Chen & Min, 1998; Li, 2001; Li, 2009). Thus, when compared with higher education graduates, the secondary vocational education often leads to low-paying, low technical or insecure jobs. The higher education ROR studies, along with Liu's (2010) research, suggest that those low-income students who are unable to afford the cost of higher education are more likely to choose lower-cost vocational secondary schools.

In addition to the above argument from an economic perspective, the existing sociological literature also sheds light on the role of China's SVE in educational inequality. In Dustmann's (2004) view, given that students are relatively young (around 15 years old) when they choose an academic or vocational secondary track, the students' parents and family socio-economic background play a significant role in students' choices. Here students' age was emphasized as a key factor for secondary track choice, and their decisions gave a high weight to available family resources and parental preferences. Dustmann argues:

Better educated parents may be in a stronger position to extract information about this potential, and decide for higher track schools despite a negative recommendation of the teacher. Also, better educated parents may feel that they have more resources (both financially and in terms of academic advice) to support their child at a higher track secondary school than parents with poorer educational background. [...] Parents' own education and professional class may shape their taste and perception of what is an appropriate educational and professional career for the child. Even in the absence of financial constraints, working class parents may consider a lower track education and an early labor market entry the best option for their child. (p. 227)

Since SVE in many countries often leads to inferior job positions, while higher education can lead to more prestigious positions, the tracking system in essence serves as an early dividing line of social class (e.g., Breen, Iannelli, & Shavit, 1998; Shavit, 1990a). Therefore, based on Dustmann's analysis of students' age, the binary structure of senior secondary education signals an early social stratification based on parental socioeconomic class and reflects strong intergenerational immobility. Consistent with Dustmann's argument, numerous scholars agree that tracking is a mechanism for the social or class reproduction of social inequality (e.g., Bertocchi & Spagat, 2004; Gamoran & Mare 1989; Iannelli, 1997; Oakes, 1985; Shavit, 1990a, 1990b; Shavit & Muller, 2006).

Based on the above analyses, it should be the case that in China, only those students whose families are able to pay the tuition and the foregone earnings of not working during high school and university—or those whose academic performance is good enough to earn them a scholarship—will choose to study in regular high schools. Low-income students whose academic performance lags behind due to a lack of social capital will be channeled into the vocational track. Such self-screening processes take place far earlier than the college entrance examination and form a skewed distribution, with more higher-income students continuing to regular high school but more low-income students entering vocational schools.

Such reasoning lends firm theoretical support to the counterintuitive phenomenon since 2004 demonstrated earlier in Figure 4.8. On the vocational side, the financial aid and enrollment policy reforms and market moderation attracted more low-income students—who are unable to afford higher education but may have a strong desire for

obtaining higher education—to the secondary vocational track, which then diverted them away from higher education. On the academic side, in spite of the constant increasing trend of higher education enrollment, the proportion of students in the academic track preparing for college entrance was shrinking. If the shrinkage continues, it will not be long before entering high school means a guaranteed entry to higher education with a high school enrollment ratio equaling that of college. As students who are both academically and financially competent will fill the high school seats, higher education will be filled with more elites. Therefore, the unbalanced secondary expenditure, together with the enrollment pattern of declining high school enrollment and increasing SVE, greatly intensifies the inequality of higher education access.

Section Discussion and Summary

This section compares China's data on secondary enrollment and finance with that of other countries in the world. Due to the tracking system in China's secondary education, the study decomposes the structure of secondary enrollment and finance between the academic track and the vocational track. The decomposition of enrollment trends reveals a complementary relationship between general high schools and vocational schools, with one falling and the other rising. It is particularly alarming that high school enrollment began to decline and enrollment in the vocational track began to rise beginning in 2004, despite the fact that the linkage toward higher education is broken on the vocational track.

Closer examination of the per capita expenditure on different tracks demonstrates that specialized secondary schools and skilled worker schools have been awarded more per capita resources than regular high schools. The analyses indicate that large enrollment

size and high unit cost together may lead to a large proportion of secondary expenditure being spent on vocational schools, diverting resources from the academic track for college preparation. Thus, an increase in overall expenditure for the secondary sector does not necessarily lead to an increase in higher education enrollment.

Based on the economic literature on social and private rates of return as well as social reproduction theories, this manuscript finds that the skewed secondary expenditure toward SVE, together with the enrollment pattern of shrinking proportional high school enrollment and increasing SVE, greatly intensified the inequality of higher education access. Class stratification in secondary education is now remarkably high, leading to a predictable demand for higher education.

Compared with the educational systems in developed countries, a universal basic education lasting twelve years rather than the current nine-year compulsory education seems a better way to reduce the early social stratification in the college pathway. However, China's current education investment and strategic development of higher education may limit its initiative in developing a universal type of high school. This may be a future trend in China.

Demographic Influences on College Access in China

The demographic changes that took place in many countries (such as increasing ethnic diversification in the U.S. and the decline in birth rates in Japan) have played a crucial, far-reaching role in affecting their college student body and have been extensively studied. For China, the world's largest population, the family planning policy, the aging trend and the large rural population have also made the influence of demographic changes on higher education increasingly evident.

In the OECD and WDI papers, six population factors— total population, older population, growth rate, employment rate of youth population, rural population, and female population—were considered as possibly influential factors on higher education finance and access. Given the unique characteristics of China’s population, the factors considered in the OECD and WDI papers are expected to have an important influence on Chinese higher education.

Total Population

In the past two decades, China’s population has been the world’s largest. It is reported that by the end of 2009, the total population of China reached 1.34 billion (NPFPC, 2010). A popular quotation in numerous newspapers and research articles, “educating a large population in a low-income country,” may illustrate the extreme difficulty of using very limited education finances to support a huge population. No matter how big the total investment in education, once divided by this extremely large denominator, the resources allocated to each individual are reduced to a very small level. Thus, although it is a non-significant predictor in the OECD and WDI manuscripts, the factor of total population can be a compounding factor that exerts a significant, negative influence on China’s higher education access.

Population Growth Rate

Both the OECD and WDI papers conclude that population growth rate does not exert an effect on higher education access. However, these general conclusions cannot deny the fact that an exceptional increase or decrease in growth rate in quite a few developed countries has had a far-reaching influence on higher education access. For example, in the U.S., the postwar baby boom (1946-1964) led to an unprecedented

expansion in American higher education 17 to 19 years later (Pascarella & Terenzini, 1998). In another instance, the remarkably low fertility rate that has been in place in Japan since 1975 has led to ratio adjustment in public resource allocations between basic and higher education, and to the bankruptcy of about 200 private HEIs due to low enrollment (Chen & Gu, 2010; Shi, 2005a, 2005b).

Similar to the U.S. and Japan, the decline in the population growth rate in China may have a profound influence on China's higher education. China's population growth rate is ranked the lowest in the world—below 1% since the late 1990s, declining gradually in the most recent decade (WDI, 2010). The dramatic drop is due primarily to the Family Planning Policy issued in the late 1970s, which requires couples from China's ethnic Han majority to have only one child (ethnic minorities are largely exempt from this policy).

The family planning policy implemented three decades ago has had an increasingly evident effect on college enrollment in the 21st century (Chen & Gu, 2010). As many researchers have observed, the decline in fertility—the number of children per woman—has produced a shrinking number of children since the 1980s. Gao (2010) compares three approaches to predicting future higher education enrollment size and concludes that the population of college age adults reached two peaks in 2005 and 2008, respectively, and has been declining gradually since 2008. Guo and Yang (2009) further predict that there will be a sharp drop in the college-aged cohort in 2025, during which the 18-year-old population will be only 15.6 million, 61.3% of that in 2005.

Therefore, given the decline in the total population of the college-aged cohort, college enrollment as well as enrollment ratios will rise over the following several

decades (Yang, 2009). Gao (2010) and Mao (2006) argue that because of the shrinking size of the college-aged cohort, the gross enrollment ratio will increase naturally to 36%-56% by around 2020, even if HEIs do not expand current enrollment voluntarily. At that point, competition among HEIs for prospective students will become more severe, and many higher education institutions, particularly lower-tier ones, may be forced to close, as occurred in Japan. Thus, examining the influence of demographic change on higher education access has become increasingly important for future higher education development.

Increasing Older Population

Both OECD and WDI papers conclude that the proportion of the older population (age 65 and older) bears a positive association with college access, probably due to the fact that a lower proportion of youth in the population leads to fewer college students which, in turn, leads to fewer students in need of funding. With a lower burden on the government, student access to higher education can be better financed.

Comparative scholars worldwide have mixed findings with regard to the influence of an aging population on higher education. One group of scholars argue that the aging trend, together with the declining fertility rate, may have a positive influence on higher education, largely through alleviated financial resources because of fewer pupils (Lopez, 2006). The other group of scholars warns of a negative influence of the aging trend, mainly due to the social and political influence of the growing proportion of the elderly on a greater demand for public resources for retirement security, health care, etc, thus shifting public priorities away from investment in education (Duderstadt, 2008; Grob & Wolter, 2005; Preston, 1984).

For China, its aging rate is slightly steeper than the average of developing countries and very close to that of the developed countries (WDI, 2010). Existing Chinese research reports controversies that are similar to those in the Western literature. Zou (2010) finds that the recent aging trend in China is largely different from that of the Western developed nations in that the Western democracies allow people of different ages to exert direct influence on public finance so as to interfere with youth education investment. However, such direct influence from the aging population may not exist for a relatively centralized society such as China. Thus, the aging trend has not impinged upon the education resources at this stage. Unlike Zou, Li and Min (2001) argue that the proportion of 65 and older population is an important indicator of the social burden of the working age (15-64) population. An older population means a heavier social burden and thus reduces the capability of individuals to share education costs. Although seemingly controversial, the two Chinese scholars' statements may both be valid but for different time periods—Zou's for the current moment and Li's for twenty or thirty years down the road.

In the earlier section on China's education finance policies, this study concludes that the current educational resource allocation favors higher education over basic education, in which the influence of the aging population seems negligible. Thus, by examining the Western and Eastern literature and recent Chinese practice, this study tends to conclude that the influence of the aging population in China may not be significant in the immediate future, but will likely become increasingly important in the future.

Employment of Youth Population

Both OECD and WDI papers reveal a negative relationship between employment of the youth population and higher education access. The WDI study finds that the negative relationship between youth employment and college access suggests that the college financial burden may deter many youths from attending and completing high school as well as enrolling in higher education institutions, and may force them to enter the job market.

This relationship may be true for China. The youth employment rates are defined as the proportion of a country's working age population from 15 to 24 years old that is employed. Since China's college age is defined as 18 to 22 or 23 years old (one or two years below the upper age limit of 24 for the definition of youth), the majority of employed youth should be those who have obtained only a compulsory or senior secondary education, and only a small part of the employed are new college graduates. Accordingly, the group opposite the employed youth, or the youth outside of the labor force, includes students in senior secondary schools and colleges as well as those who are out-of-school unemployed.

As demonstrated in Figure 4.11, China has both the highest youth employment rates (65-70%) in the world and the most dramatic decline over the nine years. The decline in youth employment but rapid expansion of college access (9-22%) in China in the same period seems to confirm their negative relationship, as concluded in the OECD and WDI papers.

The earlier section on Chinese secondary-tracking system has already compared high school and secondary vocational enrollment. The growing enrollment of students in

the secondary vocational track, and its high employment rate in particular, may substantially contribute to the high employment rates of the youth population. The expensive higher education costs and high unemployment ratios of college graduates could be the major reasons why a growing proportion of students choose secondary vocational education. It is also worth noting that in recent years, largely due to the increasing unemployment ratios for college graduates, many college students became either unemployed or returned to vocational schools for retraining, thus reducing the youth employment rates (Zhang, 2009). The stagnation of youth employment since 2003 is reflected in Figure 4.11.

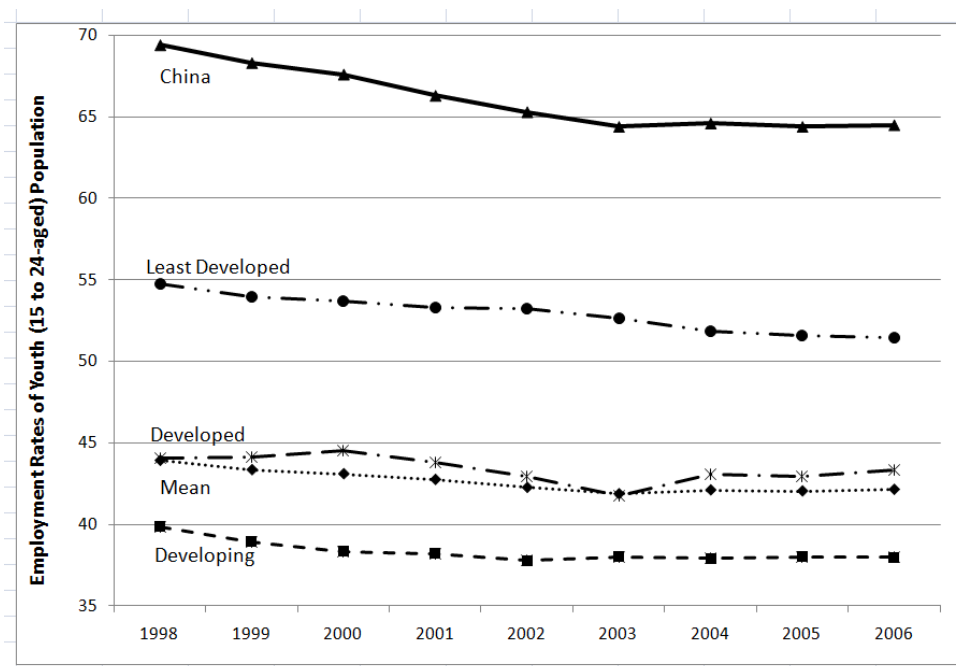


Figure 4.11. Employment Rates of Youth (15-24 years old) Population

Rural Population

In the OECD and WDI papers, the proportion of rural population does not have a significant influence on higher education enrollment ratios. The case might be different for China, however. From 1998 to 2006, China's rural population accounted for a high of 66% to a low of 59% of the entire population, ranking about 40% higher than developed nations and slightly below the average level of rural population among low-income nations. The earlier sections of this chapter have noted the alarming urban-rural disparities in the economy and higher education access. Rural students represent the low-income, most disadvantaged group, those who are least likely to be able to afford college or to attend the academic track in secondary education. Thus, this chapter tends to conclude that the proportion of rural population may have a negative influence on higher education participation.

It is important to note that China has one of the world's fastest rates of urbanization, with a nearly 1% per year reduction in rural population around the turn of the century. Thus, it is likely that the influence of the rural population on higher education access will decrease in the future.

Gender Difference

In the OECD and WDI papers, the proportion of females in the population and gender ratios in basic education do not have a significant influence on higher education enrollment ratios. This might also be true for the case of China, particularly if examining only the quantitative differences at a macro level. Indeed, thanks to the improvement in girls' education, gender difference is nearly negligible at the compulsory education level

and has been gradually reduced or even reversed at the senior secondary and higher education level.

However, further examination of the literature reveals great gender disparity on the choice of institutions and in rural areas (Fang, 2009; Zhao, 2009). Similar to many OECD countries, such as the U.K. (Halsey, 1993), although the overall number of Chinese female students is nearly equal to that of male students in higher education, Chinese female college students are concentrated mostly in low-tier or two-year institutions (Fang, 2009). In addition, Zhao (2009) finds that girls' schooling in current rural community culture is often regarded as "useless" or a "waste of money," greatly undermining girls' college dreams or even leading to girls' early drop-out from the college path.

Section Discussion and Summary

The influence of demographic changes on higher education access has become increasingly evident in China. This section examines how the demographic factors included in the OECD and WDI papers may affect China's college access. First, largely due to the extreme difficulty of using limited education resources to support a huge population, the factor of total population can exert a negative influence on college access. Second, the rapidly declining population growth rate of China, due to its family planning policy of three decades, has had an increasingly evident, positive effect on college enrollment ratios. Third, the influence of an aging population may not be significant in the near future but is likely to become increasingly important in 30 to 40 years. Fourth, the decline in youth employment but rapid expansion of college access signals a negative relationship between them. Fifth, the large size of the rural population and their low-

income status may contribute to a negative influence on higher education. Sixth, although the overall number of Chinese female students is nearly equal to that of males in basic and higher education, gender disparities exist in the choices of HEIs and in rural areas.

Conclusion

Drawing on the conclusions from the OECD and WDI manuscripts, this study investigates their implications for China's higher education access in the two most recent decades. Drawing on the comprehensive framework that was used in the previous two manuscripts, this paper examines the influences of economic growth, education finance policies, the educational system and demographic changes on college access in China. This review finds that while China's uniqueness in its educational system and demographic factors have made it an exception from the general findings of the OECD and WDI manuscripts, China's case is largely consistent with the previous conclusions regarding the influence of economic growth and education finance policies on access.

Indeed, China's active participation in world economic restructuring has led to dramatic economic growth and social changes, which has further brought about the remarkable higher education expansion around the turn of the 21st century. Consistent with most other countries, China's economic growth has strongly driven higher education access because it substantially increased individual income and enabled more people to have the financial ability to pay the costs of higher education. However, it also intensified the influence of economic disparities, largely visible through unequal access between rural and urban students as well as between eastern and western regions.

The role of education finance policies in promoting equal access to higher education is too limited to mitigate the negative influence of income disparities in China.

To drive economic growth, China's strategic planning for developing higher education led to skewed resource allocation favoring higher education over basic education. This skewing has impinged upon the resources to basic education and, thus, equality of education. Moreover, the role of institutional expenditure on access is unclear, and the insufficient student financial aid programs have only very limited influence on higher education access in China. The lack of effective financial policies in assuring equal access has left market forces to dominate the distribution of higher education opportunities. The cost-sharing strategy for financing higher education, combined with preferential enrollment practices, has tended to increase the urban-rural and regional inequalities in higher education access, favoring the upper class and middle-class students but denying more rural students.

As a result of the tracking system in China's secondary education, increasing secondary enrollment or expenditure is not necessarily related to an increase in higher education enrollment. This is because large enrollment size and the high unit cost of the secondary vocational track together may divert students and resources from the academic track for college preparation. In particular, since 2004, the rising unemployment rate of college graduates and the heavy tuition burden of higher education have led to shrinking high school enrollment but increasing vocational enrollment. More poor, rural students were channeled into the vocational track, breaking their bridge toward higher education. Class stratification in secondary education is now notably high, leading to a predictable demand for higher education.

The influence of demographic changes in higher education access has been increasingly evident in China. The huge total population, large rural population, and high

youth employment rates all exert a negative influence on college access, while the rapidly declining population growth rate of China due to its family planning policy has an increasingly positive effect on college enrollment ratios. Moreover, the influence of the aging trend may not be significant currently but is likely to become increasingly important in the future. Additionally, although there are nearly no quantitative gender differences in enrollment in basic and higher education, gender disparities exist in the choices of higher education institutions and in the rural areas.

The above comprehensive examination of access from different perspectives has made it clear that China's large-scale higher education expansion around the turn of the 21st century has violated the main principles of equal access. According to Johnstone (2003), equal access to higher education means that academic ability, talent and motivation are the only acceptable principles that correlate with higher education access, rather than family income or status, gender, and origin. In China, however, higher education access bears a strong mark of students' family income and geographic locations, and the role of education finance policies is too limited to lessen the negative market influences and to assure equal access. Such a trend poses a serious threat to healthy intergenerational mobility and societal growth.

It is alarming to point out that the current gross enrollment ratios of China are relatively low (24% in 2009), which is still "comfortably" located within the proportion of upper and middle class (together 40-50% of total population) in the social strata defined by Friedman (2005), Lu (2004), or Li (2005b). The upper and middle class are those who can afford the costs of higher education and enjoy its advantages. However, according to the current annual increasing rate of higher education enrollment, China will

soon reach out to the immense bottom class of the strata, the low-income peasants, in order to develop universal higher education. Without proper education finance policies and other policy reforms, the country is unlikely to be able to finance rural children's college dreams.

Thus, there is a need for China to redefine the role of the government and reform existing education policies in a changing environment. According to Yang and St. John's research (2010), providing full public funding to students has already become unrealistic. Given the limited resources at its disposal, Chinese government may better target the limited resources to disadvantaged groups to improve overall equity in higher education. This is the advice of this case study for China's higher education practice.

The international access literature can shed important insights into the reform of China's higher education and reduce inequality in higher education access. For example, Neave (1978), Premfors (1984) and Rhoades (1983) proposed government intervention in the forming of positive discrimination admission policies, similar to Affirmative Action currently used in the U.S. Chapman (1997) and Vossensteyn (2000) recommended that income-contingent loans replace the current mortgage-type loans in many countries. Inkeles and Sirowy (1983) and Jallade (1989) suggested that restructuring secondary school systems toward standardized academic knowledge in secondary schools was widely recognized as imperative for overcoming the barrier of tracking. This is also the advice of this case study of China's higher education practices.

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CHAPTER V

Conclusions and Implications

This dissertation, in the format of three interrelated manuscripts, examines the statistical relationship between education finance policies and higher education access in two country groups and then uses the analytical framework and empirical findings to reframe the discourse of education finance policy and access for China's higher education. This last chapter summarizes the general conclusions and contributions of the three manuscripts and then discusses their implications for future research and policy practice.

Summary of Analytical Approach and Theories

During the examination of the relationship between education finance policies and college access, the dissertation employs the following analytical framework and theories to address research questions and reach the purposes raised in Chapter I. In particular, the analytical framework and methodologies can contribute to the field of comparative higher education and allow future research to benefit from them.

Analytical Framework

The dissertation overcomes the inadequacies of the previous analytical frameworks and proposes a new and more comprehensive analytical framework that

provides a better understanding of access. The new framework incorporates factors not only from education finance but also from economic, education-system and demographic perspectives. The multidimensional view makes the framework open to external influence from society, the economy, educational systems and demographic factors. Its openness is consistent with the recurring arguments in the previous literature that access to higher education is affected by the broader social, economic and educational changes in the nations and the world.

It is important to note that this analytical framework is appropriate for both quantitative (Chapter II and III) and qualitative analysis (Chapter IV). In quantitative studies, the framework can be viewed as regression models that incorporate various factors as independent variables. On the other hand, these factors can also be individually examined by using a qualitative method, as in the China case study (Chapter IV). In addition, using the analytical model and statistical analysis to inform case analysis can help analyze the development of higher education access case studies of other countries, even though their data may not be included in the dataset.

Theoretical Framework

The above analytical framework draws on two economic theories and two sociological theories to help explain the relationship between education finance policies and higher education access. In terms of economic theories, the new growth theory by Romer (1990, 1994), which strengthens the rationale of government investment in higher education to boost economy, is complemented by Friedman's (2005) social justice theory, which proposes government intervention to reduce economic inequality.

The new growth economic theory (Romer, 1990, 1994) stresses that long-term economic growth is not the result of exogenous technological changes or forces that impinge from the outside but an endogenous outcome that is driven largely by intentional decisions of human capital investment made by profit-maximizing agents. However, since individuals do not fully understand the technological advance and social benefits that research may lead to, they tend to spend too little time acquiring knowledge and under-invest in education relative to the socially optimal outcome (Rustichini & Schmitz, 1991). Given that underinvestment in education may deliver slower growth, governments can potentially lead technological changes and advances in R&D by subsidizing higher education (Temple, 2000; Kopf, 2007). Although the new growth theory stresses that financing higher education determines growth, it does not address why public resources to higher education have still been reduced in recent decades and replaced with privatization practices (e.g., introducing tuition, shifting college cost to consumers). Nor does it address the inequality issues in the resource allocation to higher education.

Friedman's (2005) theory, on the other hand, considers government intervention via investment in education as a potential means for overcoming income inequality that had been brought about by economic development. Friedman analyzed the case of the U.S. and recognized the great financial difficulties that young, low-income Americans experience, which prevent them from attending any college without a scholarship. Thus, Friedman warns that the current financing mechanism that adopts privatization strategies (e.g., charging tuition and using loans) is a serious problem in overcoming the disadvantages of family background. He recommends that financial resources target the student population that is financially constrained in both high school and college,

probably starting from an even earlier stage. It is clear that, unlike the new growth theory, Friedman's theory supports a balance between markets and public policy, and between economic growth and social justice.

The two sociological theories—Bourdieu's (1973; 1977; 1984) cultural capital theory and Lucas' (2001) *effectively maintained inequality* (EMI) theory—are used in the Chinese case study to provide important insights into how social class, geographic factors, family background and the school system have formed unequal access to higher education between Chinese urban and rural students. These theories also warn about the potential intergenerational immobility that may arise as a result of unequal education. According to Bourdieu's theory, China urban and rural inequality can be formed and reproduced, in both passive and active manners, mostly via student family background, social class, school and culture. Cultural capital is the knowledge, experience and/or connections that people have had throughout the course of their life, giving them a higher status in society. The concept of cultural capital is fundamentally linked to “habitus” and “field”—two other concepts of Bourdieu's. “Habitus” can be regarded as the students' family and their social class background, which transmit the cultural capital to students to help succeed in the current educational system. Education can be regarded as a “field” because different social groups adopted pedagogical processes to reproduce themselves, and the motivation for this reproduction was to sustain the pre-existing class distinctions (Robbins, 1993).

Different from cultural capital theory, Lucas's (2001) EMI theory places greater emphasis on the active maintenance of inequality that the socioeconomically advantaged actors secure for themselves and their children, wherever advantages are commonly

possible. On the one hand, if quantitative differences are common, the socioeconomically advantaged will obtain quantitative advantage. On the other hand, if qualitative differences are common, the socioeconomically advantaged will attain qualitative advantage. In China's case, the quantitative and qualitative advantages mean that urban students not only acquire more opportunities to attend institutions of higher education than rural students but also attend more prestigious universities.

Methodologies

Remarkably different from the previous literature, this dissertation is the first international research to employ statistical models to establish a clear connection between the theory and the evidence that economic factors are significantly connected to increased access. Largely due to the methodological limitations of the existing literature, which is mostly qualitative or uses only descriptive statistics, this connection has not heretofore been established. This dissertation takes the advantage of the existing data on educational, social, economic and demographic changes across nations that have been collected by the international agencies, mainly the OECD and the World Bank. These data have been extensively used for decades and continuously improved upon in terms of quality.

The fixed and random-effects models that this dissertation uses are appropriate methods for analyzing the available cross-section and time-series panel data. These advanced statistical techniques enable researchers to capture and control for the country effect, which points to the uniqueness of a country's cultural heritage, and/or the time effect, which reflects policy changes over time. The models also allow researchers to focus on the impact of one factor, a set of factors, or their interaction terms on access while simultaneously controlling for many other factors in the same model. Thus, such

models can determine, in a relatively fair way, the contribution of education finance policy factor(s) in explaining the variation in access to higher education, parceling out the confounding effects from other factors.

In addition, the dissertation employs multiple model specifications and an instrumental variable method to improve analytical rigor and quality. Since fixed- and random-effects models have their own strengths and weaknesses, both the OECD and WDI chapters specify eight fixed- and random-effected models (including the models using instrumental variables), examine the cross-model consistence of estimates, and select the best performing models to draw conclusion. For example, the OECD chapter constructs four fixed or random effected models and uses Hausman test to determine a preferable model. Then, given the high consistence between the instrumental variables models and the regular random-effects model, the chapter finally chooses Model 3 (a random-effects model) to draw conclusions. The WDI chapter follows a similar procedure. Such multiple-model approach can reduce the potential bias of relying on one specific model to draw conclusions.

Moreover, the final selected models in the two chapters control both the time-invariant effects that exist for each country (e.g., national culture, political structure, education values and spending pattern on higher education) and time-variant effects (e.g., total population tended to increase annually during 1998-2006). Including both the group and time effects into fixed- or random-effect models could provide a more powerful study with both spatial and temporal dimensions, thus enhancing the quality of study. Additionally, the dissertation uses instrumental variable regression methods to resolve the endogeneity problem in the models and to enhance the analytical rigor of the study.

A Glonacal Perspective of Higher Education Access

This dissertation adopts a *glonacal* perspective of higher education access that shifts the focus to different countries (groups): it first concentrates on financial aid policies in a small group of high-income countries, then examines macro-level human capital investment in a broader set of countries, including developed and less developed countries, and finally narrows down to China's higher education access. The first two manuscripts reach beyond nation-states to generate global trends, whereas the third focuses on the national dimension and briefly analyzes the local domain (e.g., Chinese national and provincial universities). In this *glonacal* picture, global and national economic forces (e.g., world economic restructuring), national culture (e.g., Chinese culture of reluctance to use student loans), the world-wide education finance trends (e.g., cost-sharing and privatization), various international and domestic government agencies, such as the World Bank, OECD and China (central and local) governments, and students all play important roles in shaping and reacting to the globalization process of higher education access. In particular, this dissertation focuses more on how global market forces and public policy combat and influence access. It is important to note that the *glonacal* perspective makes it clear that while a global pattern is locally present, how developed countries or the country case of China, for example, may exhibit exceptional practices.

Conclusions Regarding the Roles of Education Finance and other Factors in Access

The above analytical framework and theories allow this dissertation to establish a clearer connection between education finance and access among high-income OECD countries, among a 98-country group, and in China. This section is to summarize the

findings on the relationships between differing education finance policies and access to higher education, followed by summaries of findings on GDP per capita, basic education and demographic factors.

Education Finance Policies

The following five education finance indicators are the major policy variables examined in Chapter II-IV, including financial aid programs (scholarships/grants and student loans), public expenditure on tertiary institutions, public expenditure per tertiary student, public expenditure per secondary student, and public expenditure as a percentage of GDP,

1. Student Aid Policies on Access

The indicators of student aid programs, i.e., scholarships/grants as a percentage of public tertiary expenditure and student loans as a percentage of public tertiary expenditure, only appeared in the OECD paper and China case study. How financial aid programs have affected access in the 98 countries of the WDI dataset could not be determined because of lack of data on this indicator.

The OECD study finds that scholarships/grants as a percentage of public tertiary expenditure and student loans as a percentage of public tertiary expenditure do not exert a statistically significant influence on higher education access in these OECD countries, largely due to insufficient or even declining public resources allocated to college students. However, researchers should be cautious that these findings are based on the measure of student aid programs as a percentage of public tertiary expenditure, and future research is suggested to further investigate how the monetary value of these student aid policies may affect access.

Findings from the case study of China show that student loans have emerged as a major aid program, gradually replacing grants. However, the limited funding available through student financial aid programs in China means that they have limited influence on access to higher education.

2. *Public expenditure on tertiary institutions as a fraction of the sum (private and public) of institutional expenditure*

This indicator also appeared in the OECD paper and China case study only, due to lack of data in the WDI dataset. In light of the declining or stagnant trends of public spending on tertiary institutions among the OECD nations, it is not surprising that institutional spending does not exert any influence on higher education access. Given the lack of data, the role of China's education expenditure on tertiary institutions is unclear. However, the increasing institutional stratification and the enlarging institutional revenue gap between national and regional universities seem to imply that equal access to higher education has worsened in China.

3. *Public expenditure per tertiary student as a percentage of GDP per capita*

Since public expenditures on education per tertiary student is formulated in relation to GDP per capita, it is more comprehensive in depicting higher education unit cost and the government role in cost-sharing. In both the OECD and WDI manuscripts, public expenditure per tertiary student as a percentage of GDP per capita bears a statistically significant but negative association with tertiary enrollment. Given the higher unit cost associated with providing higher education compared with basic education, the past higher education massification worldwide has made it difficult for governments to provide every college student with adequate funding. When governments spend too many

public resources on one college student, compared with the national average GDP per capita, the resources and opportunities allocated to other students may be curtailed. The negative relationship implies that for a fixed total budget on higher education and a rising total enrollment, various nations have reduced spending on each student and drawn on more private resources to increase higher education access.

The China case study also draws a similar conclusion as to the negative correlation between public tertiary expenditure per student and higher education enrollment. It is evident that for most nations in the world, the cost-sharing policy in higher education finance, during which the state financial support of higher education declined proportionally, has shifted the financial burden to students and parents.

4. *Public expenditure per secondary student as a percentage of GDP per capita*

The research includes the public expenditure per secondary student as a percentage of GDP per capita in the analytical model to examine whether the amount of funding allocated to secondary education may affect tertiary enrollment. This indicator depicts secondary education unit cost and the government role in cost-sharing. The OECD and WDI manuscripts find that public expenditure per secondary student as a percentage of GDP has no statistically significant effect on tertiary enrollment ratios for both developed and less developed countries. The lack of significance can be attributed to the fact that many developing nations still need funding to expand secondary education participation or to promote education in the secondary vocational track, neither of which necessarily broadens the pool of college-prepared graduates for higher education.

China might be an outlier of this relationship. Within the secondary education tracking system in China, a large enrollment size plus a high unit cost of the secondary

vocational track together seem to have contributed to diverting students and resources from the academic track for college preparation. In particular, after 2004, the rising unemployment rate of college graduates and the heavy tuition burden of higher education have channeled more poor, rural students into the vocational track, breaking their bridge to higher education.

5. Public spending on education as a percentage of GDP

Public expenditure on education as a percentage of GDP gives an indication of how a country prioritizes education in relation to its overall allocation of resources. The OECD manuscript finds that public spending on education as a percentage of GDP has a statistically significant, positive impact on college enrollment. This finding suggest that prioritizing education resources over other public sectors (e.g., health) and allocating a higher percentage of GDP on education sector can help improve the general education situation in a country that can benefit all education sectors, including higher education. In particular, since most OECD countries had almost universal basic education, an increase in public spending is more likely to be invested in higher education to stimulate economic growth and equalize opportunities to higher education. This statistically significant indicator also implies that OECD national still relied substantially on public finance to increase access.

Consistent with the OECD manuscript, the WDI article finds that, although public spending on education as a percentage of GDP has no statistically significant main effect on tertiary enrollment ratios, this indicator is found to have a greater impact on higher education access for developed countries than for less developed countries. This finding can be explained by the fact that the relatively lower cost of college education and the

higher income of citizens may increase the likelihood that students and parents can co-share the cost of college education with governments, whereas less developed nations are unable to do so. For less developed nations, this non-significant predictor, together with the earlier findings on a negative impact of public tertiary expenditure per student and lack of significance of public secondary expenditure per student, implies that in the absence of positive potent government intervention, non-government resources may have played a greater role in expanding access. Thus, this education finance pattern in less developed countries distinguishes itself from the pattern of the higher-income OECD nations, which still rely substantially on public finance to increase access.

In China, the priority of developing higher education over basic education that China has adopted to drive economic growth has led to skewed resource allocation that exemplifies the priority. The skew has impinged upon the resources to basic education and thus equality of education.

GDP Per Capita

GDP per capita, a measure of average income and other economic factors, is a major indicator in the analysis because it sheds light to how national economy has affected access and how market forces interact with education finance policies in affecting access. The OECD manuscript finds that national economic development, has served as a strong driver for higher education access, implying growing trend toward privatization and cost-sharing strategies over the past decade. These findings imply that using cost-sharing or privatization approaches to finance college access did not mitigate economic inequality with regard to access.

For the WDI manuscript, while the growth of the national economy bears no statistically significant association with higher education access for the 98 countries, it does have a greater impact on higher education access for developed countries than for less developed countries. Such results can be reasonably attributed to the fact that the fast growth in GDP per capita in developed countries in recent decades has enabled the average citizen/household to have more money available to pay for college education, thus increasing college participation. However, the very low level of GDP per capita in less developed countries does not allow for this expense.

The China case study finds that, although China's economic growth substantially increased individual income and enabled more people to have the financial ability to pay the costs of higher education, it concurrently intensified the influence of economic disparities, largely visible through unequal access between rural and urban students as well as between eastern and western regions. The study also finds that the roles of various education finance policies are too limited to mitigate the negative influence of income disparities on equal higher education in China. The ineffective financial policies in assuring equal access have left much room for market forces to dominate the distribution of higher education opportunities. As a consequence of the cost-sharing strategy for financing higher education, the urban-rural and regional inequalities in higher education access tended to worsen, favoring the upper class and middle-class students but rejecting more rural students.

Basic Education Indicators

The dissertation considers academic preparation in basic (primary and secondary) education important factor in examining a country's higher education access. Thus, three

indicators—primary enrollment ratios, secondary enrollment ratios, and gender ratios of basic education—are incorporated into the analytical framework. Largely due to adequate prior-college education among OECD countries, the basic education indicators do not exert any statistically significant influence on access. For the 98 countries in the WDI dataset, the lack of significance of basic education indicators suggests a loose connection between basic education enrollment and higher education access. For the case of China, the relationship between basic education and higher education access is rather complex (please refer to the earlier subsection entitled *Public expenditure per secondary student as a percentage of GDP per capita*).

Demographic Indicators

The dissertation considers five demographic factors in the analytical framework: population size, aging, growth rate, rural population, gender ratio, and youth employment rates. In both the OECD and WDI manuscripts, a negative relationship between youth employment and college access suggests that the college financial burden may deter many youths (15-24 years old) from attending and completing high schools and enrolling in higher education institutions, and may force them to enter the job market. Supporting this financially needy youth population and reducing youth employment represent an area that needs indirect support from governments to promote higher education.

In addition, the WDI manuscript finds two statistically significant coefficient estimates that may also shed light on the entire picture of higher education development. First, the positive association between the proportion of older population (age 65 and older) and college access is likely due to the fact that a lower proportion of youth in the population leads to fewer college students which, in turn, leads to fewer students in need

of funding and places a lower burden on the government. Second, the negative association between total population and higher education enrollment means that countries with a larger total population may have a larger college-aged population, increasing the difficulty for governments with supporting the demand for higher education.

The influence of demographic changes, such as the aging trend, in higher education access has been increasingly evident in China. The huge total population, large rural population, and high youth employment rates may all exert a negative influence on college access, while the rapidly declining population growth rate of China due to its family planning policy has an increasingly positive effect on college enrollment ratios.

Implications for Future Research

The empirical analysis demonstrates that the following elements are indispensable for future comparative access studies: appropriate analytical framework, comparable cross-national time-series data, and appropriate methodologies.

Analytical Framework

Future comparative research on access, whether qualitative or quantitative, needs to consider an appropriate analytical framework containing a broader range of factors. These factors can include, for example, education finance policies (e.g., tuition and fees, loans, grants, scholarships, family allowance, public expenditure as a whole and per student), the economy, educational system (e.g., primary and secondary education level), and demographic factors (e.g., population size, growth rate, aging trend, female, rural). Future research may also consider other factors that the literature has found to have an

impact on access, such as socio-political (e.g., socialist/capitalist regime type (Premfors, 1984)), and cultural factors (e.g., Confucius culture (Zhao, 2009)).

Moreover, the effects of these factors on access should be assessed in terms of whether the overall enrollment increase and whether they affect equal access among various student groups. To examine these two aspects, higher education enrollment numbers and ratios, as well as some student characteristics (e.g., age structure, national average household income, gender ratios, part- or full-time status, and race) at the national level, should be included.

Data

To provide appropriate measures of the above factors in the framework, comparable, large-scale, well-classified, cross-country and time-series databases are essential. Currently, a set of cross-country time-series international indicators have been collected and published by some international agencies, such as UNESCO, OECD, and the World Bank. Through its role in collecting information on education and reporting on conditions of education, OECD is the official agency for reporting college access for both its members and some non-member countries, and has provided the most diversified, up-to-date information among all international agencies. The World Bank has collected data on the economy, demographics and social development for more than 200 countries and regions, but much information is missing from the dataset, particularly from less developed nations.

Although much improved in recent years, the current international databases have several limitations and need further improvement (Henry et al., 2001). First, some important measures must be added, some variables need better definitions and

classifications, and the missing data should be reduced to minimum. For example, how the OECD's statistical agency measures student loans is unclear as to whether some government-subsidized loans run by private banks are also counted into the public expenditure. For another example, since scholars find that grants exert greater effects on student access than scholarships, especially for low-income students(e.g., Heller, 2001), the OECD data-collecting agency needs to distinguishes need-based aid (grants) from merit-based aid (scholarships or loans) in the datasets that were misclassified as one category. Thus, the study recommends that future data collection in the World Bank and OECD headquarter should take the data quality and definitions more seriously so as to increase the data utility.

Second, current datasets on access provide only basic information of student characteristics upon enrollment by gender and age, which are important measures for examining equality of education opportunities. In the future, considerable work needs to be done to more carefully differentiate the enrollment numbers/ratios by average household income and social status, mode of study (i.e. part-or full-time), race or other disadvantaged indicators.

In addition to the measures on student characteristics, this dissertation recommends that future research collects a total worldwide enrollment number/ratio, which includes domestic and study-abroad enrollments. The number of international students has been increasing in the last decade. Some countries like Norway purposefully send students to other countries to receive higher education because of inadequate domestic training capacity in certain areas. Some other countries like Australia, the U.K. and the U.S. recruit a large number of foreign students as a source of short-term and long-

term revenues (Vossenstyn, 2004). Thus, the measure for world higher education enrollment growth, particularly the enrollment growth in the number of international students, can better capture the exporting and importing trends in the global educational market and benefit future international comparative research on access.

Third, diverse sources, such as surveys, statistics and reports of a single country or regional institutions, have been used in most previous data collecting process (Henry et al., 2001). Although the data collecting agencies have refined the data and aligned them to comparable categories, some data still lack comparability and standardization. To improve consistency, long-term coordination of data collection activities across a large number of countries and advanced data-collecting techniques are needed.

Methodologies

The empirical analysis of this dissertation also implies that the quantitative methodologies of comparative studies need to be improved. Fixed and random-effects models are only one type of the many appropriate methodologies of data analysis. Since advanced statistical methods that best developed and widely used in evaluating the effects of college finance on access in the U.S., they can serve as valuable templates for cross-country comparisons. For example, ordinary least squares (OLS) and hierarchical linear regression (HLM) models (Bryk & Raudenbush, 1992) allow researchers to focus on the impact of one factor or a set of factors on access while controlling for many other factors at the same time in the same model.

In the statistical models, researchers can try alternative modeling by adding or reducing variables, or transforming indicators in the models. Most factors mentioned earlier can be regarded as continuous independent variables, and some others factors,

such as regime type, could be transformed to dummy variables or converted to interaction terms by multiplying with a continuous variable. In addition, future research can also convert some normalized education finance variables (e.g., scholarships/grants or student loans as a percentage of public expenditure on tertiary education, and public expenditure per tertiary or secondary student as a percentage of GDP per capita) into real monetary values and test their relationship with college enrollment. Interpreting the converted indicators can provide new perspective regarding how the changes in the volume of the education investment may affect access.

Implications for Future Practices

This dissertation examines the influences of education finance policies on higher education access and allows future policy practice to benefit from it, including program design, implementation and evaluations. This section reviews the literature and identifies access policies that could potentially improve access in the present and future. In addition to these access programs, the comprehensive analytical framework provides important insights for future policy borrowing or lending across countries.

Awareness of a Broad Set of Environmental Differences

Program design and implementation should be well informed by comparative research that is fully aware of a broad set of environmental differences in society, economy, educational systems and demographic changes. Comparative research without such a comprehensive view may lead to a failure of access policy. For example, after loan schemes were first introduced in Europe and the U.S. in the 1950s and expanded to more than thirty countries in the 1980s, China introduced a loan scheme in 1987. Largely due to the non-thorough comparative research of the differences in capitalist and socialist

systems and economic infrastructure (e.g., repayment-collecting agencies), Chinese loan schemes were not successful in expanding access (Li & Bray, 1992). Thus, this paper suggests that future policy-makers consider important factors that affect access from multiple perspectives before borrowing policies from other nations.

Multi-causal Understandings of Factors

Informed by the comprehensive analytical framework, policy-making should be framed around multi-causal understanding of varying factors. According to the comprehensive analytical framework, the increasing net college cost is only one inhibiting factor. Other barriers, such as education-system and population barriers, suggested in the framework could also explain access problems. Therefore, the persistent arguments of the effect of financial barriers on the low-income students in current comparative studies may need to be downplayed. To promote access, policy-makers must consider factors of multiple aspects and make policies from multiple aspects that could support one another, such as both reducing tracking systems and providing students with useful financial aid information.

More Efforts on Improving the Whole National Education System

According to the new framework, a country's education system is a very important factor influencing access. Nonetheless, the current literature attaches relatively less importance to national systems factors. In particular, much of cotemporary access research focuses exclusively on economic investments to provide policy implications and places too much emphasis on higher education systems at or after the transition point from secondary education to college. The biased research may misinform policy-making.

Continuing improvement in the pathways into higher education that both reach back to primary and secondary schools and reach beyond the entry point until college degree attainment is essential. Access policies will have limited impact if they operate solely on the point of entry to universities.

Thus, this paper recommends that future access programs target under-represented schools to build aspirations, raise confidence and distribute financial aid information among students, and to contribute to higher levels of academic achievement early in students' secondary schooling. This would require that universities establish stronger partnerships with disadvantaged schools, districts, regions and communities. In addition, colleges and universities should develop compensatory programs for the least disadvantaged students to help them attain degrees and ensure equal opportunity of higher education.

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