Is Enrollment into Graduate School Affected by the Business Cycle?

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ABSTRACT
In the current economic climate, reports of increased enrollment at graduate school programs frequently appear in the media. This increased enrollment is generally attributed to the declining opportunity cost of education during times of economic weakness, and thus increased investments in education as opposed to employment. Another potential effect of economic weakness on educational attainment, often overlooked, is a decline in the ability to fund education, or the credit constraints effect. Evidence in the current economic literature documents the existence of both the opposing opportunity cost and credit constraints effects of the business cycle on educational attainment. However, the empirical relationship between educational attainment and the business cycle has been primarily studied only at the level of college and high school education. This study seeks to answer the question: Is enrollment into graduate school affected by the business cycle? Specifically, I use a modified Human Capital Theory Model, and enrollment data from 1976-2005, to examine the effects of key economic indicators (the unemployment rate, employment growth, GDP growth, personal income growth, and personal disposable income growth) on changes in graduate enrollment in the United States.

Keywords: postgraduate education, graduate school, recession, human capital theory, graduate programs, unemployment, labor market, educational attainment, business cycle

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Section 1: Introduction

In current times, reports of increased enrollment into graduate degree programs as a consequence of the economy continuously frequent the popular media. In such reports, head admissions officers in the nation’s leading graduate programs validate the relationship between graduate enrollment and the economy. A recent New York Times article cites Stacey Kole, deputy dean for the full-time M.B.A. program at the University of Chicago’s Graduate School of Business, espousing the increasingly popular viewpoint: “When there’s a go-go economy, fewer people decide to go back to school. When things go south, the opportunity cost of leaving work is lower” (Edmonston, 2008). In light of views such as this, the current economic climate, and the growing population of individuals with college degrees, the relationship between the business cycle and graduate school enrollment emerges as an increasingly important issue to explore.

Evidence in much of the currently available economic literature supports the existence of an empirical relationship between the business cycle and educational attainment. However the majority of such studies (including Betts & MacFarland, 1995; Sakellaris & Splimbergo, 2000; and Dellas & Koubi, 2003) examine the relationship between the business cycle, and high school or college enrollment. Based on this literature, educational attainment in the United States appears to primarily follow a counter-cyclical pattern. Becker’s (1993) Human Capital Theory Model serves as a theoretical foundation for many of these studies. The model theorizes that weak economic conditions, and consequently fewer job opportunities and lower wages, are associated with lower opportunity costs of investing in education. The lower opportunity cost therefore results in an effect, as acknowledged in the popular media, where more individuals are willing to forgo current earnings to enroll in graduate programs. However, a less obvious effect of weak economic conditions is a reduction in the ability to finance graduate education,
otherwise known as the credit constraints effect, where fewer individuals are able to enroll in graduate programs, due to financial reasons. As the credit constraints and opportunity cost effects work in opposition to each other, the effect of the business cycle on graduate enrollment (along with other educational investments) remains an empirical question.

To my knowledge only one study, Bedard & Herman (2008), empirically examines the effect of the business cycle on graduate enrollment. Although the findings of Bedard & Herman’s (2008) analysis indicate that at least some types of graduate enrollment is cyclical, the results are largely inconclusive. This may in part be due to a notable limitation of their study: their analysis is based off data from 1993-2001. In effect their data only encompasses enrollment information between the 1990-1991 and 2001 recessions, and thus does not capture the full effect of economic fluctuations on enrollment. Additionally, Bedard & Herman (2008) use state unemployment rates as the only measure of the business cycle in their analysis, thereby limiting their analysis to only one of the many economic measures of business cycle fluctuations.

Therefore, expanding on Bedard & Herman’s (2008) study on the cyclicality of graduate enrollment, I develop my analysis based on other existing studies on the cyclicality of educational attainment to answer the question: Is enrollment into graduate school in the United States affected by the business cycle?

Specifically, my study analyzes the cyclicality of graduate enrollment by estimating the effects of five different economic indicators – unemployment, employment growth, GDP growth, personal income growth, and personal disposable income growth – on graduate enrollment in the United States. I use thirty years of enrollment data from the Integrated Postsecondary Education Data System (IPEDS) Enrollment Survey from 1976-2005, along with state-level economic data from the Bureau of Economic Analysis and the Bureau of Labor Statistics, to conduct my
analysis. In my dataset, graduate programs are further categorized into two subgroups: First-time First-professional, and Other Graduate (graduate programs excluding First-time First-professional). The study therefore estimates the effects of the business cycle on each group individually, as further discussion will show that the characteristics of each group are fundamentally different. The remainder of this paper consists of: a review of the current literature in Section 2; a description of the economic model and empirical strategy in Section 3; a description of the data, and background information on First-time First-professional and Other Graduate programs in Section 4; a discussion of the findings in Section 5; and concluding remarks in Section 6. More detailed results of the analysis can be found in the appendix in Section 8.

Section 2: Literature Review

This section consists of a summary of the most relevant literature pertaining to my study, on the effects of the business cycle on graduate school enrollment. The review covers: empirical evidence on the cyclicality of educational attainment, empirical evidence on the cyclicality of graduate school enrollment, the Human Capital Investment Model, and finally the opposing opportunity cost and credit constraints effects of the business cycle on graduate enrollment.

2.1 The Cyclicality of Educational Attainment

There exists a considerable wealth of literature evaluating the empirical relationship between the business cycle and educational attainment. Notably, a significant proportion of the literature concurs that enrollment decisions exhibit a counter-cyclical pattern, or in other words enrollment increases during recessionary periods and decreases during growth periods. Betts & MacFarland (1995) is one such article, which empirically documents the counter-cyclical nature of enrollment into higher education, and serves as a foundation for a number of latter studies.
Specifically, Betts & MacFarland (1995), use institutional enrollment, degree attainment, and financial data from the U.S. Department of Education’s Higher Education General Information Survey/ Integrated Postsecondary Education Data system (HEGIS/IPEDS), and labor market data from the March supplements of the Current Population Survey between 1969 to 1985, to examine the impact of unemployment rates on enrollments and finances at individual community colleges. Basing their study on the traditional Human Capital Investment Model, Betts & MacFarland (1995) hypothesize three main factors influence postsecondary education enrollment demand; namely, the rate of return to postsecondary education, educational costs, and family income. Further, Betts & MacFarland use the following empirical specification for their analysis:

\[
\text{ENR}_{ir,t} = f(\text{UR1812}_{rt}, \text{UR2014}_{rt}, \text{UR2216}_{rt}, \text{PDV12}_{rt}, \text{PDV14}_{rt}, \text{PDV16}_{rt}, \text{WW1812}_{rt}, \text{WW2014}_{rt}, \text{WW2216}_{rt}, \text{FEE/FTE}_{ir,t+1}, \text{E(FEE/FTE)}_{ir,t+1}, \text{AID/FTE}_{ir,t}, \text{E(AID/FTE)}_{ir,t}, \text{COST4}_{rt}, \text{E(COST4)}_{r,t+1}, \text{POP/(# 2-YR COLLEGES)}_{rt}, \text{POP/(#4-YR COLLEGES)}_{rt}, \text{YOUNG}_{rt}, \%\text{BLACK}_{rt}, \text{INCOME PER CAPITA}_{rt}, \text{YEAR}).
\]

Enrollment (\(\text{ENR}_{ir,t}\)) at community college \(i\), in census region \(r\), at time \(t\), is the dependent variable. The variables \(\text{FEE/FTE}_{ir,t}\), \(\text{E(FEE/FTE)}_{ir,t+1}\), \(\text{AID/FTE}_{ir,t}\), \(\text{E(AID/FTE)}_{ir,t}\), represent the fees, expected fees, aid, and expected aid at individual community colleges. The UR terms signify the unemployment rates for people of the stated age and education (i.e. \(\text{UR1812}_{rt}\) is the rate for 18-year-olds with 12 years of education); the PDV terms measure the present discounted value, from the point of view of a worker of age 18, or earnings of workers with the stated level of education; and the WW terms measure the weekly wages for workers of the corresponding age and education. Finally, the \(\text{COST4}_{rt}\), measures the average net cost of enrollment at four-year colleges in region \(r\) at time \(t\). Using this specification, Betts & MacFarland (1995) find that a 1 percent increase in the local unemployment rate is associated with rises in full-time
enrollment of approximately 0.5 percent in recent high school graduates, and 4 percent in all adults. Ultimately, the authors conclude that the findings indicate the existence of “a powerful link” between community college enrollment, and unemployment and economic conditions (Betts & MacFarland, 1995).

Sakellaris & Splimbergo (2000) broaden their study, on the effects of the business cycle on higher educational attainment, to a global level. Specifically, Sakellaris & Splimbergo (2000), examine the relationship between the national GDP per capita and the enrollment of foreign students in United States universities, for 74 countries. The analysis is based off data on foreign non-immigrant student enrollment in U.S. universities from the Institute of International Education (IIE), and country specific annual GDP per capita, between 1961 and 1992. The study is based on a two-period version of the Ben-Porath model, where individuals choose the fraction of non-leisure time to invest in education, so as to maximize total lifetime earnings (Sakellaris & Splimbergo, 2000). Sakellaris & Splimbergo (2000) use the following specification in their empirical analysis:

\[ \Delta \log(E_{it}) = \alpha + \Phi(L)\Delta \log(E_{i,t-1}) + \Psi(L)\Delta \log(Y_{it}) + \epsilon_{it} \]

where \(E_{it}\) is U.S. enrollment, and \(Y_{it}\) is output of country \(i\) at time \(t\). \(\Phi(L)\) and \(\Psi(L)\) are finite-order polynomials in non-negative powers of the lag operator. Similar to Betts & MacFarland (1995), Sakellaris & Splimbergo (2000) conclude that the main factors influencing higher educational decisions are: the rate of return to higher education, the cost of education, and family background characteristics, of which family income is most important. Sakellaris & Splimbergo (2000) ultimately find that U.S. university enrollment for foreign students from OECD countries is counter-cyclical, while enrollment for non-OECD countries is pro-cyclical. From these findings, Sakellaris & Splimbego (2000), conclude that the opportunity cost effect dominates the
credit constraints effect (or what they refer to as the ability-to-pay income effect) in OECD countries, while the reverse is true for non-OECD countries.

Another empirical study on the relationship between the business cycle and schooling decisions is Dellas & Koubi (2003). Dellas & Koubi (2003) examine the cyclicality of school enrollment for distinct age groups in the US population, with particular attention to the implications of capital market imperfections. Dellas & Koubi’s (2003) analysis is based on two models – with, and without capital market imperfections - where individuals choose how to allocate a fixed time endowment between work and educational activities, as well as how much to save, in order to maximize consumption. From these two models, Dellas & Koubi (2003) remark that imperfect capital markets “favors a pro-cyclical pattern” for education demand, as the credit constraints effect (what they refer to as the income effect) of a recession is more likely to pose a problem for investing in education. The authors use two methods for detrending: differencing, and a quadratic time polynomial, to study the cyclicality and macroeconomic determinants of high school drop out rates, percentage of high school students enrolling in college, and the percentage of various age groups from 18-34 attending school. Using economic data from the Bureau of Labor Statistics (unemployment rate), Federal Reserve Bank (expected real interest rate), Department of Commerce (credit), and Citibase (interest rate differentials), and school enrollment data from the Bureau of Census and the Current Population Report, Dellas & Koubi (2003) find “strong counter-cyclical effects” present in the schooling decisions of teenagers, and the age group 25-29 years (but only with regards to unemployment). The relationship between enrollment and the business cycle for the remaining age groups were found to be statistically insignificant. Additionally, Dellas & Koubi (2003) find that the expected real interest rate is negatively correlated with the enrollment rate of several age groups.
Consequently, the authors suggest that a high real interest rate could represent either a high cost of financing education, or a high opportunity cost of not transferring resources intertemporally by working (rather than investing in human capital) (Dellas & Koubi, 2003). Overall, Dellas & Koubi (2003) conclude that the overall pattern observed is mostly counter-cyclical, suggesting that capital markets are generally efficient.

Contrary to the findings of Betts & MacFarland (1995), and Dellas & Koubi (2003), Berger & Kostal (2002) find that state labor market conditions, measured by the average unemployment rate, are not significantly related to enrollment rates in public higher education. Berger & Kostal (2002), primarily study the effect finances have on the enrollment rate in public higher education in the United States. The authors use a simultaneous-equation system with the following equilibrium conditions:

\[ \text{enrollpub}S_{it} = \text{enrollpub}D_{it} \]

where,

\[ \text{enrollpub}D_{it} = \alpha_1 + \alpha_2 \text{tuitionpub}_{it} + \alpha_3 \text{avgwage}_{it} + \alpha_4 \text{tuitionpriv}_{it} + \alpha_5 \text{income}_{it} + \alpha_6 \text{wagediff}_{it} + \alpha_7 \text{unemp}_{it} + \alpha_8 \text{educ}_{it} + \alpha_9 \text{nonwhite}_{it} + \alpha_{10} \text{urban}_{it} + \varepsilon_{it} \]

and,

\[ \text{enrollpub}S_{it} = \beta_1 + \beta_2 \text{tuitionpub}_{it} + \beta_3 \text{stateapprop}_{it} + \beta_4 \text{otherrev}_{it} + \beta_5 \text{facsalary}_{it} + \beta_6 \text{admiflex_med}_{it} + \beta_7 \text{admitflex_hi}_{it} + \beta_8 \text{acadflex_med}_{it} + \beta_9 \text{acadflex_hi}_{it} + \beta_{10} \text{instnumber}_{it} + \beta_{11} \text{enrollpriv}_{it} + \eta_{it} \]

\text{Enrollpub}S_{it} \text{ measures the supply of public higher education in response to state } i \text{ and time } t \text{ specific financial variables, institution prestige, and density of institutions in a state; while } \text{enrollpub}D_{it} \text{ measures the demand for public higher education based on state } i \text{ and time } t \text{ specific tuition, wages, income, unemployment and other state demographic information. Based on data}
for the 48 continental states from 1990 to 1995, mostly from the Digest of Education Statistics, US Bureau of the Census, and from a previous study, Volkwein & Malik (1997), Berger & Kostal (2002) conclude their findings indicate the effect of the unemployment rate, and the estimated effect of the returns on investments in college (measured by the wage differential between non-production and production workers in manufacturing), are insignificant with regards to higher public education enrollment. Recognizing their conclusion, that enrollment decisions are acyclical, is divergent from the majority of the literature Berger & Kostal (2002) note the possibility that the average state unemployment rate “does not adequately capture the potential labor market conditions for college students”. Similarly, Berger and Kostal (2002), note that the wage differential between non-production and production workers in manufacturing, are likely to not perfectly match the wages of college and non-college graduates.

2.2 The Cyclicality of Graduate School Enrollment

Whilst there are a considerable number of studies that examine the cyclicality of enrollment decisions for high school and college, the effect of the business cycle on graduate school enrollment has remained largely unexplored. Although Dellas & Koubi’s (2003) findings on the schooling decisions of individuals up till 34 years are likely to include some individuals considering graduate and professional school enrollment, their study does not specifically analyze the decisions of college graduates. To my knowledge only one study (Bedard & Herman, 2008) estimates the effect of unemployment on graduate school enrollment separately. Bedard & Herman (2008) base their study on 1993-2001 data on recently graduated science and engineering Bachelor and Master’s students between 1993-2001 from NSRCG provided by the Scientists and Engineering Statistical Data System, and annual state level unemployment rates for the civilian non-institution population age 20-24 from the Local Area Unemployment
Statistics program of the Bureau of Labor Statistics. Bedard & Herman (2008) develop a version of the Human Capital Investment Model “pertaining to a B.Sc. holder’s decision to enroll in an advanced degree program”, where individuals evaluate the pecuniary and non-pecuniary returns of different educational choices and choose the option that maximizes their expected lifetime utility. Bedard & Herman (2008) use the following latent variable model:

\[ G_{it}^* = \beta_1 UER_{it} + GPA_i \beta_2 + MAJ_i \beta_3 + T_t \phi + S_i \theta + X_i \gamma + \varepsilon_{it} \]

and \( G_{it} = 1 \) if \( G_{it}^* > 0 \), else \( G_{it} = 0 \),

where \( G_{it} = 1 \) if individual \( i \) is enrolled in a particular type of graduate education program in the survey period directly after obtaining his B.Sc. (denoted by time \( t \)), and \( G_{it} = 0 \) otherwise. UER is the state level unemployment rate, GPA is a set of three GPA indicator variables, MAJ is a set of dummy variables corresponding to an individual’s undergraduate major, T is a vector of B.Sc. graduation year indicators, S is a set of state of B.Sc. graduation indicators, and X represents observable characteristics.

From this estimation Bedard & Herman (2008) find that the cyclicality (as measured by the unemployment rate) of advanced educational decisions are highly dependent on gender, degree type, and GPA. More specifically, enrollment for male Ph.D. programs is counter-cyclical, enrollment for male Master’s programs is pro-cyclical, whilst the behavior patterns for all other groups, including professional school enrollment for both genders, are not significantly related to the unemployment rate. To explain the potentially surprising pro-cyclical nature of Master’s enrollment for males, Bedard and Herman (2008) suggest that the results reflect either “a substitution of Master’s degrees for longer PhD programs during economic expansion”, or the credit constraints effect (what they refer to as the income effect) of fewer employers paying for part-time Master’s programs during recessions. The modified Human Capital Investment Model
developed by Bedard & Herman (2008) is discussed more extensively in the methodology section.

2.3 The Human Capital Investment Model

A significant proportion of studies focused on the cyclicality of schooling, base their analysis on Gary Becker’s Human Capital Investment Model, outlined in his book *Human capital: a theoretical and empirical analysis, with special reference to education (1993 edition but originally published in 1964)*. In the model, Becker outlines both the direct and indirect costs of schooling, as important considerations of schooling decisions. Direct costs include, but are not limited, to factors such as: “Tuition, fees, books, supplies, and unusual transportation and lodging expenses” (Becker 1993). On the other hand, indirect costs are considered the “difference between what could have been and what is earned” (Becker 1993). Becker emphasizes the necessity of including indirect costs when modeling schooling decisions. This consideration is particularly relevant for the focus of this study, as “foregone earnings are a major cost of high-school, college, and adult schooling” (Becker 1993).

After distinguishing between the direct and indirect costs of schooling, Becker focuses the discussion on determining the rate of return. He remarks: “The most important single determinant of the amount invested in human capital may well be its profitability or rate of return” (Becker 1993). The rate of return is calculated using the Human Capital Investment Model. In the model, $Y$ is defined as an activity providing an individual with a real net earnings stream of $Y_0$, $Y_1$, ..., $Y_n$, where $n$ is the last period. Net earnings refer to gross earnings during a particular period, minus any direct costs during the period. Consequently, the present value of the net earnings stream in $Y$ can be defined via the following equation:

$$V(Y) = \Sigma \frac{Y_j}{(1+i)^{j+1}}$$
Where $i$ is defined as the market discount rate, assumed for simplicity to be constant throughout all periods. $X$ is then considered an activity alternative to $Y$, providing a net earnings stream of $X_0, X_1, ..., X_n$, with a present value of $V(X)$. Therefore, the present value of the gain, $d$, from choosing $Y$, with $X$ as an alternative activity, is defined as:

$$d = V(Y) - V(X) = \sum (Y_j - X_j)/(1+i)^{j+1}$$

Becker relates the model more specifically to explain the relation between costs and returns of investing in human capital, defining activity $Y$ as one that requires human capital investment in the initial period, and activity $X$ as one that does not require any. More specifically in light of this particular paper, activity $Y$ can be considered as occupations available to individuals with graduate degrees, whereas $X$ are occupations available to individuals with at least a Bachelor’s degree. The cost of choosing $Y$ over $X$ is then the difference between the net earnings in the initial period, while the total return is the present value of the differences between net earnings in later periods. More explicitly:

$$C = X_0 - Y_0$$

Where $C$ is the cost. And:

$$k_j = Y_j - X_j$$

Using $R$ to measure the total return Becker defines:

$$d = \sum k_j/(1+i)^{j+1} - C = R - C$$

Where $d$ has been previously defined as the present value of the gain from choosing $Y$, with $X$ as the alternative activity.
Finally, Becker (1993) uses these costs and returns to derive the rate of return, \( r \), of activity Y, with X as the only alternative activity. By definition the rate of return is the discount rate, equating the present value of returns to the present value of costs:

\[
C = \sum k_j / (1+r)^j
\]

Which then implies:

\[
\sum Y_j / (1+r)^{j+1} - \sum X_j / (1+i)^{j+1} = d = 0
\]

Thus Becker (1993) concludes that the internal rate of return is also the rate of discount, equating the present value of net earnings for activity X and activity Y.

Based on Becker’s model, we can then conclude that the decision to invest in education is dependent both on the relative earnings difference between X and Y, and the direct investment cost of engaging in Y. Thus lower earnings in \( X_0 \), as a potential consequence of an economic downturn, will then lower the opportunity cost of investing in Y compared to X, and increase the rate of return of investing in Y. The converse is true if earnings in \( X_0 \) are higher, resulting in a lower rate of return of investing in Y. Becker then expands his discussion to multiple investments in human capital over multiple periods, in other words determining the optimal lifetime investment in human capital. However, as this study only focuses on individuals’ decisions regarding one investment, graduate school, that discussion is beyond the scope of this literature review.

There is one final consideration to make regarding Becker’s *Human capital: a theoretical and empirical analysis, with special reference to education* (1993). When discussing the problem, Becker notes several key observations regarding investing in human capital. Specifically relevant to this study’s objective, regarding the cyclicality of graduate school, he notes: “Unemployment rates tend to be inversely related to the level of skill” (Becker 1993),
thereby explaining a further incentive for workers to invest in human capital to lower their likelihood of being unemployed during future periods of economic weakness. In this respect differences in net earnings, as a result of investing in human capital, reflect both the differences in monetary earnings, as well as the increased likelihood of being employed.

2.4 Opposing Opportunity Cost and Credit Constraints Effects

Based on the economic theory and empirical evidence in the literature, the effect of the business cycle on educational decisions can therefore be separated into two distinct and opposing effects: the opportunity cost effect, and the credit constraints effect. Although the opportunity cost effect is an intuitively more obvious effect, and more widely discussed, the credit constraints effect is equally important in modeling schooling decisions. Several studies (including Betts & MacFarland 1995; Sakellaris & Splimbergo 2000) consider family income as one of the primary factors affecting desire to invest in education. A number of studies examine what they refer to as the income effect of educational demand, more accurately referred to as the credit constraints effect in this study, as well as the price responsiveness of low versus high income individuals. Berger & Kostal (2002) use educational and economic data between 1990 to 1995 to analyze the effects differing financial consequences have on the enrollment rate in United States public higher education. The authors find that a $1000 increase of production worker’s wages (Berger & Kostal’s (2002) proxy for non-college graduate wages), leads to a significant 0.58 percentage point higher enrollment rate, leading them to conclude “that for public colleges and universities any negative wage time cost effect is offset by a higher positive income effect due to increased average earnings”. The finding, that current incomes have any effect at all on enrollment decisions, is evidence that credit constraints exist. Based on the permanent income hypothesis, individuals would never choose to borrow from their current self to finance educational
investments. Rather, as educational investment would benefit an individual’s higher income self in the future, if unconstrained by credit they would choose to finance their education solely through loans, which their higher income self in the future would repay. In this way they can smooth their consumption over their lifetime. However, as current incomes appear to have an effect on educational investments, we can deduce that individuals are spending current incomes to finance their educations, and therefore credit constraints do exist and are an important consideration when modeling educational attainment decisions.

As the credit constraints effect emerges as an important factor, incorporating both the credit constraints effect and opportunity cost effects of changes in economic conditions on educational attainment is vital. One such study that considers the opposing credit constraints and opportunity cost effects in their model of individual demand for education is Dellas & Koubi (2003). As previously mentioned, Dellas & Koubi’s (2003) study is focused on the relationship between the economy and schooling decisions, with respect to capital market imperfections. They evaluate several economic indicators and their relationship to educational attainment decisions, in the development of their economic model.

With regards to the effect the business cycle has on the opportunity cost of education, Dellas & Koubi (2003) note that the real wage is pro-cyclical, and therefore income forgone while engaging in educational activities is lower during recessions. In other words the opportunity cost of investing in education is lower during periods of economic downturn. Additionally, Dellas & Koubi (2003) remark that even if wages were held constant, the counter-cyclical nature of unemployment would lead to higher numbers of unemployed individuals, with lower opportunity costs of education during recessions. Consequently, these factors lead the opportunity cost of educational activities to be counter-cyclical, and thereby illustrate the
opportunity cost effects of the business cycle on graduate enrollment.

Dellas & Koubi (2003), also discuss the credit constraints effect of the business cycle on educational attainment decisions. As noted earlier, Dellas & Koubi (2003) remark that the real wage is pro-cyclical, and thus incomes are lower during times of economic recession. The pro-cyclical nature of real wages, lead Dellas & Koubi (2003) to suggest that there exists an effect during recessions reducing the ability to invest in education, thereby leading enrollment to follow a pro-cyclical pattern. Furthermore, the authors note that with capital market imperfections, “a low level of disposable income that cannot be supplemented by external funds may represent an insurmountable obstacle to pursuing schooling” (Dellas & Koubi, 2003).

Thus, Dellas & Koubi (2003) conclude that the resultant effect of the business cycle on enrollment in higher education is dependent on the relative sizes of the opportunity cost and credit constraints effects. They note that if the opportunity cost effect dominates the credit constraints effect, enrollment is counter-cyclical, while if the reverse is true, enrollment is pro-cyclical (Dellas & Koubi, 2003). With negligible capital market imperfections, Dellas & Koubi (2003) note that enrollment is always counter-cyclical. Evidence from Dellas & Koubi’s analysis (2003), discussed in the earlier subsection on the cyclicality of educational attainment, show that enrollment demonstrates primarily counter-cyclical properties, leading them to conclude that the opportunity cost effect dominates the credit constraints effect in their study. Nevertheless their findings, among others in the literature, illustrate that the opposing credit constraints and opportunity cost effects of the business cycle on educational attainment, are important considerations that should be made when modeling enrollment decisions.
Section 3: Methodology

In the literature review I discussed the various models economists have developed to study the cyclicality of schooling. In the methodology section I use those models as a foundation to develop my own analysis for the purposes of my study: Is enrollment into graduate school affected by the business cycle? I first present an economic framework to analyze the problem, followed by the empirical strategy, and end with a discussion on influences of previous empirical studies on the development of the empirical model.

3.1 Economic Model

The economic model is an adaptation of Bedard & Herman’s (2008) stylized version of the Human Capital Investment Model. Specifically, the model pertains to the decision, of an individual, to enroll in a postgraduate program after graduating from college. As in Bedard & Herman’s (2008) model, individuals face two periods immediately following college graduation (t=1, 2). Individuals have the choice between enrolling in graduate school in period 1 and working in period 2, or working for both periods. \( w_t \) is defined as an individual’s wage in period \( t \) if they do not have a graduate degree, while \( w_{g2} \) is the wage if the individual has completed a graduate degree in period 1. Additionally, the non-monetary amenity level is defined as \( a_t \) for the amenity obtained during graduate education, \( a_t \) for jobs available to non-graduate degree holders in period \( t \), and \( a_{g2} \) for jobs available to individuals with a graduate degree. The model assumes wages vary over the business cycle, while non-monetary amenity levels are invariant to fluctuations in the business cycle. Changes in the business cycle will then lead to changes in the wages individuals face in time periods 1 and 2, thereby resulting in the opportunity cost effect.

Although the model used by Bedard & Herman accounts for the opportunity cost effect of changes in the business cycle on graduate enrollment, their model does not fully account for the
existence of the credit constraints effect. From the current literature on the cyclicality of schooling, it is evident that both the opportunity cost effect and the credit constraints effect are present. Thus, I extend my economic model to incorporate the credit constraints effect of the business cycle on an individual’s decision to enroll in graduate school. In addition to the variable T, which is used by Bedard & Herman to account for the tuition cost of graduate education, I include the variables B and r in my model. B represents the monetary amount individuals need to borrow prior to period 1 to finance their graduate education, while r represents the interest rate for both period 1 and 2 combined. \((B*r)\) therefore represents the monetary amount individuals have to pay at the end of period 2, as a consequence of the amount borrowed including interest. More specifically B is defined by the following equation:

\[
B = T - F - S - E
\]

(1)

Where the variable F represents finances available for graduate school from personal or family savings and income, the variable S represents stipends available from academic institutions or the government, and the variable E represents finances available from employers. The model allows T (tuition), current personal or family finances (F), stipends (S) and employer financing (E) to vary with the business cycle, and consequently the money an individual needs to borrow (B), also fluctuates according to economic conditions. Similarly the interest rate \(r\) is variable in relation to the business cycle, and therefore \((B*r)\) the amount individuals who invest in graduate education have to repay at the end of period 2, is highly dependent on economic conditions. Two aspects make this a model of credit constraints. Firstly, the inclusion of current personal or family finances (F), as a source of funding for graduate education, is one such indication that this is a model of credit constraints. As previously mentioned, the use of current personal funds to finance educational investments is evidence of the existence of credit constraints. Otherwise
following the permanent income hypothesis, under unconstrained credit individuals would choose to finance education entirely through borrowing, and repayment by their higher income future self. The second aspect of the model that illustrates credit constraints is the variable interest rate \( r \). Similarly the dependency of the interest rate on economic conditions is only realistic given the existence of credit constraints.

Based on this framework, an individual will choose to enroll in an advanced degree in period 1 if:

\[
EU(w_1 + w_2 - T - (B^r), a_1, a_2) > EU (w_1 + w_2, a_1, a_2)
\]  

(2)

where expected utility is a function of net lifetime earnings and non-monetary amenity levels. I included the possibility for individuals to earn a wage \( w_1 \) while enrolled in graduate school to account for individuals who work part time while earning their degree, for full-time enrolled individuals \( w_1 \) will simply equal zero. From this equation it is evident that the decision to enroll in graduate school is dependent on the wage premium of a graduate degree holder, net educational costs, including interest repayment as a result of credit constraints. As both the wage premium and the educational costs vary with the business cycle, based on this model the decision to enroll in graduate school is sensitive to changes in the business cycle.

### 3.2 Empirical Model

Based off the economic model, which pertains to individual enrollment decisions, the empirical model analyzes the effect changes in distinct economic indicators have on enrollment into graduate programs. Consider a simple model:

\[
\ln Enr_{ijt} = \beta_0 + \beta_1 Ind_{jt} + \beta_2 enr\_lvl + \beta_3 dc_{college1} + \ldots + \beta_{(n+1)} dc_{collegen} + \beta_{(n+2)} timed_{college1} + \beta_{time} timed_{college}\n\]  

(3)
Where the variable $\text{Enr}_{ijt}$ is the total enrollment for graduate programs for institution $i$ in state $j$ and time $t$, and the variable $\text{Ind}_{jt}$ is the specific economic indicator for state $j$ at time $t$. The variable $\text{enr}_\text{lvl}$ is a dummy variable that is 1 for each specific type of graduate program, dependent on the categorization of graduate programs in the database. For the purpose of this study, graduate enrollment is distinguished into two subgroups, and thus only one $\text{enr}_\text{lvl}$ variable is needed, however additional $\text{enr}_\text{lvl}$ variables can be added to accommodate additional classifications of the type of graduate programs in the database. The $\text{dcollege}_1$ to $\text{dcollege}_n$ variables are indicator variables for each academic institution in the database, which control for institution specific effects. While the $\text{timedcollege}$ variables establish and control for a linear time trend for each academic institution. Including both institution specific indicator variables and a linear time trend for each academic institution, controls for the majority of non-cyclical variation in the data.

This model is estimated using panel data, with enrollment numbers for each academic institution in a given year serving as individual observations. Additionally, the state of each academic institution is recorded, and thus the economic indicators used in the analysis are specific to the state of academic institution and time. The empirical model in equation (3) estimates the effect changes in specific economic indicators have on all types of graduate enrollment, while controlling for different types of graduate programs. However, the model can also be modified to empirically analyze each type of graduate program separately, as categorized in the dataset:

\[
\ln\text{Enr}_{ijt} = \beta_0 + \beta_1\text{Ind}_{jt} + \beta_2\text{dcollege}_1 + \ldots + \beta_{(n+1)}\text{dcollege}_n + \beta_{(n+2)}\text{timedcollege}_1 + \beta_{(n+3)}\text{timedcollege}_n
\]  

(4)
Where equation (4) is essentially the same as equation (3), with the exception of the exclusion of the enr_lvl variable in the empirical specification, and where the analysis is only carried out for observations where enr_lvl=1 for a particular type of graduate program. Using equation (4) and repeating the test for each type of graduate program in the database, the effect of a particular economic indicator on each category of graduate programs can be estimated. These estimates combined with the effect on graduate enrollment as a whole can be used to empirically determine the effect, if any, of the business cycle on graduate school enrollment in the United States.

My empirical model is an extension on previous empirical models covered in the literature for several reasons. The inclusion of institution fixed effects and institution specific time trends in my empirical specification allow greater control over non-cyclical variation in the data, compared to controlling for state or region specific effects (as done so in Betts & MacFarland 1995, Berger & Kostal 2000, and Bedard & Herman 2008). Additionally, the inclusion of institution specific time trends not only controls for the general trend of increasing investment in education over time, but controls for institution specific shocks, such as planned increases in the general size of an enrollment class due to the opening of a new campus. Additionally, my specification enables different economic indicators to be used as measures of the business cycle, and allows for the analysis of the individual effects of each of these measures. By contrast, the majority of studies on the cyclicality of schooling tend to use only one measure of the business cycle (typically unemployment or wages), or incorporate these economic measures in a single empirical test. Therefore the inclusion of institution fixed effects, institution specific time trends, and the individual analysis of different economic indicators as measures of the business cycle, allow for a more accurate estimation of the effects of the business cycle on graduate school enrollment.
Section 4: Data and Background Information

The dataset constructed to estimate the effects of the business cycle on graduate school enrollment in the United States, consists of enrollment and economic data from 1976 to 2005. Throughout the thirty year period from 1976 to 2005 that the dataset covers, the US economy experienced three major recessions: 1980-1982, 1990-1991, and 2001 (NBER). The length of the dataset and presence of economic variability is vital, for the purposes of estimating the effects of fluctuations in the business cycles on graduate school enrollment. In particular, the coverage of three different recessions by the timeframe of the dataset notably distinguishes this study from the only other study on graduate school cyclicality (Bedard & Herman, 2008). All the graduate enrollment data in the data set was obtained from the Integrated Post Secondary Education Data System (IPEDS) Enrollment Survey available via the National Center for Education Statistics (NCES) on WebCASPAR. As measures of the business cycle, I used state-level unemployment rates and employment growth rates from the Bureau of Labor Statistics, as well as GDP growth, Disposable Income Growth, and Personal Disposable Income Growth from the Bureau of Economic Analysis.

4.1 Enrollment Data

The Integrated Postsecondary Education Data System (IPEDS) Enrollment Survey is conducted by the Department of Education's National Center for Education Statistics (NCES). The enrollment variable in the survey indicates the number of enrolled students for courses creditable towards a degree, diploma, certificate or part of a vocational or occupational program. Data from this survey is available for fall enrollment from 1967 till 1998, and fall enrollment from 2000 till 2005. Data for fall enrollment in 1999 was not released by NCES. The enrollment
data from 1967 to 1985 was derived from The Higher Education General Information Survey (HEGIS), and the enrollment data from 1986 to 2005 was derived from IPEDS.

The dataset for this study covers enrollment for all academic institutions with graduate programs anytime between the years 1976 to 2005. Institutions with less than ten years of enrollment information during this time period were omitted from the dataset for the reason of insufficient data to establish an institution specific time trend (a vital component of the empirical specification). The survey classifies students enrolled in graduate programs over this period either as: First-time First-professional or Other Graduate Students. First-Time First-professional students are defined as students enrolled for the first time in a first-professional degree program. First-Professional degrees as defined by the survey consist of the following degrees: Chiropractic (D.C. or D.C.M.), Dentistry (D.D.S. or D.M.D.), Law (L.L.B. or J.D.), Medicine (M.D.), Optometry (O.D.), Pharmacy (Pharm.D.), Podiatry (D.P.M., D.P., or Pod.D.), Theology (M.Div., M.H.L., B.D., or Ordination) and Veterinary Medicine (D.V.M.). A notable exclusion from this professional degree list is the M.B.A., which is then classified under Other Graduate Students. Other Graduate Students consist of students enrolled in a graduate degree not classified as First-time First-professional. Graduate degrees are defined by the IPEDS Enrollment Survey as courses at the post-baccalaureate level. Further background information on the characteristics of First-Time First-Professional degrees and Other Graduate degrees will follow in a latter subsection.

Given these definitions of the enrollment variables by the IPEDS Enrollment Survey, the dataset for the study consists of enrollment information for a total of 1330 academic institutions from 1976 to 2005. Institutions with both First-time First-professional and Other Graduate students enrolled are considered as two separate institutions in the dataset. The standardized
name of each academic institution is also recorded in the dataset, along with the enrollment numbers for either First-time First-professional or Other Graduate students. The names of the academic institutions were used to determine the state where the institution resided in, and the corresponding state was consequently used to match the appropriate economic data from 1976-2005.

4.2 Economic Data

To capture fluctuations in the business cycle, five different state level economic indicators were utilized for the purposes of the study: unemployment rate, employment growth rate, GDP growth, personal income growth, and personal disposable income growth. Both the state unemployment rate and state employment growth rate from 1976 to 2005 were obtained from the Bureau of Labor Statistics as part of the Local Area Unemployment Statistics (LAUS). The LAUS program produces monthly and annual labor force data for Census regions and divisions, states, counties, metropolitan areas, and many cities, by place of residence. In this study, March unemployment rates from 1976 to 2005 for each state were matched to the corresponding academic institution. The unemployment rate variable recorded in the database indicates the percentage of the total labor force, and is seasonably adjusted. Similarly, March employment figures from 1977 to 2005 for each state were matched to the corresponding academic institution, and used to determine the employment growth rate variable in the dataset. Employment growth data for March 1976 was unavailable at the time of the data collection.

The remaining state level economic data used in the study – GDP, personal income, and personal disposable income– were obtained from the Bureau of Economic Analysis. The state GDPs, matched to academic institutions in the dataset, represent an all industry total and are recorded in millions of current dollars. State GDP data from the Bureau of Economic Analysis
between 1963-1998 are from the Standard Industrial Classification (SIC), while data from 1998-2005 are from the North American Industry Classification System (NAICS). In the dataset used in the study, state level GDP data was obtained from the SIC for the years from 1976 till 1997, and the remaining data (from 1998 to 2005) from NAICS.

Per capita personal income and per capita personal disposable income data in the dataset were also collected from the BEA. The BEA defines the personal income data at the state level as the income received by all persons from all sources in a particular state divided by the state population. The BEA uses the Census Bureau’s annual midyear population estimates to determine the state population. Personal income is the sum of net earnings by place of residence, rental income of persons, personal dividend income, personal interest income, and personal current transfer receipts. Personal disposable income per capita used in the dataset, from the BEA, is calculated as the total personal income less personal current taxes, in other words the proportion of personal income available after taxes for spending and saving. Both the state level per capita personal income and state level per capita personal disposable income data from the BEA were matched to the corresponding academic institutions in the dataset by state and time.

4.3 Background on First-time First-professional and Other Graduate degrees

The remainder of this section consists of a discussion on the characteristics of the two types of graduate students classified in the dataset: First-time First-professional students and Other Graduate students. Unfortunately, the limitations of constructing a dataset covering a long time period, for the study, resulted in only two classifications of types of graduate students available. Particularly in the case of Other Graduate students, the unavailability of more specific classifications, and consequently considerable variability within the group, might pose issues when analyzing the effects of the business cycle on enrollment behavior. To provide some
background information on the characteristics of First-time First-professional and Other Graduate degree composition, I use 2005 data from the IPEDS Completion Survey, available via the National Center for Education Statistics (NCES) on WebCASPAR. Although enrollment and completion data are not perfect substitutes for each other, the degree level and area of concentration data available via the IPEDS Completion Survey provides at least an approximation on the composition of First-time First-professional and Other Graduate degrees.

From the 2005 IPEDS Completion Survey data, approximately 90,000 students graduated with First-time First-professional degrees. This figure is considerably smaller than that of Other Graduate students, which had approximately 650,000 students. These 90,000 students with First-time First-professional degrees were consequently classified into three different areas of concentration: Life Sciences (which for the most part consisted of medically related degrees), Law, and Religion & Theology. The composition of the students were 43.6% Life Sciences, 6.7% Religion & Theology, and the remaining 49.7% Law. From this breakdown, as illustrated in chart 1 below, it is evident that the majority of First-time First-professional students are either Life Sciences or Law students.

Chart 1
The composition of Other Graduate students, as indicated in the 2005 data from the IPEDS Completions Survey, has considerably more variation compared to First-time First-professional students. The approximately 650,000 students recorded in the IPEDS 2005 Completions Survey are classified in the survey both by degree level and area of concentration. Looking at the degree level composition of Other Graduate students in Chart 2, an overwhelming proportion are Master’s Degree students (86.8%), with the remainder classified as Doctorate Degree students (8.0%), First Professional Certificate students (0.2%), Post-Master’s Certificate student (2.1%), and Post-Baccalaureate Certificate students (3.0%). First-Professional Certificates are defined as awards requiring completion of a program of study specifically for individuals who have completed a first-professional degree. Post-Master’s Certificates are awards below the level of Doctorate degrees available to students completing a program of study designed for individuals with Master’s degrees. Similarly, Post-Baccalaureate Certificates are awards below the level of Master’s degrees available to students completing a program of study designed for individuals with Bachelor’s degrees. More detailed information on the classification of graduate degree levels is available in the Appendix.

Chart 2
The area of concentration composition of 2005 Other Graduate students is the most notable indication of within group variability. The approximately 650,000 Other Graduate students, by area of concentration, are composed of Engineering (6.3%), Math and Computer Sciences (3.9%), Life Sciences (10.2%), Psychology (3.2%), Social Sciences (5.3%), Humanities (2.5%), Arts and Music (2.3%), Education (30.7%), Business and Management (21.8%), Communication and Librarianship (2.16%), Social Service Professions (2.8%) and Other (8.7%). Students with area of concentration classified as ‘Other’ consist of Physical Sciences, Geosciences, Science and Engineering Technology, Interdisciplinary or Other Sciences, Religion and Theology, Architecture and Environmental Design, Law, Vocational Studies and Home Economics, other Non-sciences or Unknown Disciplines. This group was combined for simplicity. From this breakdown, as illustrated in Chart 3, the composition of the Other Graduate group, at least by area of concentration, is evidently highly variable.

**Chart 3**
Section 5: Results

Using equations (3) and (4) described in the methodology, and economic and enrollment data from 1976 to 2005, I estimated the effect the business cycle – measured by five different economic indicators - has on enrollment into graduate school. For each of the five different economic indicators, I separated the analysis into three different effects: 1) for all graduate enrollment, 2) for Other Graduate enrollment (all graduate enrollment excluding First-time First-professional), and 3) for First-time First-professional enrollment. Table 1a reports the effects the unemployment rate has on enrollment into these three categories of graduate programs in row 1 of columns (1)-(3). A similar format is used for the remaining economic variables, with table 1b reporting the effects of employment growth, table 1c reporting the effects of GDP growth, table 1d reporting the effects of personal income growth, and finally table 1e reporting the effects of personal disposable income growth on graduate school enrollment.

From the background information on First-time First-professional programs and Other Graduate programs it is evident the two types of graduate programs are characteristically very different. Therefore this section discusses the empirical results separately for First-time First-professional and Other Graduate, and consequently the individual effect of the business cycle on enrollment into each type of program.

5.1 First-time First-professional Enrollment

The findings show that the effect of the business cycle on First-time First-professional enrollment follows a relatively consistent counter-cyclical pattern. More specifically, a 1% increase in employment growth is associated with a 4.09% decrease in enrollment, while a 1% increase in GDP growth corresponds to a 2.04% decrease in First-time First-professional enrollment. Finally, 1% increases in personal income growth and personal disposable income
growth are associated with 1.68% and 1.30% decreases in First-time First-professional enrollment respectively. All estimates for employment growth, GDP growth, personal income growth, and personal disposable income growth, are statistically significant at the 1% level. These findings indicate changes in the business cycle, as measured by these economic indicators, have a counter-cyclical effect on enrollment. In other words, periods of economic growth or expansion are associated with a reduction in First-time First-professional enrollment, while the converse is true for periods of economic weakness. The counter-cyclical nature of First-time First-professional enrollment, as indicated by the results of the empirical analysis, imply that changes in these four economic indicators used to measure the business cycle (employment growth, GDP growth, personal income growth, and personal disposable income growth), result in an opportunity cost effect that dominates the credit constraints effect. More explicitly, changes in the four economic measures previously mentioned, have a relatively bigger effect on the opportunity cost of First-time First-professional enrollment, compared to the credit constraints on funding First-time First-professional education. The one economic measure studied in the analysis that does not have an effect on First-time First-professional enrollment is the unemployment rate. Results from the empirical analysis show that the estimated effect of the unemployment rate on First-time First-professional enrollment is statistically insignificant.

To get a sense of the absolute effect on First-time First-professional enrollment figures one can expect from business cycle variation, I use the Fall 2005 enrollment figure of 347,497 enrolled in First-time First-professional programs (source: IPEDS Enrollment Survey, 2005), along with the standard deviation for each of the four economic indicators with statistically significant effects (employment growth, GDP growth, personal income growth, and personal disposable income growth). For employment growth, the standard deviation over the 30 year
period was approximately 2.0%, which along with the -4.091 coefficient, results in a change of an estimated 28,432 individuals enrolling in First-time First-professional programs, as a consequence of average fluctuations in the employment growth rate. Using a similar process, I calculated changes in enrollment associated with average changes in GDP growth rate (8,503 individuals; standard deviation 1.2%; coefficient -2.039), personal income growth rate (2,864 individuals; standard deviation 0.49%; coefficient -1.682) and personal disposable income growth rate (1401 individuals; standard deviation 0.49%; coefficient -1.296). Looking at these figures, which approximate the effect changes in employment growth, GDP growth, personal income growth, and personal disposable income growth have on actual First-time First-professional enrollment figures based on average business cycle fluctuations, it is evident that the effect is strong even on an absolute level.

The collective strength and consistency of the effects of the business cycle on First-time First-professional enrollment, as indicated by the results, are unsurprising given the characteristics of First-time First-professional programs. As over 90% of First-time First-professional degrees conferred are either law or medically related degrees (IPEDS Completions Survey 2005; used in this case as an estimate for area of concentration breakdown for enrollment), First-time First-professional degrees are clearly defined by these two subgroups. As individuals who choose to enroll in law or medically related degrees primarily do so for the purposes of improving their attractiveness on the labor market, as opposed to strong academic interests, intuitively it makes sense that enrollment decisions are affected by the business cycle. Additionally, the finding that First-time First-professional enrollment is unaffected by the unemployment rate is also unsurprising, as general state-level unemployment rates are unlikely to be a good measure of labor market opportunities for college graduates. Unemployment in
itself is less likely to be an issue for college graduates, compared to non-college graduates, and thus other economic indicators are likely to be better measures of compensation and attractiveness of job opportunities available, in other words labor market conditions, for college graduates. This notion is consistent with the finding that employment growth, GDP growth, personal income growth, and personal disposable income growth all have significant empirical effects on First-time First-professional enrollment.

A final issue to resolve regarding First-time First-professional enrollment is the likelihood that a majority of individuals enrolling in First-time First-professional degrees are motivated by a considerable degree of non-monetary amenity, which in the economic model is invariant to the business cycle. Therefore one would expect First-time First-professional enrollment to be potentially less sensitive to economic fluctuations than observed in the findings. One possible explanation is perhaps the decision to enroll in a First-time First-professional degree at some point during an individual’s lifespan is largely unaffected by economic fluctuations. Instead, the counter-cyclical nature of First-time First-professional enrollment might be due to individuals timing their enrollment in response to economic conditions, rather than the decision to enroll itself.

5.2 Other Graduate Enrollment

Before proceeding to a discussion on the results of the empirical analysis for Other Graduate enrollment, it is important to reflect again on the considerable amount of variability between the many different graduate programs represented in the group. Compared to First-time First-professional where over 90% of degrees conferred are either law or medically related programs, Other Graduate covers a much broader spectrum of very different subject areas, including Engineering (6.3%), Education (30.7%) and Business and Management (21.8%).
Another notable source of variation amongst the degrees classified under Other Graduate programs, are the range of degree types awarded. Although the majority of Other Graduate degrees conferred are Master’s degrees (86.8%), Doctorate degrees represent a notable 8% of the total degrees conferred, and this distinction introduces another element of within group variation.

Looking at the results of the empirical analysis, the effects of the business cycle on Other Graduate enrollment are comparatively less consistent than that on First-time First-professional. When the unemployment rate and employment growth rate are used as measures of the business cycle, Other Graduate enrollment demonstrates pro-cyclical behavior. Notably, a 1% increase in the unemployment rate results in a 0.032% decrease in enrollment, and a 1% increase in employment growth results in 2.80% increase in enrollment, both results are statistically significant at the 1% level. The pro-cyclical nature of Other Graduate enrollment, when the unemployment and employment growth rates are used as measures of the business cycle, is a result of the credit constraints effect dominating the opportunity cost effect in response to changes in each of these economic measures. The effect of changes in the unemployment rate on Other Graduate enrollment is particularly interesting, because although the effect is statistically significant, the magnitude is relatively small in comparison to the other effects estimated in this study. The small size of the effect seems to concur with the previously suggested notion that the unemployment rate is not a good indicator for employment opportunities for college graduates. By contrast, the empirical analysis shows that a 1% increase in GDP growth, results in a 1.634% decrease in Other Graduate enrollment. More explicitly, Other Graduate enrollment is counter-cyclical when GDP growth is used as the measure of the business cycle. Similarly, the effects of personal income growth and personal disposable income growth on Other Graduate enrollment demonstrate counter-cyclical patterns, with 1% increases in personal income growth and
personal disposable income growth corresponding to 2.14% and 2.09% decreases respectively in Other Graduate enrollment. The counter-cyclical nature of Other Graduate enrollment when GDP growth, personal income growth, and personal disposable income growth are used as measures of the business cycle, are a consequence of opportunity cost effects dominating the credit constraints effects. Effects for all the economic indicators are statistically significant at the 1% level.

From these results it is evident there exists considerable variation in the effects changes in different economic measures have on Other Graduate enrollment. The inconsistency amongst the effects is illustrated by the finding that Other Graduate enrollment is pro-cyclical with respect to changes in the unemployment rate and employment growth, while Other Graduate enrollment is counter-cyclical with respect to changes in GDP growth, personal income growth, and personal disposable income growth. Although there might be several plausible explanations for the variation amongst the effects of different economic measures on Other Graduate enrollment, the variation of effects is likely to be a consequence of the diversity of degree types and area of concentrations represented in the Other Graduate group. More specifically, one potential explanation for the variation observed is the different economic measures are picking up different aspects of labor market conditions, and thus affecting the various subgroups within Other Graduate differentially. For example, one particular economic measure might be a strong indication for labor market conditions for graduate degrees in Business and Management, while another economic measure might be a strong indicator for labor market opportunities for degrees in education. Additionally, business cycle variation might lead to a relatively larger opportunity cost effect on some programs, and a larger credit constraints effect on other programs, leading to the observation of both pro and counter-cyclicality.
A final note to make is that although Other Graduate education collectively does not clearly exhibit solely pro or counter-cyclicality, this does not mean that individual subgroups within Other Graduate education are not strictly pro or counter cyclical. Instead, it is likely that some subgroups, for example Business and Management degrees, will actually demonstrate strong and obvious cyclicality if observed individually. This suggests that estimating the effects of the business cycle on individual subgroups might provide more conclusive and informative findings on the cyclicality of enrollment. However, while conducting empirical analysis at such a specific level might be desirable and informative, detailed data pertaining to area of concentration and even degree level is unavailable for the length of time covered in my analysis. Therefore the trade-off between the length and the level of detail of the enrollment data is an important characteristic of studies on graduate enrollment.

**Section 6: Conclusion**

Evidence from my analysis suggests that the business cycle does have an effect on enrollment into graduate school. Interestingly enough, the cyclicality of graduate school enrollment appears to depend on the type of graduate program. Particularly in the case of this study, the cyclicality of First-time First-professional enrollment differs considerably from that of Other Graduate enrollment. First-time First-professional enrollment shows clear counter-cyclical behavior when employment growth, GDP growth, personal income growth, and personal disposable income growth are used as measures of the business cycle. This counter-cyclical behavior indicates that with respect to First-time First-professional enrollment, the opportunity cost effect of changes in the business cycle dominates the credit constraints effect. As an overwhelming majority of the individuals enrolled in these programs tend to be enrolled in law or medically related degrees, and hence are largely motivated by improving their labor market
opportunities, the counter-cyclicality of First-time First-professional enrollment is unsurprising.

By contrast, Other Graduate enrollment does not exhibit clear pro-cyclical or counter-cyclical behavior in response to changes in the business cycle. Rather, the cyclicality of Other Graduate enrollment is dependent on the economic indicator used to measure the business cycle in the analysis. Specifically, Other Graduate enrollment is pro-cyclical with respect to unemployment and employment growth, and counter-cyclical with respect to GDP growth, personal income growth, and personal disposable income growth. The ambiguous nature of Other Graduate enrollment cyclicality is also an unsurprising finding, given the variability in degree levels and areas of concentration classified under Other Graduate.

Nevertheless the observance of both pro-cyclical and counter-cyclical behavior for Other Graduate enrollment clearly shows that enrollment into graduate school is not strictly counter-cyclical, nor is the opportunity cost effect the only effect of the business cycle, as implied by the popular media. Instead, the results indicate a presence of both the opportunity cost effect and credit constraints effect, working in opposition to each other, in response to changes in the business cycle. The findings of this study are particularly important, as no other empirical study documents such conclusive evidence on the effects of the business cycle on graduate school enrollment. The only study in the current literature that examines the cyclicality of graduate school enrollment, Bedard & Herman (2008), produces largely inconclusive results on the cyclicality of graduate school enrollment, likely a consequence of several limitations in their analysis.

Although the study does establish an empirical relationship between enrollment into graduate school and the business cycle, the findings introduce new questions regarding this relationship. Firstly, why does the cyclicality of Other Graduate enrollment differ depending on
the economic indicator used to measure the business cycle? One possible suggestion previously mentioned in the results section is that the different economic measures are affecting individual subgroups within Other Graduate enrollment differentially. Thus there is the likelihood that although Other Graduate enrollment does not show clear pro or counter-cyclicality these individual subgroups might. While the limitations on the data do not allow the analysis of graduate school enrollment to be studied at that level of detail for the length of time studied in this analysis, the cyclicality of individual types of graduate programs, defined at a degree and area of concentration level, does remain an issue that requires further exploration. However as of now, no obvious solutions to this conundrum emerge, and thus remains an aspect of graduate school cyclicality that is ambiguous.

To conclude, while there exists an empirical relationship between the business cycle and enrollment into graduate school, the nature of the cyclicality is dependent on the relative magnitudes of the opportunity cost and credit constraints effects. The findings of my study indicate that the cyclicality of graduate school enrollment is highly dependent on the economic indicators used to measure the business cycle as well as the type of graduate programs studied. Thus, the cyclicality of graduate enrollment is a more complex issue, than reports in the popular media suggest, and remains a topic that requires further analysis in the future.
Section 7: References


## 8.1 Results Tables

### Table 1a

The impact of the UER on graduate enrollment growth

<table>
<thead>
<tr>
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<th>All programs (1)</th>
<th>All programs excluding first-time first-professional programs (2)</th>
<th>First-time first-professional programs (3)</th>
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<td>Number of Observations UER</td>
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### Table 1b

The impact of Employment growth on graduate enrollment growth

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### Table 1c
The impact of GDP growth on graduate enrollment growth

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### Table 1d
The impact of Personal Income growth on graduate enrollment growth

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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 1e
The impact of Personal Disposable Income growth on graduate enrollment growth

<table>
<thead>
<tr>
<th></th>
<th>All programs -1</th>
<th>All programs excluding first-time first-professional programs -2</th>
<th>First-time first-professional programs -3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Observations</td>
<td>34129</td>
<td>25498</td>
<td>8631</td>
</tr>
<tr>
<td>Personal Disposable Income Growth</td>
<td>-2.828 (0.0530)</td>
<td>-2.087 (0.0526)</td>
<td>-.236</td>
</tr>
<tr>
<td>Non-Professional Programs</td>
<td>0.175 (0.0138)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

8.2 Summary tables on First-time First-professional and Other Graduate degrees

Table 2a
Completion of Other Graduate Degrees by Degree Level (2005)

<table>
<thead>
<tr>
<th>Degree Level</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorate Degree</td>
<td>8.04%</td>
</tr>
<tr>
<td>Master’s Degrees</td>
<td>86.77%</td>
</tr>
<tr>
<td>First Professional Certificates</td>
<td>0.16%</td>
</tr>
<tr>
<td>Post-Master’s Certificates</td>
<td>2.08%</td>
</tr>
<tr>
<td>Post-Baccalaureate Certificates</td>
<td>2.95%</td>
</tr>
</tbody>
</table>

Table 2b
Completion of Other Graduate Degrees by Concentration (2005)

<table>
<thead>
<tr>
<th>Area of Concentration</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>6.33%</td>
</tr>
<tr>
<td>Math and Computer Sciences</td>
<td>3.93%</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>10.22%</td>
</tr>
<tr>
<td>Psychology</td>
<td>3.18%</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>5.29%</td>
</tr>
<tr>
<td>Humanities</td>
<td>2.51%</td>
</tr>
<tr>
<td>Arts and Music</td>
<td>2.33%</td>
</tr>
<tr>
<td>Education</td>
<td>30.71%</td>
</tr>
<tr>
<td>Business and Management</td>
<td>21.81%</td>
</tr>
<tr>
<td>Communication and Librarianship</td>
<td>2.16%</td>
</tr>
<tr>
<td>Social Service Professions</td>
<td>2.82%</td>
</tr>
<tr>
<td>Other</td>
<td>8.71%</td>
</tr>
</tbody>
</table>
Table 2c

<table>
<thead>
<tr>
<th>Area of Concentration</th>
<th>2005 Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences</td>
<td>43.58%</td>
</tr>
<tr>
<td>Religion</td>
<td>6.74%</td>
</tr>
<tr>
<td>Law</td>
<td>49.68%</td>
</tr>
</tbody>
</table>

8.3 Graduate Degree Descriptions (source: IPEDS Completion Survey 2005)

(1) Doctorate Degrees

The highest awards students can earn for graduate study. Doctoral degrees include degrees such as Doctor of Education, Doctor of Juridical Science, Doctor of Public Health, and the Doctor of Philosophy in any field such as agronomy, food technology, education, engineering, public administration, ophthalmology, or radiology. For the Doctor of Public Health degree, the prior degree is generally earned in the closely related professional field of medicine or in sanitary engineering.

(2) First-Professional Degrees

Awards that require completion of a program that meets all the following criteria: (1) completion of the academic requirements to begin practice in the profession; (2) at least 2 years of college work prior to entering the program; and (3) a total of at least 6 academic years of college work to complete the degree program, including prior required college work plus the length of the professional program itself. First-professional degrees may be awarded in the following 10 fields:

- Chiropractic (D.C. or D.C.M.)
- Dentistry (D.D.S. or D.M.D.)
- Law (L.L.B., or J.D.)
- Medicine (M.D.)
- Optometry (O.D.)
- Osteopathic Medicine (D.O.)
- Pharmacy (Pharm.D.)
- Podiatry (D.P.M., D.P., or Pod.D.)
- Theology (M.Div., M.H.L., B.D., or Ordination)
- Veterinary Medicine (D.V.M.).

Even though the master's degree is required in some fields (e.g., Library Science, Hospital Administration, or Social Work) for employment at the professional level, these are included as master's degrees.

(3) Master's Degrees

Awards that require the successful completion of a program of study of at least the full-time equivalent of 1 academic year, but not more than 2 academic years of work beyond the bachelor's degree.

(4) Bachelor's Degrees
Awards (baccalaureate or equivalent degree, as determined by the Secretary, U.S. Department of Education) that normally require at least 4 but NOT more than 5 years of full-time equivalent college-level work. This includes ALL bachelor's degrees conferred in a 5-year COOPERATIVE (WORK-STUDY PLAN) PROGRAM. A cooperative plan provides for alternate class attendance and employment in business, industry, or government; thus, it allows students to combine actual work experience with their college studies. This value also includes bachelor's degrees in which the normal 4 years of work are completed in 3 years.

(5) Associate Degrees
Awards that normally require at least 2 but fewer than 4 years of full-time equivalent college work.

(6) First-Professional Certificates
Awards that require completion of an organized program of study designed for persons who have completed the first-professional degree. Examples could be refresher courses or additional units of study in a specialty or subspecialty.

(7) Post-Master's Certificates
Awards that require completion of an organized program of study of 24 credit hours beyond the master's degree, but does not meet the requirements of academic degrees at the doctorate level.

(8) Post-Baccalaureate Certificates
Awards that require completion of an organized program of study requiring 18 credit hours beyond the bachelor's degree; designed for persons who have completed a baccalaureate degree, but do not meet the requirements of academic degrees carrying the title of master.