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## The college-going choice in Virginia: A study in the demand for higher education

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**The college going choice in Virginia: A study in the demand for  
higher education**

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The College of William and Mary, 1987

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THE COLLEGE GOING CHOICE IN VIRGINIA:  
A STUDY IN THE DEMAND  
FOR HIGHER EDUCATION

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A Dissertation  
Presented to  
The Faculty of the School of Education  
The College of William and Mary in Virginia

---

In Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Education

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by

Thomas Edward Butler

December 1987



THE COLLEGE-GOING CHOICE IN VIRGINIA:  
A STUDY IN THE DEMAND  
FOR HIGHER EDUCATION

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Thomas Edward Butler

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## Chapter I

### INTRODUCTION

#### Background for the Study

The research presented here is an application of demand analysis to higher education. Demand analysis is a tool used by economists to describe and measure the choice behavior of consumers. As applied to higher education, demand examines the enrollment decisions of students.

Research interest in the demand for higher education has grown dramatically since Campbell and Siegel's seminal work in 1967. The research to date shows much diversity, in terms of the rationale of the researcher, the research design and the statistical technique used. A common thread exists, however, in almost all education demand studies: the use of the human capital model as the theoretical framework within which the research is conducted.

The human capital model, developed by Becker (1964) and Schultz (1961), treats the decision to enroll in higher education as an investment decision. Students weigh the expected benefits of higher education against the direct and indirect costs of the education. The present value of the stream of expected benefits from enrollment must be at least as great as the present value of the direct and indirect costs of education before a student will be

willing to invest in education.

Arguably, analysis from this perspective results in a more narrow view of choice than actually occurs. Economists have recognized that higher education is in some respects also a consumption good, providing immediate transitory benefits as well as future benefits. If the value of these consumption benefits is sufficiently large, students may choose to obtain education even if investment benefits are less than costs.

Treating higher education as an investment good has been shown to add to our understanding of the demand for higher education. Importantly, treating higher education as an investment good does not preclude it from also being examined as a consumption good.

Working within the human capital framework, education demand studies tend to fall into one of two categories: forecasting models and behavioral models (Weinschrott, 1977). Forecasting models attempt to model rather rigorously the elements of demand, hoping to obtain precision in their estimates of the demand function. (See, for example, Carroll and Relles, 1975; or Weller, 1984). These models often have as their objective informing some immediate decision facing a higher education institution (or group of institutions), such as setting tuition levels, determining the correct number or mix of staff, or fixing the size of the physical plant.

The research conducted here lies within the second category of demand studies, behavioral models. These models are less concerned with the accuracy of their estimates of demand, concentrating instead on the analysis of outcomes when the elements of the demand function are allowed to vary. The focus of these behavioral models is on the theoretical. While many behavioral researchers are concerned with public policy issues, others simply wish to better understand higher education choice behavior.

#### Major Issues

The major issues within the study of higher education demand are of two types, stemming from the two principal motivations for conducting these demand studies. For researchers concerned with public policy issues, major issues quite naturally tend to center on policy concerns. For researchers wishing to better understand choice behavior, major issues tend to be related to the specification of the demand model. Each of these two types of major issues are taken up in this section.

Public Policy Issues. Because demand analysis examines choices and can be used to examine the impact of one choice on another, it has become a useful tool for policy analysis. Weinschrott (1977, p. v) identified four policy issues which have stimulated research on higher education demand:

\*o Equalizing the access of students of different

economic means to higher education and using tuition and student aid to achieve the desired distribution of those in colleges.

- o The "crisis" of excess capacity in higher education and the opportunities for employing underused resources in the future.
- o Utilizing existing higher education facilities in the face of the alternative spatial distribution of students.
- o The effect of reforms in public tuition policy on the distribution of students between the public and private sectors and the financial impact on the private sector if students have freer choice."

Other policy issues which lend themselves to demand analysis include:

- o determining the impact of public support for one segment of higher education on other segments; and
- o measuring the effect of higher levels of student debt on higher education enrollment decisions.

In Virginia, as in other states, a number of these issues are of vital concern to state government and higher education policy makers. The Virginia Plan For Higher Education (State Council of Higher Education for Virginia, 1974) lists as one of its three primary goals for Virginia higher education the provision of access to all who want and can benefit from higher education. The 1985 revision of The Virginia Plan reiterates this goal as still valid. Also identified as an issue of concern in the 1985 update is the increased dependence of Virginia students and parents on education loans.

Foremost among the goals of the Virginia Plan,



however, is the expressed desire to establish the Virginia system of higher education as among the best in America. Will all elements of Virginia's system share equally the resources devoted to obtaining this goal? What the relative enrollment impacts of pursuing this goal will be on Virginia institutions remains an important policy question.

Few issues more clearly point out the need for a better understanding of the elements of demand than the recent enrollment swings of the Virginia Community College System. Tuition increases after 1982 were held responsible in part for subsequent enrollment declines. Lowered tuition charges in 1986 did indeed coincide with higher enrollments (Virginia Community College System, 1987). Given the community college role of providing higher education to those with the least access to it, a better understanding of the sensitivity of low income students to price is called for.

Demand Specification Issues. For those most interested in modeling choice behavior of consumers of higher education, three issues related to specifying the demand function stand out as important:

- o specifying the set of choices available to consumers of higher education;
- o establishing the independence of the demand function from the supply function; and

- o incorporating financial aid awards into the demand model.

Early researchers in the field of higher education demand tended to limit the set of choices available to consumers to either attending college or entering the work force. With time the set of choices expanded to include choices between types of colleges (e.g., public or private, junior college or senior college), as researchers attempted to make their choice models more realistic.

At least one researcher has extended the model to include the choice of obtaining non-collegiate occupational education. (See Corman, 1983; and Corman and Davidson, 1984.) Unfortunately, the methodological soundness of this most recent extension must be questioned because of failure to insure the independent determination of the demand and supply functions.

Maintaining the independence of demand and supply has been recognized as an important issue in education demand research from the earliest studies. Often referred to as the "identification problem" in the literature, it refers to the bias which results when demand and supply relationships include the same explanatory variables. Avoiding the identification problem in demand studies means specifying demand variables that do not also determine the supply function.

Two strategies have been successfully applied by

researchers to minimize the identification problem. Collecting data at the individual level lessens the possibility of the identification problem, because the data represents the actual decisions made by consumers of higher education. When using aggregate data, a cross-sectional design, instead of a longitudinal design, avoids the problem if the researcher can assume that price (that is, tuition and required fees) is (1) determined by demand and supply factors from a previous time period, and (2) not influenced by demand factors in the present time period. This strategy has been acceptable in higher education demand studies because price is generally not used to ration college places in any given year.

The final issue in demand specification, including financial aid awards in the model, has proved to be one of the most difficult to deal with. While most researchers would agree to its inclusion, few have been fortunate enough to have access to suitable data. Measurement of financial aid awards continues to be a problem because aid can come from so many different sources, and may take many different forms. In fact, different forms of aid (such as loans versus grants) may have differential impacts on enrollment patterns.

This problem is particularly acute when analyzing at the state level as opposed to the national level. While some national survey data bases (such as the National

Longitudinal Survey) have included limited financial aid award information, states are not routinely collecting such information.

### Research Question

The main purpose of this research was to model the choice behavior of Virginians as they sought out higher education. Put another way, this research attempted to measure the demand for higher education in Virginia. The research was motivated more by a desire to better understand choice behavior than to enlighten a particular policy concern. This is not to imply that policy was of no concern, however. In fact, it is recognized that a better understanding of behavior could potentially enlighten a wide array of public policies.

The focus of the research presented is on the behavioral. No attempt was made to obtain precise estimates of demand for forecasting purposes. Instead, a generalized model of demand was developed. Attention was directed (1) to a better understanding of the elements of demand, and their interrelationships; and (2) to a better understanding of the choices available to students and how these choices may be substitutes for one another.

Importantly, this research is a case study of Virginia's higher education demand. While many aggregate demand studies measure the nation's demand for higher education, relatively few measure the demand within an

individual state.

One recent study has measured the demand for higher education in Virginia (Strickland, 1983). The Strickland study attempted to show the impact of certain economic, non-economic, and environmental variables on enrollment demand in Virginia.

Strickland's study, like the present study, was based on the human capital model, and treated higher education as an investment good. The variables under study were typical of those used in the investment approach to explaining demand. The study also used local cities and counties as the unit of analysis, then aggregated to the state level.

In two important respects, however, the Strickland study had a narrower scope than the research reported here. Strickland limited her analysis to public four-year colleges. More importantly, hers was not a study of student choice. Rather, it was a study of the impact of the variables under study on enrollment demand at one type of institution. As Strickland notes, "...the analyses conducted for this research were a logical first step in the attempt to study student choice patterns..." (p. 73, emphasis added).

Demand studies aggregated at the state level, such as the Strickland study and the present study, are important for several reasons. First, without minimizing the impact of federal policy making on higher education, it is the

individual states which have responsibility for enabling and regulating higher education. Given the magnitude of this responsibility, and the resource requirements which accompany it, research that informs the states' decision and policy making processes becomes very important.

Additionally, because of the individual states' enabling and regulating responsibilities, the character of higher education varies by state. In many respects, each state has developed its own higher education system. Moreover, in most states the consumers of higher education largely come from the state where they obtain their higher education. Virginia residents comprised, for example, approximately 86% of the enrollment at Virginia state-supported institutions in 1985 (State Council of Higher Education for Virginia, 1985, Table 1). [State supported institutions accounted for 84% of all enrollments that year (State Council of Higher Education for Virginia 1985, Tables 1 and 3)]. Thus higher education can be viewed as a "product" that is produced by a state and consumed by that state's residents, making demand analysis at the state level all the more appropriate.

#### Hypotheses

The following hypothesis served to guide the research: the decision to obtain higher education is a function of (1) the direct and indirect costs of higher education; (2) the income levels of consumers; and (3) the tastes and

preferences of consumers regarding higher education.

For each type of educational activity (i.e., attending a community college, a four-year public college or a four-year private college) it is expected that:

- o the costs of the activity bear negatively on enrollment for that activity;
- o the costs of the activity are positively related to enrollment for alternative activities;
- o factors which increase the returns to that activity bear positively on enrollment for that activity; and
- o factors which increase the returns to that activity are negatively related to enrollment for alternative activities.

#### Variables Under Study

The data for demand studies may either be collected at the individual student level or aggregated to some larger unit of analysis. Because of the lack of information on individual students for many of the variables to be examined, aggregate data was used in the research presented here. Thus the choices of typical, or average, students were studied, and not the choices of actual students.

In order to obtain sufficient variation in the variables selected, the local political jurisdiction--a Virginia city or county--was used as the unit of analysis. Because the research examined the demand for higher education in Virginia, only in-state enrollments (both

full-time and part-time) at Virginia colleges, public and private, were used. To avoid problems associated with the simultaneous determination of demand and supply, the study used a cross-sectional analysis, examining events of 1985.

Four measures were used to construct the dependent variables:

- o the percent of the college eligible population enrolled in a public community college (CC);
- o the percent of the college eligible population enrolled in an undergraduate program at a public four-year college or university (PUB);
- o the percent of the college eligible population enrolled in an undergraduate program at a private four-year college or university (PVT); and
- o the percent of the college eligible population not enrolled in college (NIC).

Because the research focused on the probability that an educational option would be chosen, three dependent variables were constructed from these four measures by taking the ratio of CC, PUB, and PVT each to NIC. Thus the dependent variables CC/NIC, PUB/NIC, and PVT/NIC represent, respectively, the odds of selecting each one of the educational options.

The independent variables included measures of cost, students' preferences regarding higher education, and family income. Similar variables have been used in most



aggregate demand studies of higher education, although the methods used to measure these variables have differed somewhat from study to study.

### Research Method

The research employs a qualitative choice model where the student must choose among several educational alternatives. Logit is a commonly used estimating technique for this type of analysis (see e.g., Radner and Miller, 1975; Bishop, 1977; Manski and Wise, 1983; and Corman and Davidson, 1984) and was used in this research.

Logit is a statistical technique which allows one to predict among several discrete alternatives, given a set of explanatory variables. It is designed to relate the relative frequencies of choices to the characteristics of the individual and his options. Logit measures the probability that an option will be chosen, assuming that the option is a function of the characteristics of the individual and the set of options available to him.

In the research conducted here, logit was used to predict which of several higher education options had the highest probability of maximizing utility for the typical student, given student and institutional characteristics. The statistical properties of logit have been discussed by Nerlove and Press (1973) and McFadden (1974).

### Justification of the Research

Research on the demand for higher education has shown

that demand is a complex function of economic as well as non-economic factors. The research presented here draws from both of these categories to develop a model that is representative of enrollment demand in Virginia.

The research is justified on several grounds. As has been indicated, the main purpose of the research was to model the choice behavior of Virginians as they sought to consume higher education. While solidly rooted in the tradition of higher education demand and human capital analysis, the research conducted here is notable for analyzing demand at the state level, for using an expanded choice set over previous research in Virginia, and for avoiding the methodological problems associated with the identification problem. As such it represents a significant contribution to the literature.

Furthermore, demand analysis within the human capital framework is a tool which has been little utilized by Virginia higher education researchers and policy-makers. By acquainting policy-makers with the technique, and by demonstrating its utility for the Virginia case, this condition may hopefully be overcome.

The greatest potential value, however, may come from a better understanding of the variables which make up the model, and their interrelationships, for these add to our understanding of the college-going choice and shed light on important policy issues.

## Chapter II

### REVIEW OF THE LITERATURE

This chapter reviews selected research on the demand for higher education. The issues developed in Chapter One to describe the literature are expanded upon and become the criteria by which four prominent works in the demand for higher education are evaluated.

Meaningful comparison of the findings of studies of higher education demand is made difficult by the disparateness of the studies. Varying levels of aggregation have been used; independent and dependent variables have been defined differently; a number of different functional forms have been used; and both time series and cross-sectional perspectives have been applied (Weinschrott, 1977).

In order to make more meaningful the comparison of dissimilar studies, this review focuses on the form of the demand studies as well as the findings. Study of the literature reveals that a number of issues related to the specification of the demand model are important to the technical correctness of the studies. Moreover, as a practical matter, no study is ever completely technically correct, given the constraints on resources available to researchers. The manner in which a researcher deals with

these specification problems, however, defines the context in which findings must be interpreted.

The chapter is divided into three parts. In part one the evaluative criteria (i.e., the model specification issues) are identified and discussed. Part two is a description and evaluation of each of the studies being reviewed. Part three presents a summary of findings.

### Evaluation Criteria

In this section a number of issues important to the specification of higher education demand models are presented. How researchers treat these issues sets the stage for interpretation of their findings, making these model specification issues useful tools for comparison and evaluation.

Explanatory Variables. The demand for a given good is generally taken to be a function of its cost (direct and indirect), the tastes and preferences of consumers, consumer incomes, and the prices of related goods. Researchers in the economics of education, working within the human capital framework which considers higher education to be primarily an investment good, have used similar categories of independent variables.

The complete picture of the cost of attending college includes both direct and indirect costs. Direct costs, or out of pocket costs, include items such as tuition, fees, and living costs that are directly attributable to

attending college. Indirect costs are the costs of opportunities foregone because of attending college, such as lost employment earnings.

Direct costs are expected to bear negatively on demand for higher education. The effect on demand of indirect costs is less clear, because different costs may have countervailing effects on demand. An increase in employment earnings, for example, may dampen enrollments as students opt to take advantage of the higher wage, while also increasing the ability of families to finance higher education. In general, it is felt that higher opportunity costs decrease the demand for higher education (Bishop, 1977, Corrazini, 1972).

Tastes and preferences of students regarding higher education, because of their subjectivity, have proven difficult to measure directly. Proxies for this variable have included measures of student ability (on the assumption that a brighter student is more predisposed to attend college), matriculation rates for the student's school or community (which may reveal school or community expectations regarding college attendance) and socioeconomic level. Socioeconomic level (as well as race and sex) has more often been used to examine the distributional effects of dependent variables on subgroups of the population being studied.

Income is intended to represent the student's ability

to pay for higher education and is positively related to enrollment demand. Most researchers have gathered income data at the family level, rather than at the individual student level, believing that a student relies on the resources of the family to finance his education. As noted later in this chapter, income is an incomplete measure of ability to pay when educational loans and grants are available.

As applied to the demand for higher education, the final variable of the general model, the price of related goods, has to do with the perception that colleges, or types of colleges, are substitutes for one another. When colleges are considered substitutes, a change in the direct costs of attending one will affect the enrollment demand of the other. The expected relationship is positive. As an example, enrollment demand at college A should rise if tuition is increased at substitute college B.

Interestingly, in spite of consensus by economists on the variables which make up the general demand function, the models used by educational economists are diverse with regard to the variables included. This stems from two factors. First, several of the variables in the general model are not directly measurable, requiring that proxies be used. In some cases a number of proxy variables may seem plausible. Second, researchers are often concerned with obtaining the maximum predictive power of the overall

model. Given different research objectives, researchers may elect to include somewhat different variables in their models.

Choice Set. An important element of demand models which must be specified is the range of choices assumed available to the student consumer. Corman and Davidson (1984) maintain that from the earliest studies of demand, most have assumed students had two options: attend college or not. Even more recent studies which have examined the type of college that students will attend are considered by them to be variations on this same theme. Their own work broadened the analysis to include the post-secondary vocational education option.

Equally important as the number and type of choices, however, is the way in which choice is modeled. As noted by Jackson and Weathersby (1975), the early higher education demand research, typified by Campbell and Siegel (1967), Hoenack (1967), and Spies (1973), used just one parameter to summarize the demand relationship. Campbell and Siegel, for example, used the ratio of average proportional change in enrollment to change in cost to summarize demand. Using just one parameter implies fixed decision rules for students contemplating enrolling.

Later research, growing out of choice theory, assumed that decision rules are not fixed, and may change with the options that are available (Jackson and Weathersby, 1975).

Works such as those of Radner and Miller (1975), Kohn et al (1974), and Corman and Davidson (1984) assume students evaluate the options available to them and, given student and institutional characteristics, select the option which has the highest probability of maximizing the student's utility, or satisfaction.

Financial Aid. Inclusion of financial aid in higher education demand models poses one of the more difficult problems in specifying demand. Although such awards are often recognized as important to a complete specification of demand, few researchers have had sufficient data to include a well developed financial aid variable in their models.

The presence of financial aid, either as grants or loans, is important to a complete understanding of demand because of its effects on the price and income variables. An award of financial aid reduces the present price of attending college, while at the same time increasing disposable income. Both of these actions tend to increase demand for higher education.

Unfortunately, the complexity of the financial aid variable makes collecting good financial aid data difficult. The number of sources of aid, the differential impact of different types of aid, and the importance of including the aid offered at all institutions considered (and not just the college chosen), contribute to the



difficulty.

Financial aid is available from the federal and state governments; from private individuals, private businesses and non-profit organizations; from private and public lenders; and from the colleges themselves. Ideally, a measure of financial aid awards should include aid offers from all these different sources.

Aid can take several different forms, including loans, grants and scholarships, and grants partially offset through employment (Tierney, 1980). It seems reasonable to expect that each form has a different effect on enrollment demand. Grants, for example, are, *ceteris paribus*, more attractive to prospective students than loans or work study. Ideally, any measure of financial aid awards included in a demand model should take into account the type of aid offered as well as the amount. Because students may be offered several different types of aid, the mix of award offers which makes up the financial award package should also be considered.

While the number of sources and types of aid makes the measurement of a financial aid variable difficult, measurement is complicated even further by the fact that the total award package available to a given student is likely to vary from one college to another. Students make choices based on the financial award picture at each of the alternative colleges considered. Thus any financial aid

variable included in a demand model should take into account the financial aid package for each alternative college, and not just the college accepted.

Faced with the difficult measurement problems associated with including a financial award variable in education demand models, many researchers have chosen to omit the variable entirely. (See, e.g. Radner and Miller, 1975; Corman, 1983; and Strickland, 1983.) Others have had to use less than ideal representations of the variable (e.g., Carroll, Mori, Relles, and Weinschrott, 1977; and Jackson, 1978).

The Identification Problem. The identification problem arises when the demand and supply relationships contain similar variables and, as a result, cannot be distinguished from each other. Without a priori knowledge about the supply or demand relationship it is impossible to determine which is affected by a change in an explanatory variable. (For a complete discussion of the identification problem in econometrics see Fisher, 1966. Most primers on econometrics also offer discussions. See, for example, Chu, 1972; and Cassidy, 1981.)

In higher education the intersection of demand and supply determines the actual number of students enrolled. A change in either the demand schedule or the supply schedule results in a new intersection, and possibly a new number of students. Unless the independence of the supply

and demand functions is maintained, it is impossible to say whether a change in demand or a change in supply caused the change in enrollment. If, for example, both functions use tuition as an explanatory variable, it is impossible to know, in the absence of additional information, whether a change in tuition changed demand or supply, or both.

At least two potential sources of simultaneous equations bias exists for researchers in higher education demand. In time series, or longitudinal, studies, if the unit of observation is aggregated beyond the individual, the income variable in the demand equation may be confused with income as an explanatory variable for the supply equation. For while income does not typically influence supply in the general case, the supply of higher education, as a good provided largely from the public sector, is sensitive to the aggregate income of recent time periods.

A second potential source of bias arises when the supply of college seats is rationed by price. In this case the price (or tuition) variable appears in both the supply and demand functions and its effect on the two may not be distinguishable. Fortunately, places in higher education institutions are not usually rationed by price. Exceptions may occur in private occupational-technical schools, and when colleges use financial aid awards to attract particular students.

### Description and Evaluation of Related Research

In this section four higher education demand studies are described and evaluated. Each of the studies is prominent in the literature of education demand. Equally important, the reviews serve to demonstrate how researchers have approached the different problems associated with specifying the higher education demand model.

Radner and Miller, 1975. The Radner and Miller demand study is part of a larger work which examines several issues of both demand and supply of higher education in the U.S. Indeed, the demand model is developed in large part to provide one piece of the future picture of the higher education "industry" in America. Other pieces of the picture looked at by Radner and Miller include the relationship between student/faculty ratios and the estimation and projection of the number of educated persons. Only Chapter Three of Radner and Miller, which presents a study of the demand for freshman places in U.S. colleges, is reviewed here.

Using data from Project SCOPE (a longitudinal study conducted by the Center for Research and Development in Higher Education at the University of California, Berkeley) Radner and Miller estimated individual demand for higher education in California, North Carolina, Massachusetts, and Illinois. They found that post-secondary choice was affected by family income, the costs of other

post-secondary options, student academic ability, and the selectivity of other colleges for which the student was eligible.

*Explanatory Variables.* Radner and Miller measured the demand for college places by testing the influence of four quantitative factors: family income, the costs of alternative post-secondary options, student academic ability, and the academic selectivity of alternative institutions of higher education. These quantitative variables conform fairly well to the general model for demand, with one exception. There is no variable which measures the indirect costs of enrolling in college, typified by foregone earnings or the unemployment rate. Given its importance in other research (Hoenack, 1967; Corrazzini et al, 1972; and Corman and Davidson, 1984, for example), inclusion of this variable would likely have strengthened this model.

As Weinschrott (1977) has noted, Radner and Miller model the four explanatory variables in a highly restrictive manner. The cost and income variables are not entered separately, but as one cost-per-income-level variable. The coefficients of cost and income are thus constrained to be equal. As a result, Radner and Miller measure the interaction of cost and income, but not the separate effects of cost and income.

Similarly, student ability is entered only in

interaction with the school selectivity variable. There is no separate entry of these variables into the model. Again, only the interaction of the variables is measured, and not the separate effects. No explanation is offered for choosing such a restrictive specification of demand, other than to indicate that good explanatory power was obtained for the cost/income and ability/selectivity variables.

After determining the effects of these quantitative explanatory variables, additional qualitative variables reflecting student attitudes, aspirations and background were categorized, grouped and tested to see if they had the potential to improve the model. In all, twenty-one sets of qualitative variables were used.

Curiously, none of the tested qualitative variables were included in the Radner and Miller model, although a number were identified as having the potential to improve the model. By limiting the examination of the qualitative variables in this manner, Radner and Miller were unable to verify that the qualitative variables improved the model or to measure their impact on the model.

**Choice Set.** The choice set available to students in the Radner and Miller model was taken from the options actually chosen by students in the Project SCOPE sample. Because of the impracticality of treating every higher education institution in the four state sample as a

separate option, Radner and Miller classified the institutions into nine categories based on three levels of school selectivity and three levels of cost. A tenth no-college option was added.

The goodness of the choice set is dependent on how representative it is of the actual choices available to students. The Radner and Miller study, being able to draw on individual student data, used a choice set which is fairly rich. In order to further improve the representativeness of the choice set, Radner and Miller inserted variable measures for actual schools, rather than averages of several schools, where possible.

No fixed decision rules are assumed to be in operation in the Radner and Miller model as students make their choices among options. Through the use of the conditional logit procedure, Radner and Miller measure the probability that an option maximizes a student's satisfaction, given student and institutional characteristics. The student's decision rules are allowed to change as each option is examined.

**Financial Aid.** No financial aid variable is included in the demand model. The authors maintain that financial aid was available to only a small proportion of students in 1966, the year for which data was collected, and is of no consequence to the analysis.

**Identification Problem.** Radner and Miller believe

that simultaneous equations bias is avoided in their study because individual, rather than aggregate, student data is used. The income variable, which in the aggregate would appear the same for both the supply and demand relationships, is kept distinct through the use of individual data.

Bishop, 1977. The purpose of Bishop's study was to develop a model of demand for higher education that accounted for the influences of public policy as well as the economic environment. Using Project Talent data on male high school juniors in 1960, Bishop modeled the national college attendance behavior of 20 subgroups of students defined by student ability and family income. Individual student data on enrollment was used, although a number of variables made use of aggregate data.

Bishop found that tuition, high admissions standards, foregone earnings, and travel and room and board costs had significant, negative effects on enrollment. Also, students with high income and high ability were found to have lower price elasticities, which is to say their decision to enroll was less sensitive to changes in tuition. Both admissions standards and breadth of curriculum were found to have positive effects on enrollment. Social status of the student's neighborhood also showed a strong positive relationship to enrollment.

From a policy perspective, Bishop argued from his



findings that aiding students from low-income families was more efficient than across the board reductions in tuition, if the objective was simply to increase the number of students enrolled. He also argued that establishment of a two year college in a city with no college did not increase enrollment as much as establishing a four year college with the same tuition level.

**Explanatory Variables.** Bishop's model included 13 explanatory variables which he categorized as policy variables, social and economic variables, and background variables. All variables found in the general model for demand are included.

Bishop's measure of direct costs is particularly interesting. It was arrived at by summing the costs of tuition, travel, and room and board for the cheapest feasible college available to the student. A feasible college had to offer a broad range of programs, accept at least 20% of the state's high school graduates, and be compatible with the student's racial and religious preferences. Bishop argued that once a set of colleges feasible to the student was determined, the relevant choice within that set was between the cheapest college and not attending at all. The cost variable thus constructed focused on the decision to attend college or not, rather than on which college (or type of college) was attended.

Two measures of indirect costs were used. Foregone

earnings were defined as one third of the median yearly earnings of male workers in the SMSA or county of the student's residence. Also used was the earnings differential between college and noncollege occupations (actually an indirect benefit).

Several variables were included in the model which may be classed as tastes and preferences of students. Representative of these is social status of the neighborhood, academic aptitude, family socioeconomic status and draft pressure. The last of these, a measure of those eligible for the draft, was expected to be positively related to enrollment since postponing the draft increased the incentive to attend college.

Family income and student ability, while not directly included in the model, were used to stratify the students into 20 income-ability groups. In effect 20 separate models of higher education demand were constructed.

Overall, the range of explanatory variables used in the Bishop model indicates a well developed model of demand. A potentially serious problem with specification of the direct cost variable does exist, however. In measuring travel costs Bishop assumed constant values for determining costs for both campus residents and commuters, including a constant number of trips. That commuters and residents make the same number of trips seems most unlikely. As a result, Bishop's direct cost variable, of

which travel is a part, is likely biased.

**Choice Set.** Bishop limits his empirical examination to college attendance, without reference to type of college attended. Choice is therefore limited to attending college or not. This seriously constrains interpretation of Bishop's findings. At the same time, given the broad policy issues with which Bishop is concerned, a broad look at enrollment demand may have been most appropriate.

The characterization of choice is further constrained by limiting the analysis to males. Bishop may have chosen to exclude women from the study in order to emphasize his draft pressure variable, although no explanation is offered by Bishop. In any event, there is no reason to believe that the choices made by males would conform precisely to those made by a population of men and women.

As with the Radner and Miller (1975) study, Bishop uses a logit procedure which estimates the probability that an option will maximize a student's utility. Because only two options are considered, the benefit of decision rules being allowed to change as each option is considered becomes moot.

**Financial Aid.** No financial aid award variable is included in Bishop's demand model. Bishop argues that financial aid was offered on such a small scale during the time period under study (1961) that inclusion of a

financial award variable is unwarranted. Given the importance to Bishop's study of identifying the minimum cost higher education institution, failure to consider even a small amount of financial aid may bias study results.

**Identification Problem.** Bishop does not address the problem of simultaneous equations bias. Without knowing his assumptions regarding the supply of higher education, it is difficult to establish whether demand was identified in his study. Other authors who have used cross-sectional studies with aggregated data have claimed independence of demand and supply by assuming that supply was determined exogenously in a time period previous to that under study. (See, e.g., Wise, 1983).

**Tierney, 1980.** While the stated purpose of Tierney's study is to model the decision to enroll in a public or private higher education institution, the research is remarkable in several ways. Tierney's study represents one of the few serious attempts at including financial aid into a higher education demand model. Not only did he examine the amount of aid received, but the type (grant, loan or work study) as well. His study is unique, too, in that only those students who applied and were accepted by at least one public and one private college were included in the analysis. The nature of the data set Tierney used provided information not only about the college which was ultimately selected, but also each of the colleges the student

indicated he was considering as of his senior year in high school.

Tierney's work is a cross-sectional look at national demand for private and public colleges, using a data base of students entering college in 1975. Based on his findings, Tierney argued that financial aid was an effective instrument for increasing competition between public and private colleges, and that student loans were relatively more efficient at providing equality of choice between public and private institutions than work study or grants.

*Explanatory Variables.* Tierney presents one of the more creative approaches to defining the explanatory variables included in his demand model. He calculated the differences between the college chosen and other colleges in the student's choice set along six dimensions: tuition, distance from college to the student's home, college selectivity (as measured by average academic ability), and three financial aid variables (amounts offered in scholarships and grants, loans, and work-study). By creating maximum difference variables, Tierney was able to focus on the comparison of chosen college to not chosen colleges.

In addition to these institutional variables, seven individual student variables were included. Parent's income, father's education, mother's education, student

academic ability, race, student aspirations, and a dummy variable for whether the student enrolled at his first choice college were added to the model.

This rather large set of explanatory variables addresses each of the principal dimensions of education demand found in the general model, with one important exception. As in the Radner and Miller (1975) study, no measure of indirect costs is included.

Even more limiting for the model, however, was Tierney's decision to restrict the sample to students who had been admitted to at least one public and one private college. Rather significant differences between the students in the original data base and the students in Tierney's sample appeared. Because of higher family income levels and student ability levels for students in the Tierney sample, the Tierney findings cannot be considered representative of college students in general.

*Choice Set.* The set of higher education choices available to students in the Tierney model included all public and private higher education institutions. The dependent variable, however, was operationalized as either matriculation to a public institution, or matriculation to a private institution. The choice set modeled, then, was limited to either a public institution or a private institution, with no apparent distinction between four-year and two-year institutions. The "no college" option is not

included in the model. Only those students who actually matriculated are included in the sample.

The restrictiveness of Tierney's model of choice, coupled with the restrictiveness of the sample, work together to produce a model with a very narrow focus. In Tierney's case, this narrowness would appear to be at cross purposes with his intent to both model demand for higher education and say something about the impact of financial aid on college choice. The definition of his model prevents statements made about demand or financial aid from being generalized to the population of individuals considering higher education.

*Financial Aid.* A strength of Tierney's work is his inclusion of financial aid variables which measure both the type and amount of aid offered and awarded. The impact on choice of scholarships and grants, loans, and work-study assistance are all reflected in the model. As noted previously, some of the explanatory impact of the financial aid variables is lost because of the limits to generalizing findings.

*Identification Problem.* Tierney does not specifically address the identification problem. No obvious limits to identifying demand are noted. One may assume that the use of individual data in a cross-sectional research design minimizes difficulties with identifying the demand relationship.

Corman and Davidson, 1984. The Corman and Davidson model is distinct from other research reported here in two respects. Aggregate, rather than individual, data are used in the analysis. Also, the choice of academic or vocational program is explicitly considered. This is accomplished by including post-secondary occupational schools, along with four-year and two-year colleges, in the analysis.

The Corman and Davidson study is one of national demand for post-secondary education. Data aggregated at the individual state level were analyzed for the year 1976. Two separate models were tested using the same explanatory variables. In the first model the dependent variable was type of school attended: four-year, two-year, post-secondary occupational or none. The dependent variable in the second model was type of program: vocational (at either a community college or post-secondary occupational school), academic (at either a community college or four-year college) or none.

Corman and Davidson found that tuition levels, unemployment rates and unemployment in managerial jobs compared with unemployment in other types of jobs were the key economic variables for explaining enrollment rates. Income proved to be a less important constraint to enrollment. Especially interesting was the finding that four-year colleges, two-year colleges and post-secondary



occupational schools were close substitutes for one another on the price dimension (that is, a tuition change in one influenced enrollment at the others).

**Explanatory Variables.** The Corman and Davidson model included eight explanatory variables: state per capita income, the ratio of the adult population aged 18-24, the ratio of the adult population aged 65 and over, total unemployment rate for the state, the ratio of the unemployment rate for professional and management occupations to the unemployment rate for clerical and craft occupations, and average statewide tuition for each of the three types of schooling. The model conforms well to the general model for higher education demand. Measures of direct and indirect cost, income, prices of related goods, and tastes and preferences are included. The latter are measured by the percent of elderly and percent of young populating a state. Corman and Davidson reasoned that a state with a relatively larger share of younger people would have a stronger preference for post-secondary education.

Unlike the studies using individual student data, no measure of student ability is used. Corman and Davidson make a convincing argument that the aggregation of ability scores reduces the variance in the scores to the point that ability measures do not explain differences in enrollment.

**Choice Set.** The choice set Corman and Davidson

used represents a significant expansion over other education demand studies. They examine choice on two levels, type of institution (four-year, two-year or occupational) and type of program (vocational or academic). In both cases the no-college or no-program option is considered, too. The inclusion of post-secondary occupational schools as an option for high school graduates provides for a more complete model than previously specified in other research. At the same time, inclusion of this option brought with it methodological problems, as described below in the section on the identification problem.

Corman and Davidson also use a logit procedure for data analysis. Decision rules for choosing among options are not fixed under such an analysis, but may change with the option.

*Financial Aid.* No measure of financial aid is included in the Corman and Davidson model. While Corman and Davidson make no mention of financial aid in their work, one can speculate that some of the explanatory power of a financial aid variable would be lost in aggregation to the state level.

*Identification Problem.* The most serious weakness of the Corman and Davidson study results from simultaneous equations bias. Corman and Davidson assume that the supply

of higher education is perfectly elastic (that is, neither a higher nor a lower price will induce suppliers to offer more places in schools), and that tuition in each state is determined by factors which are exogenous to demand. Under such conditions the demand relationship would be identified. Furthermore, for higher education provided in sectors other than the for-profit sector these assumptions probably hold.

These assumptions do not hold for education provided by post-secondary occupational schools, however. A higher price would induce these for-profit schools to offer more places, just as a lower tuition would induce them to offer fewer. With for-profit schools, an argument that price is exogenously determined from demand is difficult to defend; rather, price is determined by the interaction of demand and supply. Because of Corman and Davidson's inclusion of for-profit schools in their demand model, coefficients in the Corman and Davidson work must be interpreted with considerably more than the usual amount of caution.

#### Summary

The purpose of this chapter was to review and evaluate selected research on the demand for higher education. Four evaluative criteria related to specification of demand models were used. In this section, summary statements will be made about the literature reviewed, within the context of the four evaluative criteria. As well, the findings of

this review of the literature will be related to the study being undertaken.

Explanatory Variables. The research reviewed shows quite a bit of diversity in terms of the actual explanatory variables used. Radner and Miller used just four variables, which were combined to form two explanatory variables: the ratio of cost to income level and the ratio of student ability to college selectivity. In contrast, Bishop used thirteen explanatory variables on 20 income/ability subgroups of students.

Two factors seem to account for the differences in variables used. First, the nature of the research question posed required that different variables be used. Bishop's interest in financial aid and in the demand for public versus private colleges dictated that different variables be used than, for instance, in the Corman and Davidson study with its emphasis on post-secondary education demand. Second, the level of aggregation used changed the nature of the variables selected. Aggregation naturally requires the use of proxy measures in the absence of individual data.

In spite of the differences in variables used, a fair amount of agreement exists across the studies in terms of the categories of variables used. These categories generally conform to the categories of variables for all demand studies. Variables representing direct cost, income, the price of related goods, and tastes and preferences were

used in each of the studies reviewed here. The most notable exception to this agreement occurred in the measurement of indirect costs, as two of the studies omitted this variable.

Choice Set Of all the evaluative criteria used, the choice set appears most sensitive to the research problem being studied. In many respects the research problem defined the choice set for the studies reviewed. An interest in examining public versus private demand requires that the choice between the two be examined. Similarly, a broad look at higher education demand may only require that the "college or no college" choice be studied.

The choice sets of the research reviewed had little in common. All looked at choices within higher education, of course, and most recognized the value of using an analytical procedure which did not impose fixed decision rules on students choosing higher education options.

Financial Aid. Just one of the studies reviewed (Bishop) incorporated financial aid into the demand model. In spite of its importance to demand, suitable financial aid data continues to be omitted from enrollment demand studies because of the difficulties with collecting this information.

Identification Problem. Simultaneous equations bias proved to be a problem for just one of the studies reviewed, the Corman and Davidson work. Two of the studies, however,

(Bishop and Tierney) made no mention of the identification problem, nor did they lay out assumptions which would have allowed for identification of the demand relationship. The Corman and Davidson study serves to remind that simultaneous equations bias is a potential problem for demand studies in higher education, and one that should not be ignored.

Conclusions for the Present Study. The findings of this review of the literature should not only serve to describe and analyze the literature to date, but also to shape the research presently under study. Based on this review, several factors appear to have special importance for the study at hand.

- o To the extent possible, some measure for each of the variables generally included in demand models (costs, tastes and preferences, consumer income, and the prices of related goods) should be used to ensure full development of the model. Variables which increase the costs of enrolling will be negatively related to enrollment demand. Variables which increase the benefits of enrolling will be positively related to demand.
- o The set of options declared available to potential students should be as closely in agreement with the set of options actually available as possible, within the constraints of sound methodology. For

methodological reasons, inclusion of for-profit post-secondary occupational schools is not advisable.

- o The modeling of choice is more realistic when decision rules regarding the choice of options are allowed to change with the options available. Applying the statistical technique, logit, to a choice model appears most suitable to achieve this end.
- o Financial aid as a variable is important to a full understanding of the demand for higher education. The lack of data suitable to develop this variable makes its inclusion in demand models problematic.
- o A cross-sectional design using aggregate data minimizes the identification problem, making it an appropriate choice for the present study.

## Chapter III

### RESEARCH METHOD

As noted in Chapter I, the purpose of this research was to model the demand for higher education in Virginia. The research method used to accomplish this purpose is outlined in this chapter. A brief review of human capital theory, and its application to this research, is presented first. This is followed by a discussion of the principles of econometric modeling of choice.

Next, the model to be tested in this research is described. Included are descriptions of the research approach used, the dependent and independent variables included in the model, the hypotheses to be tested, and the data analysis procedures used. The chapter concludes with a discussion of the limitations of the study.

#### Human Capital Theory

Human capital theory is largely an outgrowth of the work of Becker (1964), and Schultz (1961). It is an extension of traditional investment theory, which describes and predicts the use of physical capital resources in production.

For economists, capital is a concept that represents those resources which are manufactured and used to assist with production, generally tools and equipment. Just as



producers invest in additions or improvements to physical capital resources according to expected costs and benefits, so do individuals invest in improvements in their "human capital" according to perceived costs and benefits.

Economists assume that individuals are maximizers, and that choices are based on attempts to maximize present or future utility. Utility, which is largely self-defined, refers to the satisfaction an individual obtains from some decision, action or purchase. Most of the things individuals decide to do are done because they provide some measure of immediate utility. Economists refer to such activities as consumption.

Certain activities may be undertaken because they increase one's ability to obtain utility in the future. These are referred to as investment. Saving rather than spending part of one's income does not provide satisfaction in and of itself. It has the potential to provide future utility, however. Investment activities are undertaken if the expected benefits of investing outweigh the costs of investing. Because the expected benefits come in the future, it is the present value of the expected benefits that enters the decision. Costs include direct costs as well as indirect costs such as the satisfaction that is foregone when one decides not to spend.

Investment decisions which relate to the use of one's own physical and mental resources fall within the area of

"human" capital. Thus human capital theory can be used to describe and predict labor force decisions. Similarly, decisions to undertake activities which make individuals more productive, and therefore more valuable in the production process, may be analyzed in light of human capital theory.

Viewed from the perspective of human capital theory, the decision to obtain higher education is largely an investment decision. For a variety of reasons, attending college may increase an individual's value to producers, resulting in a stream of future benefits. Enrolling also entails cost, however, not the least of which may be giving up the opportunity to earn present income.

According to human capital theory, a student decides to invest, or enroll, in higher education if the present value of the expected benefits of enrolling are at least equal to the present value of the direct and indirect costs associated with enrolling. Likewise, choices among colleges are made with an eye toward maximizing utility, as measured by net present benefits.

Higher education may in some respects behave as a consumption good, too, providing immediate utility. Treating higher education as an investment good does not preclude it from also being a consumption good. However, treating it as an investment good does allow one to infer that variations in the factors which influence the expected

stream of net present benefits are related to variations in enrollment demand.

It is because these factors are related to variations in enrollment that human capital theory explains higher education demand. Individuals facing choices about attending college are utility maximizers. As a result, enrollment demand is inversely related to the costs of higher education and positively related to factors which increase the returns to higher education.

#### Econometric Modeling of Choice

Much of economic research focuses on the relationship between a dependent variable and explanatory (or independent) variables. Modeling of choice likewise examines the relationship between dependent and explanatory variables. Significantly, the dependent variable in a choice model takes the form of a choice from a group of alternatives. The dependent variable is not a continuous variable, but is discrete. A finite number of possible outcomes exist.

Choice models, rather than predicting the expected value of an outcome, predict the probability that an outcome will be chosen. The probability that an outcome will be chosen is a function of the explanatory variables and the attributes of the available alternatives. Importantly, choice models are not intended to predict the exact choice that a person will make, but to assign a

probability to each choice. Choice models focus on the likelihood that an alternative will be chosen.

Like all empirical models, choice models are based on an assumed relationship between outcomes and explanatory variables. Estimates are reliable only to the extent that the choice model captures the basic determinants of the choice. The most important influences on choice must be reflected, as well as the basic alternatives available to individuals (Manski and Wise, 1983).

Ultimately, choices are made to maximize utility. Choice models make the behavioral assumption that the  $j$ th alternative is chosen by the  $i$ th individual if he values that alternative more than any other available--- that is, if the net benefits from that alternative exceed the net benefits from all other alternatives.

#### Model to be Tested

The research tested a model which took the general form of

$$D = f (C, I, T)$$

or, higher education demand,  $D$ , is a function of the costs,  $C$ , of attending; income,  $I$ , available for educational expenses; and tastes and preferences,  $T$ , of students. Students were faced with four discrete choices: enroll at a public community college, enroll at a public four-year college, enroll at a private four-year college, or not enroll in any college. It was assumed that students were

rational and made choices which served to maximize their utility, taking into account the options available to them, and the factors C, I, and T.

In other words, it was assumed that choices were made by evaluating the costs and benefits of each educational alternative and selecting the alternative which yielded the greatest net present benefits. If the present value of benefits did not exceed costs, the individual would not enroll in school.

Research Approach. The demand model was tested using aggregate cross-sectional data for Virginia for 1985, the most recent year for which complete data were available. The unit of analysis was the local political subdivision, either a Virginia city or county.

Cities and counties were used as the unit of analysis primarily to ensure sufficient variation in the variables included in the model. Examination of the variables included in the study revealed that Virginia's local municipalities are quite diverse on the measures under study. Unemployment rates, for example, ranged from a high of 20.2% to a low of 2.1%. Similarly, median income ranged from a high of \$45,772 to a low of \$18,104. All other variables evidence similar variation.

Aggregate, rather than individual data were used in this research, in part because of a lack of individual data for many of the variables under study. Thus the choices of

average, or typical, students were examined, and not the choices of actual students. The use of aggregate data was appropriate, however, particularly in light of the very central role higher education demand plays in understanding and planning for almost every facet of the higher education enterprise. Given this importance, state-wide researchers and policy-makers were, quite naturally, an intended audience of this research, making data aggregated at the state level appropriate.

A cross-sectional design was used primarily to guard against the identification problem. As outlined in chapter II, time series research studies which make use of aggregate data are prone to difficulties with identification. For the purposes of this research it was assumed that the supply of places in colleges was determined exogenously from the demand for those places; that is, by factors not included in the demand model such as operational costs, endowments, grants and donations, and aggregate income from time periods previous to that under study.

Dependent Variables. Four measures were used to construct the dependent variables: percent of the college eligible population enrolled in a public community college (CC); percent of the college eligible population enrolled in a public four-year college (PUB); percent of the college eligible population enrolled in a four-year private college

(PVT); and percent of the college eligible population not enrolled in college (NIC). From these measures, three dependent variables were constructed (which represented the probability of selecting each of the three educational options) by taking the ratios of CC, PUB, and PVT to NIC. Appendix A provides methods of calculation and sources of data for the dependent variables.

The college eligible population was assumed to be all adults over age 18. While the population of individuals age 18 to 24 is often considered to be the traditional cohort of potential students, use of this group as the denominator for the dependent variables fails to factor in the increasing numbers of older students who have opted for college. As an illustration of this point, in 1985 39% of the students enrolled in Virginia public institutions were age 25 or over. In Virginia community colleges that year, 57% of the students were age 25 or over (SCHEV, 1985, Tables 1 and 6).

Enrollment figures for each of the educational options were collected at the local city and county level, and included full and part-time students. Like older students, part-time students comprise a significant proportion of enrollments in Virginia colleges [44.5% of the Fall 1985 headcount at state supported institutions (SCHEV, 1985, Table 5)], and should be factored into the demand model.

The decision to include part-time students in the estimation of demand was an attempt to obtain a broader and more complete estimate of demand. Including part-time students, however, potentially reduces the impact of certain other variables, especially for the community college choice where large numbers of students attend on a part-time basis. To the extent that part-time students work, they may be influenced less by changes in wage rates or unemployment rates than full-time students who do not work. Interpretation of findings must take these possible effects into account.

Explanatory Variables. The explanatory variables estimated direct and indirect costs, family income level, and tastes and preferences of students. Appendix A provides methods of calculation and sources of data for each of the explanatory variables.

Two types of costs face students contemplating enrollment in higher education, direct (or out of pocket) and indirect. Unfortunately, the most straightforward measure of direct costs---average tuition and required fees charged at each educational option---could not be used. These charges do not vary by locality, and thus could not be reflected statistically in the analysis. Instead, measures of the financial burden of enrolling in each of the three educational options (PUBFB, PVTFB, and CCFB) were calculated by taking the ratio of average tuition and



required fees to median family income. Similar measures have been used by Radner and Miller (1975) and Strickland (1983).

Two measures of indirect costs were used. The wage rate (WAGE) that could have been earned had students not enrolled is a foregone cost of attending college. The average weekly wage per employee for each city and county was used to measure the wage rate variable.

Also reflective of indirect costs was the unemployment rate variable (UERT). The higher the unemployment rate the higher the cost of the no-college option. The annual average unemployment rate by city and county for 1985 was used.

Income measures the ability of the student and his family to finance higher education. The most appropriate measure of aggregate income level is median family income for each city and county. Because median family income is used as the denominator for the financial burden variables, it could not be used again separately in the model. Instead, the percent of the local population having completed one or more years of college (EDCOMP) served as a proxy for median income. A number of researchers have noted the strong correlation between income and educational attainment rates (Corrazini et al, 1972; Hopkins, 1974; Strickland, 1983; and Tannen, 1978). In the present study the correlation between median income and EDCOMP was .86

The principal use of the EDCOMP variable was to indicate students' tastes and preferences regarding higher education. A higher educational attainment rate reflects a greater community propensity toward obtaining higher education. 1980 is the most recent year that data on education completion rates were calculated for Virginia localities. Use of the EDCOMP variable as constructed assumed that relative completion rates from one locality to another remained constant from 1980 to 1985.

Omitted from the model were measures of the price of related goods. Ideally, the price of related goods would be measured by the average tuition and fees charged at each of the educational options whose probabilities were not predicted in a given equation. Because average tuition and fees do not vary by locality, the price of related goods could not be incorporated into the model.

Also omitted from the model was a measure of financial aid. Undoubtedly, inclusion of a financial aid variable would have strengthened the model conceptually. The lack of available data on financial aid offers and awards to Virginia students prevented inclusion of the variable in the model.

Hypotheses. Given the postulates of human capital theory and the research findings to date in higher education demand studies, it was hypothesized that:

enrollment rates for Virginia higher education

alternatives (community colleges, four-year public colleges, and four-year private colleges) are a function of the financial burden associated with attendance for each option, the local average wage, the local unemployment rate, and the local educational attainment rate;

the financial burden associated with each educational alternative is negatively related to enrollment rates for that educational alternative;

average wages are negatively related to enrollment rates for all educational alternatives;

unemployment rates are positively related to enrollment rates for all educational alternatives; and that

educational attainment rates are positively related to enrollment rates for all educational alternatives.

Analysis of Data: The data was analyzed with a qualitative choice model wherein the typical potential student chose among three educational alternatives: attending a community college, attending a four-year public college, or attending a four-year private college. Logit, an estimation technique frequently used for such analyses, was used to determine the probability that an alternative would be chosen, given the set of explanatory variables in the model. The model included three separate equations.

Applying the logit technique to the model developed above in this chapter gives the following model equations:

$$\begin{aligned} (1) \log (CC/NIC) &= b_0 + b_1 \log CCFB \\ &+ b_2 \log WAGE + b_3 \log UERT \\ &+ b_4 \log EDCOMP \end{aligned}$$

$$\begin{aligned}
 (2) \log (\text{PUB/NIC}) &= b_0 + b_1 \log \text{PUBFB} \\
 &+ b_2 \log \text{WAGE} + b_3 \log \text{UERT} \\
 &+ b_4 \log \text{EDCOMP}
 \end{aligned}$$

$$\begin{aligned}
 (3) \log (\text{PVT/NIC}) &= b_0 + b_1 \log \text{PVTFB} \\
 &+ b_2 \log \text{WAGE} + b_3 \log \text{UERT} \\
 &+ b_4 \log \text{EDCOMP}
 \end{aligned}$$

The expression on the left hand side of each equation is the logged odds (or probability) that an educational option will be selected. The probability of either choosing one of the three educational options or not attending college must be 100%. (Thus, the probability that the no-college option will be chosen may be found by subtracting the sum of the odds for the three equations from 100%.) The demand model, while incorporating separate equations, is unified. If the probability of one option being selected increases, it must do so at the expense of the probabilities of the other options. Stated another way, any increase in the demand for one option decreases the total demand for the other options.

The use of logged variables on the right hand side of the equation serves several purposes. First, the form of the equation is linear in logarithms which allows the  $b$  parameters to be estimated by the least squares regression technique. The specification of the demand equation is not linear, however, but multiplicative, because an equation which is of the form  $\log X = b_0 + b_1 \log Y$  is

equivalent to  $X = (b_0) (b_1 Y)$ .

Specifying demand in a multiplicative form is a common practice, although there is no a priori basis for choosing a multiplicative form over a linear form. Intuitively, such a form has appeal for estimating the demand for higher education, however. The multiplicative form assumes that the marginal effects on demand of each independent variable are dependent on the value of that variable as well as on the other variables in the equation, while a linear form assumes that the marginal effects of each independent variable are constant. As an illustration of the difference, if income increased from a low level to a high level, the demand for higher education might increase continuously. A linear equation assumes a constant rate of increase, while a multiplicative equation assumes that the increase will be more rapid at lower levels, then gradually taper off at higher levels. The latter is intuitively more appealing than the former. Additionally, tests of each form of the equation resulted in better goodness of fit measures for the multiplicative form in the present study.

Finally, demand functions of this form have the useful property of displaying regression coefficients which can be directly interpreted as elasticity coefficients. Elasticity is the measure of the percentage change in a dependent variable which results from a 1% change in an

Independent variable.

### Limitations of the Study

In all social science research, findings must be interpreted in light of any limitations inherent in theoretical assumptions made, research approach used, specification of the model, or measurement of variables. This section discusses these types of limitations for the present study.

While the use of human capital theory to explain the demand for higher education is well established, it necessarily limits that explanation to the investment motive. The consumption motive for demanding higher education, that is, enrolling in college because it yields immediate satisfaction, is not considered. The findings of the present study, rooted in human capital theory, can not be interpreted to explain the demand for higher education as a consumption good.

Limitations result, as well, from the fact that the present study is a case study of Virginia higher education demand. Study findings, except to the extent that Virginia is typical of other states, may not be generalized to other states or to the nation as a whole.

Furthermore, because the study used a cross-sectional design, examining data for 1985, findings may not be interpreted as representative of other years, except to the extent that 1985 is considered a typical year. Also

because of the study's cross-sectional design, trends in the effects of the explanatory variables on the dependent variables can not be discerned. Only direct, or present effects, were measured. Future effects could not be projected.

Findings must also be interpreted in light of limitations inherent in the specification of the demand model. In order to predict student choice, the explanatory variables must reflect the most important influences on choice. One instance of such a limitation was the lack of a financial award variable in the model. Its absence not only limited the potential explanatory power of the overall model, but precluded discussion of the effects of financial aid awards on enrollment demand.

A second limitation inherent in the specification of the model results from the absence of a direct cost variable measured by tuition and required fees. Such a variable appears in most higher education demand models, but could not be included in the model presented here because of a lack of variation by city and county within each educational option.

While it is true that exclusion of the tuition variables limits the completeness of the specification of the demand model, three factors limit the impact on the model under study. First, it is well established that the relationship between tuition and demand is significant and

negative. Including tuition and fees would have strengthened the overall model, but probably would not have added significantly to what is already known about the impact of the variable. Second, because of the very clear differences in average tuition and fees charged by each educational option, the choice of a given educational option is in reality a choice to pay a particular level of tuition, just as it is a choice to obtain a particular set of educational programs or to attend college at a particular location. Third, the financial burden variables used instead of tuition capture some of the impact of tuition on choice, although they do not strictly measure tuition, but the ratio of tuition to median income.

A final instance of a possible limitation inherent in the specification of the demand model results from the inclusion of part-time students in the enrollment variables. Part-time students who also work (as well as part-time students who are homemakers or retirees) may be less sensitive to the wage and unemployment variables of the model than full-time students. Any impact from including part-time students would most likely show up in the community college choice because of the relatively larger share of part-time students attending community colleges.

In this same vein, it should be noted that the fourth choice faced by students in the model is "not attend



college," and is not "enter the work force." Had the choice been characterized as "enter the work force," methodological problems would have resulted from including part-time students who quite possibly are already in the work force. The assumption of discrete choice would have been violated.

Lastly, measuring variables in the aggregate limits interpretation of findings. Because the present study used aggregate rather than individual data, findings are representative of the average or typical student, but not actual individual students.

## Chapter IV

### ANALYSIS OF RESULTS

#### Introduction

This chapter analyzes and presents the results of the model equations described in Chapter III. The chapter material is presented in three sections. The first section provides a statistical description of the variables under study. This is followed by a discussion of the independent variables used in each model equation to predict the probability that an educational option would be chosen. The final section examines and compares the overall explanatory power of the three model equations.

#### Description of the Variables

The purpose of this section is to reintroduce the variables under study by providing descriptive statistics of them. Table 1 provides means, standard deviations, and minimum and maximum values for the variables which were used in the calculation of the dependent variables. As has been noted, the data was collected at the city and county level, so that, for example, the mean of Eligible Population represents the average population across all localities.

TABLE 1

SUMMARY STATISTICS  
DEPENDENT AND COMPONENT VARIABLES

|                          | Mean      | St Dev    | Max        | Min      |
|--------------------------|-----------|-----------|------------|----------|
| Eligible Population      | 31,371.57 | 54,341.15 | 492,552.00 | 2,366.00 |
| Private 4 Yr Enrollment  | 98.31     | 167.84    | 1,180.00   | 1.00     |
| Public 4 Yr Enrollment   | 708.19    | 1,866.57  | 18,633.00  | 23.00    |
| Comm. College Enrollment | 758.90    | 1,474.76  | 13,831.00  | 24.00    |
| Not in College           | 29,806.17 | 50,991.45 | 459,099.00 | 2,314.00 |
| PVT                      | .33       | .27       | 1.58       | .02      |
| PUB                      | 1.84      | 1.85      | 16.53      | .39      |
| CC                       | 2.23      | 1.05      | 7.72       | .62      |
| NIC                      | 95.60     | 2.56      | 98.13      | 74.17    |

N of Cases = 136

Table 2 provides summary statistics for the independent variables. A healthy degree of variation is evident in all the variables. As an indicator of the relationship between dependent and independent variables, regression coefficients of correlation for these variables are presented in Table 3.

TABLE 2

SUMMARY STATISTICS  
INDEPENDENT VARIABLES

|        | Mean   | Std Dev | Maximum | Minimum |
|--------|--------|---------|---------|---------|
| PVTFB  | .21    | .04     | .30     | .11     |
| PUBFB  | .07    | .01     | .10     | .04     |
| CCFB   | .03    | .01     | .04     | .02     |
| EDCOMP | 25.03  | 11.34   | 63.03   | 9.64    |
| UERT   | 7.52   | 3.55    | 20.20   | 2.10    |
| WAGE   | 302.57 | 65.25   | 529.00  | 192.00  |

TABLE 3

REGRESSION COEFFICIENTS OF CORRELATION (R)

|     | PVTFB | PUBFB | CCFB  | EDCOMP | UERT  | WAGE  |
|-----|-------|-------|-------|--------|-------|-------|
| PVT | .01   | --    | --    | .30*   | .15   | .04   |
| PUB | --    | .43** | --    | .59**  | .26** | .19*  |
| CC  | --    | --    | .30** | .32**  | .02   | .34** |

\* t significant at  $p < .05$  level

\*\* t significant at  $p < .01$  level

### Independent Variables

Individuals were faced with three educational options: attend a private four-year college, attend a public four-year college, or attend a community college. This section explores the influence of the independent variables on the probability of selecting each of the educational options. The probability of choosing any option was the ratio of the percent of the eligible population enrolled in that option to the percent of the eligible population not enrolled in college. For example, the probability of choosing the private four-year option was  $PVT/NIC$ . While the analysis which follows focuses on findings related to the three educational options, it should be remembered that the no college option was the basis for establishing the probability of choosing any one of the educational options.

The independent variables which were used to predict the probability of selecting the educational options were measures of cost (financial burden, wage rates, and unemployment rates), income (approximated by educational completion rates), and tastes and preferences (also approximated by educational completion rates). The estimated effects of each of the independent variables for each of the educational options are presented in turn.

Financial Burden. Table 4 reveals the effects of the three financial burden variables on each of the three educational

option equations. The hypothesized relationship, that the probability of choosing any of the educational options was negatively related to financial burden, was supported for the community college and public four-year college options. As the financial burden for either of these options increased, the probability that they would be chosen decreased.

TABLE 4

ESTIMATED EFFECTS OF  
FINANCIAL BURDEN VARIABLES

|  | Coeff.  | t      | Signif. t |
|--|---------|--------|-----------|
| Community College<br>Option (CCFB)     | -.87486 | 2.707  | .0077     |
| Public 4 Yr<br>College Option (PUBFB)  | -.38320 | -1.053 | .2941     |
| Private 4 Yr<br>College Option (PVTFB) | 1.80700 | 3.126  | .0022     |

Conceivably, either of the two measures whose ratio made up the financial burden variables could have contributed to the relationship. Either higher tuition and required fees or reduced family income to pay for college expenses could be expected to result in a lower probability of enrolling in a community college or a public four-year college.

Interestingly, while the sign of the coefficient for

the public four-year option was as hypothesized, the coefficient lacked statistical significance. Strickland (1983) used a similarly constructed variable in her analysis of enrollment demand of individual public four-year colleges in Virginia. Her measure of financial burden was statistically significant for all colleges but those comprising her "major universities" group--University of Virginia, College of William and Mary, and Virginia Polytechnic Institute and State University. Possibly the impact of those institutions on the population of public four-year colleges reduced the overall significance of the financial burden variable for the present study.

The hypothesized negative relationship between financial burden and the probability of enrolling in a private four-year college was not supported by the model. Instead, the relationship was positive and statistically significant. Thus, the higher the financial burden, the greater the probability that the private four-year college option was chosen.

As developed in Chapter III, the probability of selecting any one option is a measure of the utility of that option. Applying that idea to the present research means that increases in financial burden increased the utility of the private college option, and decreases in financial burden decreased the utility of that option for students.

An important characteristic of the model equations used in the study is that the regression coefficients can be directly interpreted as elasticity coefficients. Elasticity is a measure of the responsiveness of a dependent variable to a 1% change in an independent variable. The coefficient of any given independent variable represents the percent change in the dependent variable that results from a 1% change in the independent variable.

Examination of Table 4 reveals that a 1% decrease in CCFB would result in a .87% increase in the probability that the community college option would be selected. Similarly, a 1% decrease in PUBFB would give rise to a .38% increase in probability that a public four-year college would be chosen, and a 1% decrease in PVTFB would result in a 1.81% decrease in the probability that a private four-year college would be selected.

Precise interpretation of elasticity coefficients can occur only under rather exacting data measurement techniques. General observations can be made about the relative degree of elasticity of the variables, however. In the case under study, it is interesting to note that the community college and private four-year college options were considerably more sensitive to changes in financial burden measures than the public four-year college option. This is not surprising, given that they represent,



respectively, the low and high ends of the financial burden spectrum.

Examining the elasticity coefficients and their signs together presents an interesting picture. The three educational options appear to represent three points along a continuum for the dimension of financial burden. The utility of the community college option, at one end of the continuum, decreases with an increase in financial burden. So does the utility of the public four-year college option, but to a lesser degree. The utility of the private four-year college, at the opposite end of the continuum, increases with an increase in financial burden. This continuum corresponds to that of the price dimension for the three options. Cost, or financial burden, was apparently an important determinant of the utility which students expected to derive from each of the three educational options.

Wage Rates. Table 5 shows the estimated effects of the WAGE variable on the probability of selecting each of the educational options. WAGE was statistically significant (at  $p < .05$  level) for only one of the model equations, the community college option. Counter to the study hypotheses, WAGE was positively related to the probability that each of the educational options would be chosen, although the low level of significance for the two four-year options makes interpretation of their signs difficult.

TABLE 5

ESTIMATED EFFECTS OF  
WAGE VARIABLE

|                                | Coeff. | t     | Signif. t |
|--------------------------------|--------|-------|-----------|
| Community College<br>Option    | .40164 | 2.064 | .0410     |
| Public 4 Yr<br>College Option  | .01649 | .075  | .9401     |
| Private 4 Yr<br>College Option | .01821 | .052  | .9583     |

Overall, wage rate variables have provided mixed results in demand studies. In Strickland's study of demand for public four-year colleges in Virginia, wage rates were not significantly related to enrollment for these colleges statewide or in institutional groupings. The variable was statistically significant for a few individual colleges, however. Bishop (1977), on the other hand, found foregone earnings to have significant, negative effects on enrollment, as did Hoenack (1968) and Manski and Wise (1983). For the present study, wage rates did not significantly influence the probability of choosing either a public or private four-year college.

Wage rates were significantly and positively related to the probability that the community college option would be selected, however. As has been mentioned, the effects of wage rates on demand are not clear. In general they are

assumed to be an indirect cost of attending college, representing the foregone earnings which could have been earned had the student not entered college. As such they would be negatively related to demand. Wages, however, may also be thought of as a source of payment for college expenses. In that case wages would be positively related to enrollment demand. And, it is possible that both effects could be simultaneously at work to some degree.

It would appear that for the community college option wages were considered primarily a source of present income and not foregone income. One can reasonably ask why WAGE did not serve in a similar capacity for the two four-year college options. While the study results do not speak directly to this issue, one possible explanation may lie with the relatively larger number of part-time students who attend community colleges. To the extent that part-time students are employed, they will not view the WAGE variable as a cost of attending, but as a source of income which may be used in part to finance their studies. At the four-year public and private colleges, with fewer part-time students, the lack of significance for the WAGE variable could be the result of the foregone income and present income effects offsetting one another.

Yet another plausible explanation exists for higher wage rates being associated with a higher probability that the community college option was selected (and lower wage

rates associated with a lower probability). If higher wages enticed some students, who otherwise would have opted for a public or private four-year college, to forego attending college on a full-time basis in order to earn the wages, it is possible that they would elect to continue their studies part-time. Because of the disproportionate share of part-time students attending community colleges, most of the impact of such decisions would fall on community college enrollment. Similarly, when wage rates were low, the desire to attend college part-time and work full-time would be reduced, resulting in a lower probability of choosing the community college option. Thus, at different levels of wage rates, students may substitute community colleges for four-year colleges, and vice-versa.

Elasticity coefficients for the two four-year college options were very low, and, because of the low level of significance for these options, provide little insight into the impact of WAGE on choice. For the community college option, a 1% change in WAGE would result in a .40% change in the probability that a community college would be chosen.

Unemployment Rates. The effects of the unemployment rate variable are presented in Table 6. As with the WAGE variable, UERT was significant in only one model equation, the community college option. UERT was positively related

to the probability of choosing either a community college or a public four-year college, as hypothesized, but negatively related to the probability of choosing a private four-year college, (counter to the study hypothesis). As with the WAGE variable, very low levels of significance were evident for the two four-year college options.

TABLE 6

ESTIMATED EFFECTS OF  
UERT VARIABLE

|                             | Coeff.  | t     | Signif. t |
|-----------------------------|---------|-------|-----------|
| Community College Option    | .20620  | 1.807 | .0730     |
| Public 4 Yr College Option  | .00238  | .019  | .9852     |
| Private 4 Yr College Option | -.04547 | -.223 | .8237     |

What is most clear about the effects of the unemployment rate variable is that the community college option was more likely to be chosen when unemployment rates were high than when they were low. In fact, a 1% increase in the unemployment rate would result in a .20% increase in the probability that the community college option would be selected.

As expected, the cost of choosing the community

college option was lower when unemployment rates are higher. Foregone income from employment becomes less a factor influencing the decision to enroll during periods of higher unemployment.

The community college option may be more sensitive to the UERT variable than the other two options for several reasons. Being the lowest cost option of the three, it is reasonable to expect community colleges to appear relatively more attractive during times of economic hardship, such as periods of higher unemployment. Too, the vocational nature of some of the programs offered at a community college might appeal to those who wished to return to the workforce with more competitive labor market skills. The shorter length of time required to complete community college programs, particularly vocational programs, might also be attractive to such students, as would the relatively greater accessibility of community colleges to most residents of the Commonwealth.

One cannot discount the impact of part-time students when explaining the different effects of the UERT variable for the three options. During times of higher unemployment, even those who are employed may feel insecure about their future in the labor market and attempt to improve their job security by attending college part-time. Because of the relatively larger number of part-time students served by community colleges, and because of the

availability of vocational programs there, one would expect a relatively larger share of such students to choose the community college option.

The negative relationship between UERT and the probability of selecting a private four-year college, while not strong, is interesting. Perhaps a higher unemployment rate dampened present income sufficiently to reduce the utility of the private four-year college option.

Educational Completion Rates. EDCOMP served jointly as an indicator of student propensity to obtain higher education, because of community social influences, and as a proxy for family income. As hypothesized, educational completion rates were positively related to the probability of choosing each of the three educational options, although not statistically significant for the community college option. Table 7 provides relevant statistics.

TABLE 7

ESTIMATED EFFECTS OF  
EDCOMP VARIABLE

|                             | Coeff.  | t     | Signif. t |
|-----------------------------|---------|-------|-----------|
| Community College Option    | .03236  | .236  | .8141     |
| Public 4 Yr College Option  | .82084  | 5.308 | .0000     |
| Private 4 Yr College Option | 1.36216 | 5.543 | .0000     |

As most other research has found, educational completion rates had a significant effect on the perceived utility of the two four-year college options, although relatively more so for the private college option. In terms of elasticity, a 1% increase in EDCOMP would result in a .82% increase in the probability that the public four-year college option was selected, and a 1.36% increase in the probability that the private four-year college option was chosen. Apparently, the degree to which adults in a locality had attended college was a strong influence on demand for these two educational options.

EDCOMP was rather less important as a determinant of the utility of the community college option. A 1% increase in EDCOMP would result in just a .03% increase in the probability that the community college option was selected. This finding is not surprising, given that community colleges have as part of their mission serving economically and educationally disadvantaged students, who would be more likely to come from families and communities with lower educational completion rates.

#### Model Explanatory Power

This section explores the ability of the three model equations to explain differences in the probability that an educational option was selected. Goodness-of-fit measures



for the three equations are presented in Table 8.

TABLE 8  
EXPLANATORY POWER OF  
MODEL EQUATIONS

|                                | R <sup>2</sup> | F     | df  | Signif. f |
|--------------------------------|----------------|-------|-----|-----------|
| Community College<br>Option    | .20300         | 8.34  | 135 | .00       |
| Public 4 Yr<br>College Option  | .44508         | 26.27 | 135 | .00       |
| Private 4 Yr<br>College Option | .19707         | 8.04  | 135 | .00       |

The multiple R<sup>2</sup> for both the community college option and the private four-year college option were somewhat lower than is typical for this type of research. The R<sup>2</sup> for the public four-year college option was consistent with previous research, however. Given the levels of R<sup>2</sup> found, it can be presumed for all model equations that additional variables not included in the study play a role in predicting college choice.

Table 9 presents the regression coefficients for each of the independent variables again, but on a model-by-model basis. By examining Tables 8 and 9 together, another dimension of the explanatory power of the model equations can be explored, which is, did the variables under study

help predict college choice for each of the equations? Stated another way, was the study hypothesis that choices among educational options were a function of measures of financial burden, wage rates, unemployment rates, and educational completion rates supported in each of the models?

TABLE 9

COEFFICIENTS OF INDEPENDENT VARIABLES  
ALL MODEL EQUATIONS

|                             | FB         | WAGE     | UERT    | EDCOMP     |
|-----------------------------|------------|----------|---------|------------|
| Comm. College Option        | -.87486*** | .40164** | .20600* | .03236     |
| Public 4 Yr College Option  | -.38320    | .01649   | .00238  | .82084***  |
| Private 4 Yr College Option | 1.80700*** | .01821   | -.04547 | 1.36216*** |

FB is either CCFB, PUBFB, or PVTFB, depending on the model equation.

- \* significant at  $p < .10$  level
- \*\* significant at  $p < .05$  level
- \*\*\* significant at  $p < .01$  level

Based on the  $R^2$  alone, one might conclude that the public four-year model was "best," since it had the greatest overall explanatory power. Examination of Table 9 shows, however, that only one variable, EDCOMP, explained

most of the likelihood that the public four-year option was chosen. The remaining variables, contrary to the study hypothesis, played a negligible role. In terms of the contribution of model variables, the private four-year model was somewhat more satisfactory, although two of the variables, WAGE and UERT, contributed little to the explanatory power of the model equation, again counter to the study hypothesis.

Three of the four variables in the community college option played a statistically significant role in predicting that the community college option would be chosen. Only EDCOMP proved to be statistically nonsignificant. From the standpoint of being consonant with human capital theory, having significant variables related to choice, and supporting the study hypothesis, the community college equation appears to work best.

## Chapter V

### SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Understanding the dimensions of student demand for higher education is critical to developing sound policies which set the direction of higher education. Whether these policies relate to the number or types of students to be served, the types of programs to be offered, or the mix of institutions which will exist, they must take into account what students will do, what their choices will be.

That is not to say that higher education policies should be exclusively demand driven. Those who set policy still must consider the needs of all citizens, present and future, and not today's students alone. What must be borne in mind, however, as policy is developed, is that, within the realm of choices available, students will make those choices that tend to maximize their utility. Achieving policy goals may well depend on understanding the choices students will make and the variables which influence those choices.

This research attempted to model the choice behavior of college students in Virginia as they sought out higher education, as a way of gaining a better understanding of

student choice behavior. In particular, the research focused on the probability that a given educational option, either a community college, a public four-year college, or a private four-year college, would be selected. Working within the theoretical framework of human capital theory, the effects on choice of demand variables such as cost, income, and tastes and preferences were measured.

This chapter summarizes the findings of the research, presents conclusions based on the findings, and outlines implications of the study for future research.

#### Summary of Research Findings

The research findings reported in Chapter IV are summarized here. First, findings related to the separate independent variables are reviewed. These are followed by a review of the explanatory power of the three model equations.

CCFB, PUBFB, PVTFB. The three measures of financial burden were used in lieu of more direct measures of cost, such as tuition and required fees. Because the study used aggregate data, with the local city or county as the unit of analysis, measures of tuition and fees (which do not evidence sufficient variation by locality) could not be included in the models.

The financial burden measures used were a ratio of tuition and fees to median income, for each educational option and for each locality. For both the community

college option and the public four-year college option, financial burden measures were negatively related to the probability of that option being chosen. The higher the local financial burden associated with either of these two educational options, the lower the probability of their being chosen (and vice-versa).

These findings were consistent with other research, and intuitively fit with the tenets of the human capital model--as the costs associated with an activity increase, the probability of choosing the activity decreases. For the public four-year college, however, PUBFB was not statistically significant. In Strickland's (1983) research this variable was shown to be nonsignificant for major universities in Virginia, but significant for other institutional groupings.

The financial burden measure for the private four-year college option, PVTFB, was found to be significantly and positively related to the likelihood that the option was selected. This would appear to be in contradiction with human capital theory. The probability that the private four-year college was selected decreased as financial burden decreased (and vice-versa). Thus the utility of the private college option appeared to fall as its cost fell. This finding may be partially supported by Hoenack's (1968) finding that as wealth increased, students expected both to pay higher costs and derive higher benefits from college.

Perhaps at lower levels of financial burden, students perceived the utility of private colleges to be less than they could obtain at a public four-year institution, and switched, rather than attend private colleges in greater numbers.

Both the lack of statistical significance for PUBFB in the public four-year college model, and the positive relationship between PVTFB and the probability of choosing a private four-year college, point to the possibility that these two options may be so heterogeneous that each represents several options rather than just one. Even so, financial burden appeared to be an important determinant of choice. A 1% increase in financial burden resulted in a .87% decrease in the probability that the community college option was selected, a .38% decrease in the probability that the public four-year college option was chosen, and a 1.81% increase in the probability that the private four-year college option was selected.

WAGE. Wage rates did not have the hypothesized effects for any of the educational options. From study to study, measures of indirect costs, such as wage rates and unemployment rates, have provided mixed results. For wage rates, this has primarily been due to the fact that an increase in the variable may simultaneously lower the costs of attending college, by increasing present income, and increase the costs of attending, by increasing the level of

income which must be foregone.

For the public and private four-year college options, wage rates were positively, but not significantly, related to the probability of these options being selected. Given the low level of statistical significance, wage rates appeared to have little or no impact on choice for these two options.

For the community college option, wage rates were positively and significantly related to the likelihood that the community college option was selected. The present income effect of the WAGE variable apparently influenced the choice of this option. This may be due in part to the relatively large number of part-time students who attend community colleges. Part-time students who are employed will not view the WAGE variable as income which must be given up in order to attend. Instead they view it as present income, part of which may be used to finance their studies.

Also, higher wages acting as foregone income may draw students into the work force and away from attending college on a full-time basis. It seems reasonable to expect that some of these students would elect to continue their studies part-time, and most likely at community colleges, which serve relatively larger numbers of part-time students than the other two options. The present study does not distinguish between full and



part-time students, and so cannot speak directly to this issue.

UERT. The unemployment rate variable, like WAGE a measure of indirect cost, provided mixed results. UERT was significant and positive, as hypothesized, in the community college equation alone. Unemployment rates did not significantly influence the probability of selecting the public or private four-year college options.

Like wage rates, unemployment rates may have contradictory effects on the probability that an option will be chosen. Higher unemployment rates may reduce present income available for college (and even cause those still earning income to be more conservative in their spending), thus giving rise to a lower probability of attending college. It may also reduce the impact foregone income has on the probability that an option is selected, thus increasing the likelihood of college attendance.

In the present study, the cost of attending a community college was lower during times of higher unemployment. While this may have been due to the reduced impact of foregone income, other factors may have contributed to the greater probability that a community college was chosen when unemployment rates were higher. Several characteristics of community colleges could make them relatively more attractive than other educational options during periods of higher unemployment, including

their lower cost and their vocational offerings. It is also quite possible that part-time enrollments, which are concentrated in the community colleges, increase during periods of higher unemployment, as those who are still employed attempt to improve their job skills to provide increased job security.

EDCOMP. Educational completion rates served principally as an indicator of students' propensity to obtain higher education, due to community social influences. Because of EDCOMP's close correlation with median income, it also served as a proxy for family income. (Because median income was used as the denominator for the financial burden variables, it could not be entered again separately into the model equations.) As hypothesized, EDCOMP was positively related to the probability of choosing each of the educational options. The variable was statistically significant for both of the four-year college options, but, counter to the study hypothesis, was not statistically significant for the community college option.

The impact on the perceived utility of the private college option was somewhat greater than for the public college option. A 1% increase in EDCOMP resulted in a 1.36% increase in the probability that the private college option was selected, and a .82% increase in the probability that the public college option was selected.

For the community college option, local educational

completion rates appear to have little influence on students' propensity to obtain higher education. Given that community colleges have as part of their mission serving the educationally and economically disadvantaged, it is not surprising that EDCOMP was relatively less important in the community college option. A 1% increase in EDCOMP resulted in just a .03% increase in the probability that the community college option was selected.

Model Explanatory Power. While the coefficient of determination (R<sup>2</sup>) for the public four-year college option was consistent with previous research, the R<sup>2</sup>'s for the community college and private four-year college options were lower than is typical for higher education demand research. For all three options variables not included in the study apparently played a role in predicting college choice.

Of all the model equations, that of the community college option best fit the human capital model. Three of the four independent variables were statistically significant. Only educational completion rates lacked statistical significance. And while the sign of the WAGE variable was not as hypothesized, that was not entirely unexpected, given the potentially contradictory impact that indirect cost variables may have.

While the public four-year college model did the best job overall of predicting choice of any of the model

equations, almost all of its predictive power was the result of the EDCOMP variable. None of the remaining variables was statistically significant.

Two variables were statistically important to predicting the probability that the private four-year college option was selected, EDCOMP and PVTFB. This option was more sensitive to the EDCOMP variable than any of the other educational options. Curiously, the sign of the financial burden variable was not negative as hypothesized, but positive. As a result, the probability that the private college was chosen was a positive function of both financial burden and educational completion rates.

#### Conclusions and Implications for Further Research

The purpose of this research was to gain a better understanding of choice behavior by modeling that behavior within a human capital framework. While the research did add to our understanding of higher education choice behavior, it raised new questions about the choice behavior of students, as well. In this section conclusions about overall study findings are presented and possible directions for future research are explored.

Based on the overall study results, modeling the choice behavior of students using a human capital approach at first glance appears to hold little promise. The low explanatory power of two of the model equations, for example, indicates that additional, untested variables

explain much of the probability that the community college and the private four-year college options would be selected. Also, the lack of statistical significance for all but the educational completion rate variable in the public four-year college option is discouraging.

If one looks beyond these surface statistics, however, it becomes evident that the human capital model does indeed hold promise for explaining choice probability in Virginia higher education. Furthermore, the study findings point the way to additional research which may improve the success of the model as a vehicle for understanding choices and higher education demand.

Given the data constraints imposed on the study, the lower explanatory power of some of the model equations is not surprising. More encouraging results might have been obtained, had the study data requirements allowed for a more complete specification of demand, including measures of tuition and required fees and financial aid awards. Future research should be guided by these findings, although obtaining sufficient variation in price data for the public institutions will be problematic even if data is collected at the individual student level.

On balance, the variables included in the study proved to be important to the educational options which were considered. Each of the independent variables included in the model equations was statistically significant in at

least one of the equations. Two of the variables, educational completion rates and financial burden, were highly significant in two of the model equations. Although not equally as well in each equation, measures of cost, income, and tastes and preferences appeared to play a role in the choices students made among options.

Furthermore, given that community colleges, public four-year colleges, and private four-year colleges do represent different choices, or options, it is not surprising that the independent variables behaved differently in the different model equations. That the variables displayed different effects, yet were significant at some level in one or more of the models, tends to support the notion that the three options really are looked at by students as different choices available to them within the broader category of higher education.

Interestingly, the human capital model appeared to be supported more by the community college model equation than by the two four-year college equations. Wage rates, unemployment rates, and financial burden all proved to be statistically significant determinants of the probability that the community college option was selected. Only educational completion rates proved to be nonsignificant.

The effects of the wage rate and unemployment rate variables on the community college model may have been enhanced by the presence of large numbers of part-time

students at community colleges. An important direction for future research would be to separate the effects of part-time and full-time students in the choice models. That the economic variables included in the human capital model have different effects on part-time students who work than on full-time students who do not has much intuitive appeal. Such a separation could have important effects for the public four-year college model as well as for the community college model, given the relatively large number of part-time students at certain of these institutions.

Research on the relative impact on choice of the unemployment rate for full and part-time students would be especially useful. The present study tends to confirm the conventional wisdom that community college enrollments are positively related to the unemployment rate. It also found, however, that four-year college enrollments were not particularly sensitive to the unemployment variable. In exploring why that was so, the relatively larger number of part-time students at community colleges appears to have some importance. Future research which specifically examines the relative impact of the unemployment rate variable on these two categories of students could shed light on this issue beyond what is conventionally believed. Because the two types of enrollment demand may require different resources (and mixes of resources), the issue has importance for planners and decision-makers in higher

education.

If the community college model truly is more sensitive to the economic variables of the human capital model than the four-year college options, then one would expect to see wider enrollment swings for community colleges than for the other options throughout the business cycle. A comparative study of the relationship of enrollment, for each of the educational options, to the phases of the business cycle, would make an interesting study.

Several findings of the study, however, point to the possibility that insufficient specification of the number and type of educational options may have accounted for the relatively poorer model performance of the public and private four-year college options. Future research should further explore and refine the concept of the educational options which students perceive to be open to them.

Perhaps the nature of the choices perceived to be open to students is not public four-year, private four-year, or community college, but is instead based on other institutional characteristics, such as institutional selectivity or types of programs offered. Additional research is necessary to determine if such characteristics more precisely define student options than whether a college is a public or private institution.

As a first step, future research endeavors could expand the number of educational options by categorizing



Virginia higher education institutions along both price and selectivity dimensions. Under such a scheme, a moderately priced, moderately selective institution would appear to students as one option, regardless of whether the institution was public or private. Importantly, a research design of this type would have the benefit of allowing the researcher to speak to the issue of price differences without using price as an independent variable.

Finally, based on the findings of the present research, several important questions about private higher education in Virginia could be explored. The positive relationship between financial burden and the probability of selecting a private college proved to be one of the more surprising findings of the present study. Replication of this finding in other years and under other economic conditions would prove interesting. Of course, a more important question, assuming the finding holds under different conditions, would be why the phenomenon occurs. Particularly interesting would be the exploration of the degree to which substitution of public colleges for private colleges influences the finding.

The research presented here appears to have accomplished its stated purpose of gaining a better understanding of choice behavior. The human capital approach, which views decisions to enroll in higher education as investment decisions, provided useful and

interesting information about the nature of choice among higher education options. Importantly, it demonstrated the complexity of the concept of college choice, and showed the usefulness of approaching the concept, which may be fraught with casual observations based on conventional wisdom, from a more theoretical vantage point. Finally, as a first study in higher education choice in Virginia, the research has utility for its ability to refine the theoretical approach used to model college choice, and to point the way to future research. Thus the findings presented here should be useful to policy makers wishing to better understand higher education demand, as well as to students of higher education.

## Appendix A

### Measurement of Variables and Sources of Data

A description of the variables used in the study and how each was measured is provided below.

#### Dependent Variables

CC/NIC, PUB/NIC, PVT/NIC CC, PUB, PVT, and NIC were, respectively, the percent of the college eligible population enrolled in a public community college, enrolled in a public four-year college, enrolled in a private four-year college, or not enrolled in college. The numerator for CC, PUB, and PVT was the 1985 full and part-time enrollment of the educational alternative under consideration, by locality. This information is collected by the State Council for Higher Education in Virginia. The data was taken from SCHEV's R-1 reporting form required of all Virginia colleges. The denominator was the local population for 1985, over age 17, obtained from the Virginia Department of Planning and Budget 1985 population projections. NIC is the difference between 100% and the sum of CC, PUB, and PVT.

Each of the three dependent variables (expressed as the ratio of the percent of the eligible population enrolled in an educational option to the percent of the eligible population not enrolled in college) represented the probability that an educational option was chosen.

#### Explanatory Variables

PUBFB, PVFB, CCFB Measures of financial burden associated with attending public four-year colleges, private four-year colleges, and public community colleges, respectively. Calculated for each of the educational options as the ratio of tuition and required fees to median family income for the locality. Tuition and fee data were obtained from The Fact Book, 1985-86: Higher Education in Virginia, State Council of Higher Education For Virginia. 1986 projected median income by locality was obtained from Projections of Virginia Family and Household Income by Locality, 1986 to 1990, published by the Tayloe Murphy Institute, Charlottesville, Virginia.

WAGE One measure of indirect cost, WAGE represents the local wage rate that could have been earned had students

not enrolled in college. Data on the average weekly wage per employee, by locality, was obtained from the Virginia Employment Commission series, "Covered Employment and Wages In Virginia By 2-Digit SIC Industry," for the quarter ending December 31, 1985.

UERT The local unemployment rate was a second measure of indirect cost. Unemployment rates, by locality, for 1985 were compiled by the U.S. Bureau of Labor Statistics and reported in its "Historical Report on Labor Force and Unemployment" series and obtained from the Virginia Employment Commission.

EDCOMP The percent of the local population having completed one or more years of college. This rate of educational attainment is primarily a reflection of community preferences regarding higher education. Because of its high correlation with median income, EDCOMP is also used as a proxy for family income level. The rates used are the most recent completion rates available for Virginia localities and were published with the 1980 Census. Use of these rates assumes that relative attainment rates from locality to locality remained constant from 1980 to 1985.

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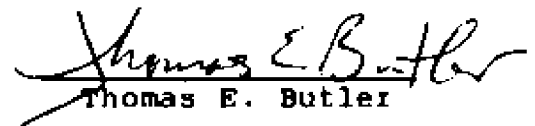
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## Abstract

### The College-Going Choice in Virginia: A Study in the Demand for Higher Education

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The research was an application of demand analysis to higher education. The theoretical framework of human capital theory was applied to the decision to choose an educational option, either a public four-year college, a private four-year college, or a public community college. According to human capital theory students weigh the expected benefits of an educational option against its direct and indirect costs, and invest in higher education only if the present value of the stream of expected benefits is at least as great as the present value of the direct and indirect costs.

The purpose of the research was to model student choice behavior in order to gain a better understanding of the choices students made and the variables which influenced those choices. The probability of selecting any one educational option was assumed to be a function of variables which reflected costs, income, and tastes and preferences. A logistic form of the demand equation was used which measured the effects of the independent variables on the likelihood that an educational option was chosen.

The study used a cross-sectional design, studying enrollment demand for 1985. The unit of analysis was the local political jurisdiction, either a Virginia city or county.

Financial burden (the ratio of tuition and required fees to median income) was found to have significant positive effects on the probability of choosing a private four-year college, and significant negative effects on the probability of selecting a community college. Local wage rates and unemployment rates were found to be significantly and positively related to choosing the community college option. The local educational completion rate for adults proved to be significantly and positively related to the probability that either the four-year private or the four-year public college option was chosen.

The coefficient of determination was highest for the public four-year college option. The community college option, however, had the greatest number of statistically significant independent variables, and appeared to be most in harmony with human capital theory.

Future research can profitably be directed in three areas. First, the effects of the independent variables on full and part-time students should be examined separately, to explore the degree to which the ability of part-time students to work and attend college influences their choices. Particularly, research on the relative impact on college choice of the unemployment rate for full and part-time students would be productive. Second, additional research is needed to confirm and explore why the probability of selecting a private college increases as financial burden increases, and to what extent this is due to substitution of public colleges for private colleges at lower levels of financial burden. Third, future research should explore and refine the concept of the educational options which students perceive to be open to them, perhaps initially by characterizing college options along institutional selectivity and price dimensions.