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Models of Individual Choice in Higher Education from the Perspective of Incomplete Information

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Abstract: The existing studies on this particular market transaction have been conducted mainly under the traditional economic analysis paradigm, with the basic hypothesis of rational man and complete information, which does not correspond to reality and therefore encounters difficulties in explaining some of the problems. This basic hypothesis has led researchers to ignore the important role of information factors in individual choices in higher education. The study reconstructed individual choosing model of higher education that based on literature review. The model selects the demand of higher education and the motivations as the logical starting point to build a comprehensive multi-dimensional model. It puts individual choosing of higher education as a behavior process composed of several continuous decision-making problems. It integrated individual factors, family factors, economic factors, social factors, cultural factors and so on .Revisiting the issue of individual choice in higher education through the hypothesis of “incomplete information” in information economics as the theoretical background can not only provide a new perspective for the study of the relationship between supply and demand in higher education but also broaden the application scope of information economics theory.

1. Introduction

The selection of higher education opportunities is a special market transaction between educated individuals and their families as buyers and higher education institutions as sellers in the higher education market, and it is also a decision-making process. According to decision theory, individuals cannot make decisions without information, and the quantity and quality of information at each stage of the decision-making process directly affects decision making. The influence of information on trading decisions has long been noticed by economists. Joseph Stiglitz and others used “asymmetric information for market analysis,” which earned them the 2001 Prize in Economic Science in Memory of Alfred Nobel. Since then, “Information economics” has been applied as an emerging discipline in many fields of study.

The existing studies on this particular market transaction have been conducted mainly under the traditional economic analysis paradigm, with the basic hypothesis of rational man and complete information, which does not correspond to reality and therefore encounters difficulties in explaining

some of the problems. This basic hypothesis has led researchers to ignore the important role of information factors in individual choices in higher education. Reality tells us that students and parents have very limited knowledge of information related to higher education and that the incomplete and inaccurate grasp of information has become an important cause of errors in educational decisions.

Revisiting the issue of individual choice in higher education through the hypothesis of "incomplete information" in information economics as the theoretical background can not only provide a new perspective for the study of the relationship between supply and demand in higher education but also broaden the application scope of information economics theory. Additionally, such an approach can improve the ability to anticipate and control individual choice behaviors related to higher education, guide families to make reasonable investments in education, reduce the risk of decision making, and provide a basis for the formulation of higher education policies.

Based on a review of literature, this study attempts to reconstruct models of individual choice in higher education from the perspective of the hypothesis of incomplete information, in order to contribute to disprove the null hypothesis of "complete information" in educational choice in the traditional economic perspective and to simulate the reality of individual choice in higher education.

2. Educational Choices and Breakthroughs from the Perspective of Traditional Economics

2.1. Education Model for Human Capital Investment Decisions

An individual choice in higher education opportunities can be viewed entirely as a human capital investment decision made by an individual in the higher education market. The special nature of human capital as a human carrier makes the decision on human capital investment a more complex process than that on physical and financial capital investments. Human capital theory focuses on the analysis and research of this process. Education models, on-the-job training models, and life cycle models are the three main types of models for human capital investment decisions. In this study, we only discuss education models.

The classical theory of human capital investment decisions hypothesizes that the labor market is homogeneous, i.e., that various categories of labor markets have the same properties, that all workers are perfectly competitive with each other in this market, and that workers have unrestricted and completely free access to each labor market. Under this hypothesis, the human capital theory for educational decisions argues that, like any other type of investment, the decision to invest in education is made by the subject of the educational decision based on a comparison between the costs to be incurred in the current period and the benefits expected to be generated in the future as a decisive factor. As a rational economic man, who seeks to maximize utility and thinks from a lifetime perspective, he will definitely make a detailed analysis and comparison of costs and future benefits of an educational investment. If the present value of recent investment costs exceeds the present value of future benefits, people will consider discontinuing the additional investment in education; conversely, an investment in extending formal education is attractive.

Education models were the earliest models for human capital investment decisions. Jacob Mincer created an education model based on human capital theory in 1970[1], suggesting that the difference in educational profits is proportional to the number of years of education. Because Mincer is most concerned with the question of what causes the difference in distributed individual incomes, his education model focuses on explaining and justifying years of education as the cause of the difference in individual income from the perspective of human capital investment.

2.2. Individual Investment Decisions in Higher Education Based on Two Income Streams

The classical human capital investment decision model hypothesizes that workers are faced with a

homogeneous, free-entry, and perfectly competitive labor market, but the real-life labor market is a segmented labor market with different attributes, which makes the model of individual investment in higher education very different from the classical education model. Traditional labor economics theory suggests that the factors influencing individuals' investment in higher education are no longer just a comparison of costs and benefits of education but an important signal from the labor market — the wage income gap between workers with different levels of education.

People choose to go to college only if they confidently expect that pursuing higher education will leave them better off in the future than they are now. This includes both consumption and investment benefits. However, the choice to pursue a college education is in a constant state of flux. In general, it seems unlikely that the consumption benefits of higher education for individuals will change often. Therefore, changes in individual choice with regard to higher education actually reflect certain changes in the costs or benefits associated with the investment characteristics of education.

From the point of view of economics, the ultimate goal of people's higher education is to obtain increased benefits from production. Therefore, it is not the quality and ability developed by education but the benefits of such quality and ability after they are put into production that influence people's decision to pursue higher education. Because the benefits of input into production after learning cannot be determined in advance, students can only estimate their future benefits by referring to the current benefits obtained by those who have received education earlier. Therefore, the current income gap between workers with different levels of education is the most important factor influencing individual investment in higher education [2].

In a somewhat broader sense, a high school graduate who is considering whether to pursue higher education is actually choosing between two different income streams[3].Only when the wage income of college graduates exceeds that of high school graduates can people be attracted to invest in higher education (unless, of course, people prefer the consumption benefits of higher education). Moreover, the total benefits of investing in higher education, i.e., the total difference between the two types of wage incomes, must be greater than the cost of attending college.

In terms of human capital theory, although traditional labor economics theory addresses the wage income differences among different groups of people in the labor market, in fact, actual labor market operation are unimaginably complex, and different types of labor markets have different levels of barriers to entry and exit. Specific manifestations are the differences in wage income, in the unemployment rate among different groups of people, and in the supply-demand relationship. Therefore, the analysis of investment in higher education from the labor market perspective should be improved on the basis of traditional labor economics models. In addition to the difference in wage income among different groups of people, key labor market indicators such as the difference in the unemployment rate among different groups of people and the degree of labor market segmentation among different occupations, industries, and regions should be incorporated into models.

2.3. Literature Review

Since its birth, economics has been built on the core premise of "rationality," and different hypotheses about the degree of "rationality" of economic actors have determined the construction of different branches of economics.

In traditional economics, the standard rational model of decision-making behavior hypothesizes that the actor is a perfectly rational predictor and that all his/her actions are the result of rigorous thinking, never having an emotional component and always making the most rational choice based on maximizing the expected utility. That is, all choices of the economic actor are made under the three conditions that the alternatives are fixed, the probability distribution of the outcome is known, and maximization of the expected utility is sought[4].From the perspective of traditional economics, each

actor is perfectly rational, has complete knowledge of the information needed, and knows everything about the trading partners and the market environment[5].The perfectly rational economic man has unlimited knowledge, unlimited reasoning power, and unlimited executive power related to the choice, is fully and completely informed about himself/herself, his/her opponent, and the decision environment, has solid preferences, and always aims to maximize the expected utility.

The same applies to the analysis of individual investment decisions in education from the traditional economic perspective. The education models in classical human capital theory and the educational investment models from the perspective of labor economics are both based on the following three basic hypotheses: the decision-making subject is a perfectly rational economic man, the choice regarding education is free of behavioral risks of the subject (risks caused by behavioral decisions of the subject), and the decision-making subject has complete information related to the decision. That is, the decision maker, when faced with making or not making an investment in education, fully seeks to maximize economic benefits, and the cost-benefit of that investment is determined, without regard to the probability of the occurrence of the benefit, which by default is 100 percent. The decision maker is fully aware of the costs and the expected benefits of receiving an education and only needs to measure whether the benefits will outweigh the costs to decide whether to choose to enroll.

The hypothesis of the "perfectly rational economic man" supports the perfect theoretical system of classical economics. However, this hypothesis is only a highly abstract ideal model, which is far from the actual situation. First, in real life, people's choices and decisions are often influenced by subtle psychological factors (e.g., individual intuition, beliefs, feelings, and emotions) rather than being dominated by the maximization of their own interests. Altruism, social justice, and voluntary behavior all contribute to the immaterial motivation of human behavior.

Second, people have limitations with regard to full executive power, i.e., bounded willpower. Even if the best solution to a problem is known, i.e., the "best solution," it is unknown whether people in reality are able to execute the solution in practice. This is an issue with regard to the ability to execute the optimal plan, i.e., willpower.

Third, people use available information to conduct a cost-benefit analysis to make a correct choice. However, people have limited rationality and do not necessarily have access to accurate and complete information; therefore, they may not be able to make the most correct choice. Even if they have complete information, considering the limitations of information processing, people very likely make choices based on partial information or experience and intuition. In real life, when people make decisions based on bounded rationality, cognitive biases are inevitable; therefore, the cognitive and computational abilities of people in this case remain far from those of a "rational economic man"[6].

Like all other markets, the higher education market is an asymmetric market with incomplete information. Individual choice behavior with regard to higher education is driven by certain needs and motivations, which are generated on the basis of people's existing images, perceptions, and judgments of information related to higher education. All images, perceptions, and judgments that people have are the subjects' reflection of objective information. "In all knowledge-based service markets, consumers face difficulties in judging the quality of these services, both before and after receiving the service" [7]. Compared to students and their parents, higher education institutions, policy-makers, and employers clearly have the advantage of information about higher education services, higher education management, and student employment, and in the process of choosing higher education, individuals rely to a large extent on external information transmission from so-called authorities and public media and self-promotion from colleges and universities to obtain information and identify and screen options. A lack of information sources and unreliable information content constitute the incomplete and inaccurate acquisition of information, leading to disadvantages for individuals with regard to information.

The concept of incomplete information in the theory of information economics breaks through the null hypothesis of complete information and complete rationality and is close to actual economic behavior. At a time when information is ubiquitous and has become an important factor of production, attention to information issues and human behavior under incomplete information has undoubtedly become an analytical perspective that cannot be ignored in various research fields. Exploring the information issue in individual choice with regard to higher education under the hypothesis of incomplete information can disrupt the traditional research paradigm and provide a new perspective for the study of individual choice in education.

3. Reconstruction of Models of Individual Choice in Higher Education From the Perspective of "Incomplete Information" — Based on Four Hypotheses About Human nature

3.1. Literature Review: Four Classical Models

Individual choice in higher education has been explained by a large number of models in existing studies. These explanatory models can be divided into four types on the basis of what they emphasize: economic models (Fuller, Manski & Wise, 1982), sociological models (Sewelland & Shah, 1968), combined models (Hossler & Gallagher, 1987; Litten, 1982), and expanded models (Litten, 1982).

Economic Models. Economic models adopt economic theories and methods and focus on the analysis of economic factors that attract and constrain individuals to make educational choices. These models assume that the educated individuals evaluate a college or university based on geographical location, economic factors, and academic factors. The weights of these three influencing factors vary with students' family background, social background, and academic experience[8].A premise implicit in economic models is that the educated individuals can measure the economic benefits of investing in higher education. Therefore, individuals make their choice of institutions and majors based on an assessment of the foreseeable economic benefits of the investment. Economic models can be further divided into two categories depending on the form of higher education: consumption analysis models (Pasternak, 2005; Chuan, 2004) and human capital investment models (Hung, Chung & Chu, 2000). Consumption analysis models view higher education as a cultural consumption product from the consumption perspective, and choices result from maximizing utility under the constraints of household income and expenditure budgets, education product prices, and other expenditures. Human capital investment analysis models treat higher education as a human capital investment from the investment perspective, and the internal rate of return of higher education influences people's investment in education [9].

Sociological Models. Sociological models focus on a series of social and individual factors that attract people to choose employment or education. Researchers argue that people ultimately choose to pursue a college education as the result of a game between employment expectations and education expectations within the constraints. Sociologists are more concerned about the formation of expectations than with the constraints faced by individuals in the real world [10]. "Status attainment" in sociological theory focuses on the role of various factors in allocating people's social status or social prestige, and higher education is considered by sociologists to be a very important means of acquiring social status, thus creating a demand for higher education.

Combined Models. Combined models extract the indicators that have the greatest impact on individual decision-making behavior from economic models and sociological models (Hossler, Braxton, Coopersmith, 1989) and provide guidance for policymakers in higher education institutions [11]. Combined models incorporate several factors that influence individual decisions from the policy analysis perspective. The advantage of combined models is that they regard college choice as a process and continuously adapt to the process characteristics of college choice and enrolment by

using a range of variables provided by other models.

Expanded Models. Litten's "expanded model of choice in higher education" focuses on the individual and social phenomena that influence choice behavior [12]. He regards the individual choice in higher education as a "funnel model," in which a large number of students consider whether or not to pursue higher education, some opt out during the process, and only a fraction of students eventually take the college entrance examinations. Because of this, Litten emphasizes the importance of analyzing the factors that influence the earliest stage of the decision-making process, i.e., the factors influencing students' pursuit of higher education or not.

Hossler and Gallagher divided this choice process into three phases [13].In the first phase, "intention," students consider whether they should continue to pursue higher education. In the second phase, "search," students gather various information about colleges and universities. In the third stage, "decision," students evaluate and decide which university to attend. Similar to Litten in his expanded model, Hossler argues that the social significance of choice plays a dominant role in students' willingness to enroll in the "intention" phase, while economic variables are added in the second and third phases, especially in the "decision" phase.

As seen from the literature review, the economic and sociological models focus on people's economic and social motivations, respectively, for choosing higher education and imply the hypotheses of economic man and social man, respectively. Moreover, these two models focus on the psychology of people's decision making when choosing which type of higher education. In comparison, the combined and expanded models attempt to increase the explanatory scope by expanding the focus from the decision point of choosing which type of higher education to the decision chain of whether to choose to pursue higher education and which type of higher education to choose, i.e., divide the students' choice of higher education into phases. In addition, economic and social factors are integrated to consider the diversity of students' needs.

This study intends to reconstruct theoretical models of individual choice in higher education from an information perspective. The collection, mastery, and use of information begins as early as students consider whether to continue their college education, and the search, cognition, and use of information is heavily concentrated in the phase of choosing colleges and majors. Therefore, it is necessary to consider individual choice in higher education as a process and analyze it in stages. It is also necessary to combine multiple factors from different perspectives instead of viewing this choice behavior from a single economic or sociological perspective.

3.2. Construction of Multidimensional Models Based on Four Hypotheses about Human Nature

Individual choice in higher education is a decision-making process. Starting from an individual's need for higher education, individuals go through two stages of decision making: whether to pursue higher education and what type of higher education to pursue.

The multidimensional models of individual choice in higher education constructed in this study focus on the initial phases of the two stages of decision making. On the premise of different hypotheses about human nature, the various needs that individuals wish to be satisfied by pursing (a certain form of) higher education are categorized and transformed into different benefit expectations and favorability assessments, i.e., expectations or motivations, so as to express this type of education choice behavior based on the evaluation of future expected benefits.

3.2.1. Cost-benefit Model Based on the Hypothesis of Economic Man

Under the hypothesis of economic man, the market demand for a good (or service) is determined by many factors, among which the main factors are the price of the good (or service) itself and the

related commodities (or services) as well as the future expectations, income level, and consumption preferences of the consumer[14].The cost-benefit model focuses on individuals' economic needs for higher education, with the family's ability to pay, the economic costs and the expected economic benefits of education, and the investment risk as key variables. Under the hypothesis of incomplete information, these key variables exist in the subjective perceptions of each individual, and the choice in higher education is the result of the subjective judgment of each variable.

Thus, the "cost-benefit" model of individual choice in higher education based on the economic man hypothesis is as follows:

$$D = f[M, C, B, S, R] \tag{1}$$

where D = individual choice in higher education opportunities; M = assessment of household ability to pay; C = perceived cost of higher education; B = perceived expected benefits of higher education; S = assessment of individual characteristics of the educated; and R = risk assessment of educational decisions.

3.2.2. Status Attainment Model Based on the Hypothesis of Social Man

The social man hypothesis argues that social men are not mutually isolated individuals but always belong to one or several social groups. Therefore, social men have both their own individuality and rich sociality. Social structure influences individuals, and an individual's behavior also influences society. Second, social men are emotional people. In the process of implementing their behavior, they do not fully follow the principle of rationality and have social motives. The action that obtains the maximum utility at the minimum cost after accurate calculation is only one of their behaviors. Where social men gather, the market mechanism has a limited regulatory power and is not the only mechanism for providing need satisfaction. The social man has multilevel needs. He seeks not only the satisfaction of basic survival needs but also the satisfaction of enjoyment, esteem, development, and self-realization needs, and there are many types of satisfaction objects he seeks.

The status attainment model focuses on individuals' social needs for higher education, with individuals' demands of achieving social class mobility, expanding social interactions, and gaining social esteem as key variables. Similarly, under the hypothesis of incomplete information, these key variables also manifest as individuals' subjective perceptions of them. As a result, a theoretical "status attainment" model of individual choice in higher education based on the hypothesis of social man can be constructed:

$$D = f[SM, C, R] \tag{2}$$

where D = individual choice in higher education opportunities; SM = demand of achieving social class mobility (perception of the function of education to achieve social mobility); C = demand of expanding social interactions (perception of the function of education to expand social interactions); and R = demand of gaining social esteem (perception of the function of education to gain social esteem)

3.2.3. Culture-value Model Based on the Hypothesis of Cultural Man

The so-called "cultural man" hypothesis originated from the German philosopher Cassirer in the middle of the 20th century. He argues that labor is the basis of human nature and the most prominent characteristic of human beings. Human beings have created culture through labor and, at the same time, have shaped their own characteristics as "cultural men." Language, mythology, religion, art, science, and history are all parts of culture[15].

The basic idea of the "cultural man" hypothesis is that a human being is a cultural man, whose

values and behaviors are all deeply marked by culture. Generally speaking, culture is the ideas and skills that people have developed in the process of transforming the objective world. Through continuous inheritance in human history, such ideas and skills have formed the philosophical thinking, religious beliefs, values, ways of thinking, legal norms, moral sentiments, aesthetic interests, customs and habits, and survival abilities of people in a nation or region, thus stipulating the way of living. Culture is a summation of a person's spiritual states such as worldview, values, way of thinking, morality and ethics, beliefs, will, ability, and aesthetic taste[16].

The culture-value model focuses on the cultural factors that influences an individual's choice in higher education. These cultural factors contribute to the creation of people's desire to pursue higher education and a certain form of it. This model uses national cultural traditions, religious beliefs, community culture, and individual values as key variables. The impact of each of these four factors on individuals can then be attributed to a constraint of educational concepts. Based on the above analysis, a theoretical "culture-value" model of individual choice in higher education based on the cultural man hypothesis can be constructed:

$$D = f[EC(T, F, C, V)] \tag{3}$$

where D = individual choice in higher education opportunities; EC = educational concepts; T = national cultural traditions; F = religious beliefs; C = community culture; and V = individual values.

3.2.4. Self-actualization Model Based on the Hypothesis of Self-actualizing Man

The "self-actualizing man" hypothesis was proposed by American psychologist A. Maslow in the 1960s. He argues that human needs are divided into five levels on the basis of degree of importance: physiological needs, safety needs, belongingness and love needs, esteem needs, and self-actualization needs. Self-realization needs are the highest level of human needs, referring to the growth needs of people who seek to develop and exercise their abilities or potential to reach the perfect state. These include exerting potential, realizing ideals, continuously pursuing career success, and refining technology. The process by which people realize their potential through certain work or activities is a type of self-realization.

The self-actualization model focuses on individuals' self-fulfillment needs for higher education, with the demands of achieving academic aspirations, improving self-cultivation, enhancing general competence, and realizing career aspirations as key variables. Similarly, under the hypothesis of incomplete information, these key variables are also expressed as individuals' subjective perceptions. Thus, a theoretical "self-actualization" model of individual choice in higher education based on the self-actualizing man hypothesis can be constructed:

$$D = f[K, M, A, P] \tag{4}$$

where D = individual choice in higher education opportunities, K = demand of achieving academic aspirations (perception of the utility of education to achieve academic aspirations), M = demand of improving self-cultivation (perception of the utility of education to enhance self-cultivation), A = demand of enhancing general competence (perception of the utility of education to enhance general competence), and P = demand of realizing career aspirations (perception of the utility of education to realize career aspirations).

Based on the above analysis, a multidimensional model of individual choice in higher education can be constructed based on four hypotheses about human nature from the perspective of "incomplete information," as Figure 1.

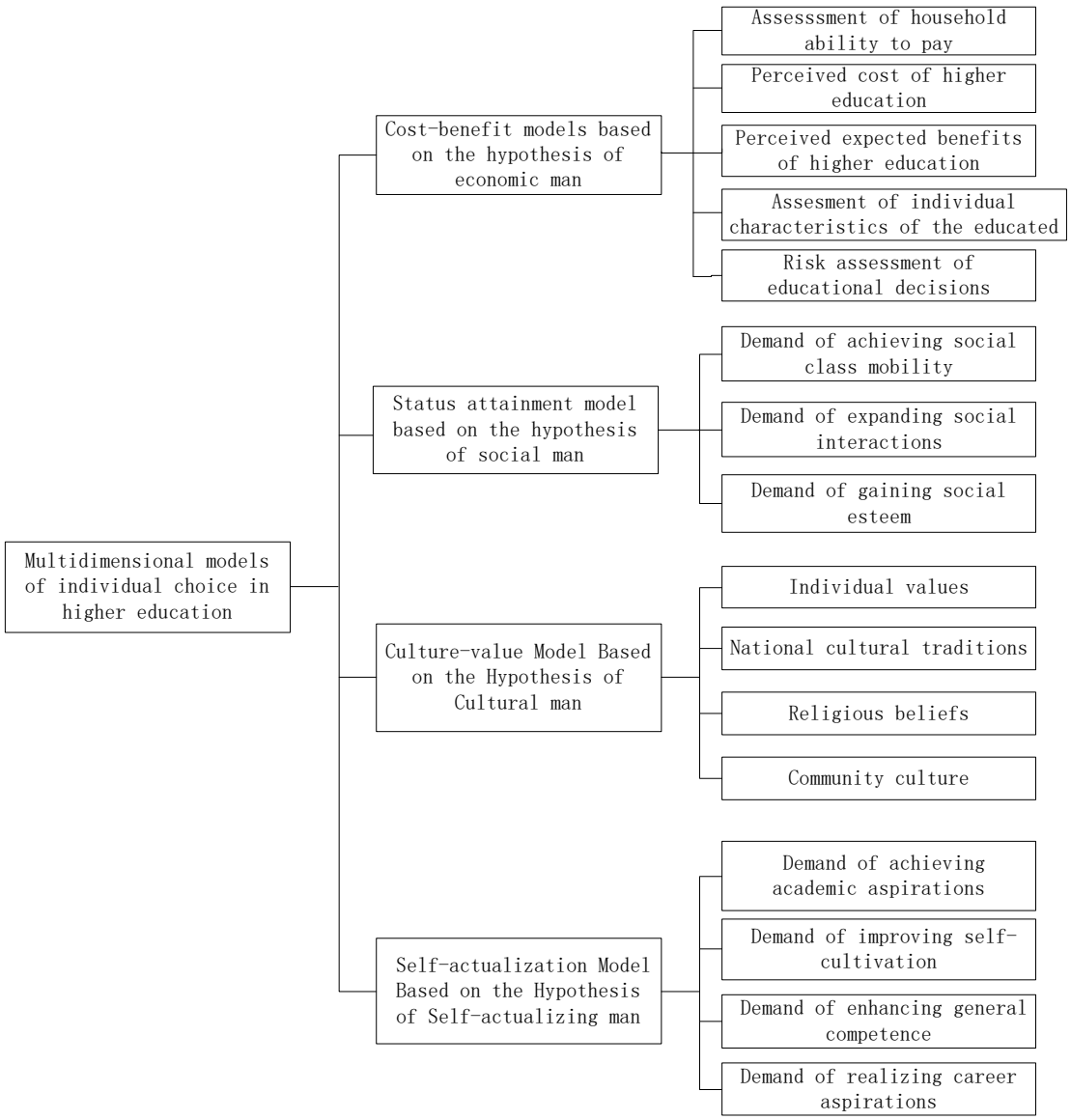

Figure 1: Multidimensional Model of Individual Choice in Higher Education

4. Discussion

In reality, a perfectly rational human absolutely does not exist. For example, a study by Zhong and Lu finds that the basic hypothesis of the human capital theory, i.e., students and their families would choose the optimal level and type of education based on the optimal level of economic benefits of education, is only partially supported in the Chinese context. The reason for this result may be related to the fact that students and their families often lack information about the costs and benefits of higher education when making higher education decisions; even if they know this information, they may not necessarily process it in an economically rational manner.

Information is the prerequisite for all decisions, and the difference in decision-makers' reception, perception, and processing of information may lead to completely different decisions. Individuals involved in actual educational activities do not have the characteristics of a rational man and do not possess complete information. Whether decisions are made considering costs and benefits or an understanding of the social environment and national policies, these factors are subjective perceptions driven by limited information and limited rationality. When individuals and families

make decisions related to higher education, the way they obtain and the frequency with which they collect information about higher education, as well as their abilities to grasp and process such information, are the main variables that influence their individual choice in higher education. The more extensive their access to relevant information, the more frequent their attention to information, the more authoritative the information sources, and the stronger the ability to process information, the better individuals can make rational choices after a comprehensive analysis.

However, in both theoretical and empirical studies around the world, the information factor has rarely been investigated or placed as a key factor in the analysis of influencing factors. The reason for this gap is related to the usual use of the traditional economic analysis paradigm. Only by breaking away from the traditional economic analysis paradigm and analyzing individual choice in higher education from the perspective of information can it be possible to guide individuals' biases in information acquisition and utilization in a targeted manner, so as to reduce the risk of individual choices driven by a lack of information and information cognitive biases.

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